An Assessment of the Australian Road System: Volume 1

Report

The scope of the report is broad in as much as it attempts to develop a comprehensive, explicit and detailed analysis of both historical and future road investment for the whole of Australia. The report does not make specific total funding recommendations, nor does it attempt to suggest what should be the future levels of Commonwealth, State and Local Government funding of roads expenditure. It focuses considerable attention on past patterns of road expenditure and on the economic merit of those expenditures. The sensitivity of the results of the economic analysis to different levels of overall road funding is examined. This examination is particularly directed to assessments of efficient allocations of resources between road categories and States.

BUREAU OF TRANSPORT ECONOMICS

AN ASSESSMENT OF THE AUSTRALIAN ROAD SYSTEM: 1979

PART 1

AUSTRALIAN GOVERNMENT PUBLISHING SERVICE
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FOREWORD

This report comprises the final version of the Bureau of Transport Economics' interim report 'An Assessment of the Australian Road System: 1979 Part 1', which was tabled in Parliament by the Minister for Transport in May 1979, together with Part 2 which consists of verbatim comments provided to the Bureau by interested bodies.

Although the report has drawn upon the considerable body of technique and experience developed by the Commonwealth Bureau of Roads, it does incorporate some significant differences. First, the report does not make specific total funding recommendations, nor does it attempt to suggest what should be the future levels of Commonwealth, State and local Government funding of roads expenditure. Second, the report focuses considerable attention on past patterns of road expenditure and on the economic merit of those expenditures. Third, the sensitivity of the results of the economic analysis to different levels of overall road funding is examined. This examination is particularly directed to assessments of efficient allocations of resources between road categories and States.

The scope of the report is broad in as much as it attempts to develop a comprehensive, explicit and detailed analysis of both historical and future road investment for the whole of Australia. In tackling this task various data deficiencies and procedural constraints needed to be addressed. Accordingly, the quantitative results need to be appreciated in this context. Thus, the detailed quantitative results may be open to refinement in the light of improved data bases and complementary methodological procedures. Notwithstanding this, the approaches adopted in the report are such that the analytical results and general conclusions may be regarded not only as indicative but also robust.

The results of the analyses presented in this report provide a factual basis which, it is hoped, will assist the community and relevant authorities assess alternative road expenditure policies. The report also provides guidance to the three levels of Government in Australia on economically efficient allocations of available funds among the various road categories and indicates areas where further research activity might profitably be directed.

(Colin A. Gannon)
Director

Bureau of Transport Economics
Canberra
May 1979

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CHAPTER 1 - INTRODUCTION

ROLE OF THE BUREAU

The Commonwealth Bureau of Roads (denoted in the remainder of this report as the CBR) was established in 1964 with the statutory function of advising the Commonwealth Government on the matter of financial assistance to the States for roads and road transport.

In June 1977 the Commonwealth Bureau of Roads and the Bureau of Transport Economics (established in 1970) were amalgamated to form a new Bureau of Transport Economics (referred to in this report as the Bureau or the BTE). In March 1977, in the second reading speech to the Parliament on the Commonwealth Bureau of Roads (Repeal) Bill 1977, the Minister for Transport, the Honourable P.J. Nixon MP, stated, inter alia, that:

> "The new body will continue the present functions of both the present Bureaux. Its primary function will be to assist and advise the Government. Its duties will in part be to:
>
> - Undertake evaluations of the Australian road situation as presently done by the Bureau of Roads. These will continue to be done, as in the past, by consultation in the broadest sense with State and local Government authorities. It includes conducting investigations and reporting to the Minister on the matter of the need for financial assistance to the States for roads and road transport.
>
> - Advise and assist the Government in its consideration of financial assistance to the States for roads and road transport."

TERMS OF REFERENCE

Pursuant to the above general roads advisory function, in September 1978, the Minister gave the new Bureau of Transport Economics the following specific terms of reference.

REPORT ON ROADS

I direct the BTE to make assessments of and report on:

(a) Total road needs for Australia for the period 1979-80 to 1982-83;

(b) The condition of the Australian road network and changes to it over the past five years in the light of expenditure undertaken by all levels of Government;

(c) Trends in the levels and patterns of funding of road programs by the different levels of Government in Australia; and

(d) The effects of alternative levels of total future road funding from all sources.

SCOPE OF THIS REPORT

This report is directed towards meeting the above terms of reference in the following ways.

Total road needs 1979-80 to 1982-83

These are assessed in a similar manner to that used in earlier roads reports[1] of the CBR i.e.,

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(1) Commonwealth Bureau of Roads, Report on Commonwealth Financial Assistance to the States for Roads 1969, CBR Melbourne, January 1969; and Report on Roads in Australia 1973, CBR, Melbourne, November 1973; and Report on Roads in Australia 1975, CBR, Melbourne, December 1975. (These reports are referred to in this report as CBR roads reports 1969, 1973, and 1975).

- an estimation of the cost of needs identified by engineering criteria, employing a design period of fifteen years for roads and thirty years for structures (bridges etc.); and

- an estimation of the economically warranted levels of construction expenditure at a discount rate of 10 per cent based upon cost-benefit analysis together with other assessments of likely warranted expenditure for other categories (for example, maintenance and administration).

In addition, a supplementary analysis has been made by projecting road investment needs using the capital-output ratio method.

The Condition of the Australian Road Network and Changes to it Over the Past Five Years in the Light of Expenditure by Governments

This task has been approached by assessments derived from comparative analyses of data from the various road inventory surveys conducted jointly by the CBR and the National Association of Australian State Road Authorities (NAASRA).

In particular, a more detailed analysis was made of the changes in the condition of the national highways system.

Trends in the Levels and Patterns of Funding of Road Programs by the Different Levels of Government

Estimates of road expenditure by each level of government have been made for the period 1974-75 to 1978-79 for each State and Territory. The principle adopted was that the originating body would be credited as the source of road funds[1], even though

(1) This definition encompasses more than might be traditionally thought of as constituting road funds. For instance, Commonwealth roads assistance includes funds provided under specific roads assistance legislation plus funds classified as other forms of assistance or expenditure which are in fact spent on roads - such as roads expenditure from natural disaster assistance, employment creation schemes. State and local Government expenditures may also include expenditures (on roads) by other authorities, general administration, interest paid and capital purchases.

organisations associated with other levels of government may actually spend those funds. The exception to this general rule is where local government authorities receive general purpose assistance grants from the Commonwealth. These grants were treated as becoming part of the general revenue of local government and the extent to which they have been spent on roads has been attributed to local government as the source of funds.

Selected analyses of these financial data have been made, including estimates of total road expenditure by source of funds for each State, on both a per motor vehicle and per capita basis.

Projections of expenditure by categories and source of funds have been made for 1979-80, while projections at total State level by source of funds have been made for 1980-81 to 1983-84. In addition, a retrospective analysis has been made for the period 1974-75 to 1978-79 comparing the estimated actual expenditures in road construction by category and State with:

(a) the economically warranted and recommended (warranted and feasible) programs of expenditure previously estimated by the CBR; and

(b) the economically efficient allocation, by State and road category, of the actual total level of road expenditure over the period.

The Effects of Alternative Levels of Total Future Road Funding from all Sources

A number of levels of future total road programs have been assessed for their impacts on such variables as:

(a) net benefits to road users;

(b) the key industries supplying the road construction industry; and

(c) the level of employment in the road construction industry.

SPECIAL STUDIES

The results of a number of special studies were drawn on, in preparing this report. These included the following:

- Australian Road Survey 1977 Update
- Inter-regional freight movement study
- Urban residential street study
- Road construction price index study
- Study of financial allocations to roads
- Capital formation in transport
- Roads' standards study
- Study of changes in the national highway network
- Resource allocation study

A number of these studies were carried out by BTE staff or, in some cases, by consultants. Some of these culminated in the publication of reports and in these cases specific references are made in the text. Many of these studies were initiated by the CBR, and some, particularly the 1977 Update of the Australian Road Survey and attendant financial information, were dependent on the supply of information by the State Road Authorities (SRAs) and other bodies.

COMMENTS FROM INTERESTED GROUPS

The Bureau, recognising the wide interest in the question of road funding, invited comments from a number of organisations. As the Bureau had the advantage of access to approximately 300 submissions made to the CBR in 1975, and as these covered an extremely wide range of issues, it was decided not to duplicate that earlier general call for submissions. Accordingly, the invitation for comment was made only to the organisations indicated below:

- State Ministries of Transport
- the State Road Authorities
- Associations of Local Government Authorities.

The Bureau, while not precluding comment of a general kind, invited specific comments from these organisations on selected issues relevant to road funding.

In addition, comments from various interested groups, e.g. the Automobile Association of Australia, the Australian Road Federation, the Australian Road Transport Federation, the National Roads and Motorists Association of New South Wales (NRMA) and the Brisbane City Council, were received.

The written responses on the requested topics are summarised in Chapter 8, while the verbatim responses are reproduced in Annex 6, Part 2, to this report.

AREA BOUNDARIES AND ROAD FUNCTIONAL CLASSIFICATIONS

The investigations in this report relate to the same area boundaries and road functional classifications as used previously by the CBR with the following exceptions:

- the area of the Australian Capital Territory previously classed as rural, has been amalgamated with the Canberra outer urban area;

- the Statistical Division of Darwin has been adopted as the urban area of the newly constituted self-governing territory, the Northern Territory, in keeping with the approach used for the States; and

- some minor changes to road functional classifications have been made to accord with improvements made to various roads in recent years, but such changes affected only an extremely small component of the road system and thus have an insignificant effect on the composition of the functional classes, i.e., arterial and local roads referred to in this report are virtually the same set of roads included in these categories in the CBR's 1975 roads report.

OUTLINE OF REPORT

PART 1

Chapter 1	Contains the introduction, which outlines the terms of reference and scope of the report (this Chapter).
Chapters 2 & 3	Background information chapters. Chapter 2 - comprises a broad review of road funding and resource allocation of recent years. Chapter 3 - comprises an assessment of the factors determining the future demand for roads.
Chapters 4,5,6,&7	Address specifically the terms of reference, although these are treated in modified sequence to facilitate a more logical order of presentation.
Chapter 4	Changes in condition of the road network.
Chapter 5	Road needs 1979-80 to 1982-83.
Chapter 6	Trends in levels and patterns of road finance.
Chapter 7	Effects of alternative levels of future road funding.
Chapter 8	Summary of the comments provided to the Bureau.
Chapter 9	Conclusions.

Annexes

Flow charts describing the contents of Chapters 1 to 7 are included at the end of this Chapter. These charts set out the contents and methodologies applied in the preparation of this report.

GENERAL COMMENT ON ANALYTICAL AND METHODOLOGICAL CONSTRAINTS

Data Limitations

The CBR's 1973 roads report utilised data on the physical condition of Australian roads which were collected in conjunction with the National Association of Australian State Road Authorities (NAASRA) by a survey known as the Australian Roads Survey 1969-74. This survey comprehended all roads open to the public in Australia as at June 1972.

However, the CBR's 1975 roads report did not utilise such an extensive data bank. Instead earlier information was updated by the State Road Authorities. This update was confined to major urban and rural arterial roads (which included the roads now covered by the Commonwealth's national highways program). For rural and urban local roads, assessments were made of projected expenditure needs based on the results of the 1969-74 survey and other information from State and local Government sources.

A similar update, the 1977 Update Survey, was undertaken for this report for national highways, arterial roads and certain local roads and is described more fully in Chapter 4. It should be noted that in reaching an estimate of a warranted program of roads expenditure, the Bureau did not have available reliable and more recent information on the expenditure needs for local roads, MITERS, road maintenance or road administration. The Update Surveys must be acknowledged as somewhat unsatisfactory since they were based on data collected several years previously. This data deficiency is not expected to be so acute in the future as NAASRA is currently compiling a data bank similar in extent to the 1969-74 survey. Unfortunately, this work was not sufficiently advanced to be used for this report.

Format of Report

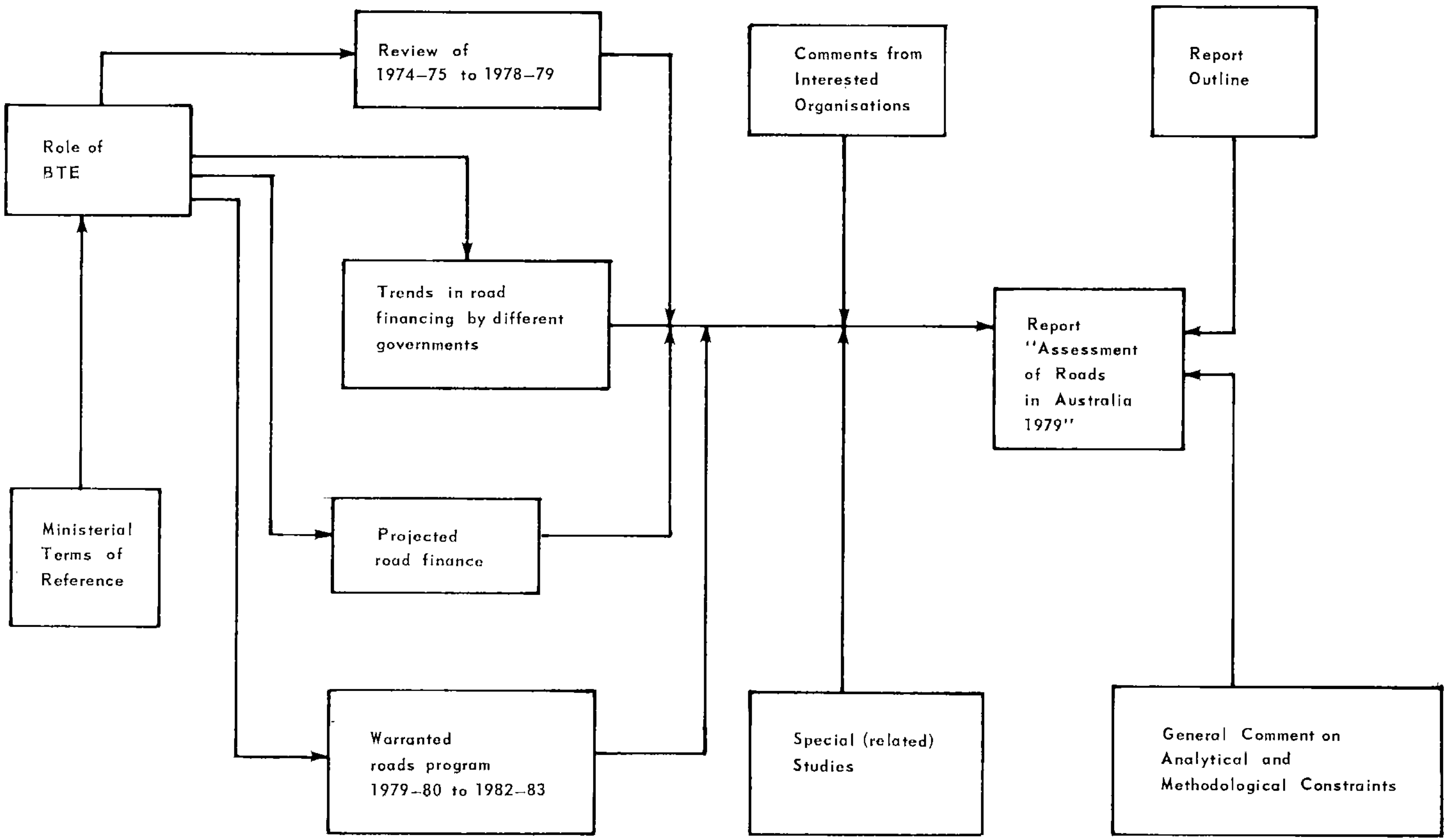
The three previous CBR roads reports developed recommendations pertaining to Commonwealth financial assistance for the Minister for Transport's consideration. CBR formulated specific recommendations in pursuance of statutory functions made possible under the legislation by which it was established. The Bureau of Transport Economics does not have statutory authority status. Rather it is the function of the BTE, as an independent professional research organisation, to examine and report on the historical trends and the likely future status of the road infra-structure and its consequences in terms of economic efficiency.

Consistency of Results

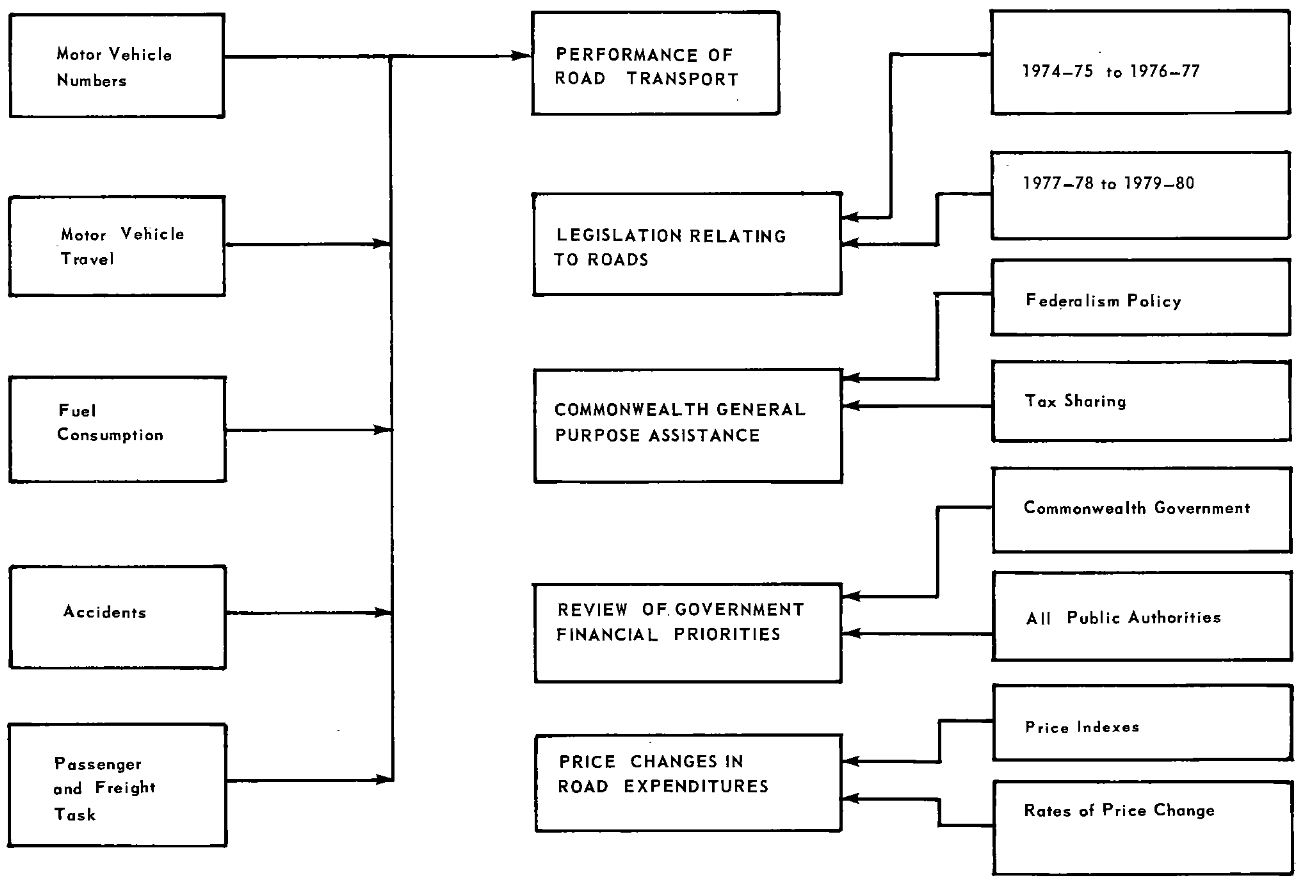
The warranted roads expenditure program presented in this report is (especially for some road categories) somewhat lower than might have been expected on the basis of past CBR roads reports and in light of recent road expenditure levels. The two major reasons for these variations are data deficiencies and the method of evaluation. The problems of data deficiencies have been referred to above.

The CBR, in reaching the warranted program reported in its 1975 road report, applied some manual adjustments to the computer model evaluation results in the light of specific knowledge of, and perceived deficiencies in, the evaluation procedures. It was judged by the CBR that the computer modelling procedures were not sufficiently comprehensive to allow, to an acceptable degree of accuracy, a full assessment of road expenditure needs. Although similar conclusions have been reached by the BTE, it was considered that the large scale modelling process used was effective in achieving broad indications of patterns of warranted expenditure.

Chapter 1. INTRODUCTION



Chapter 2. A REVIEW OF RECENT YEARS



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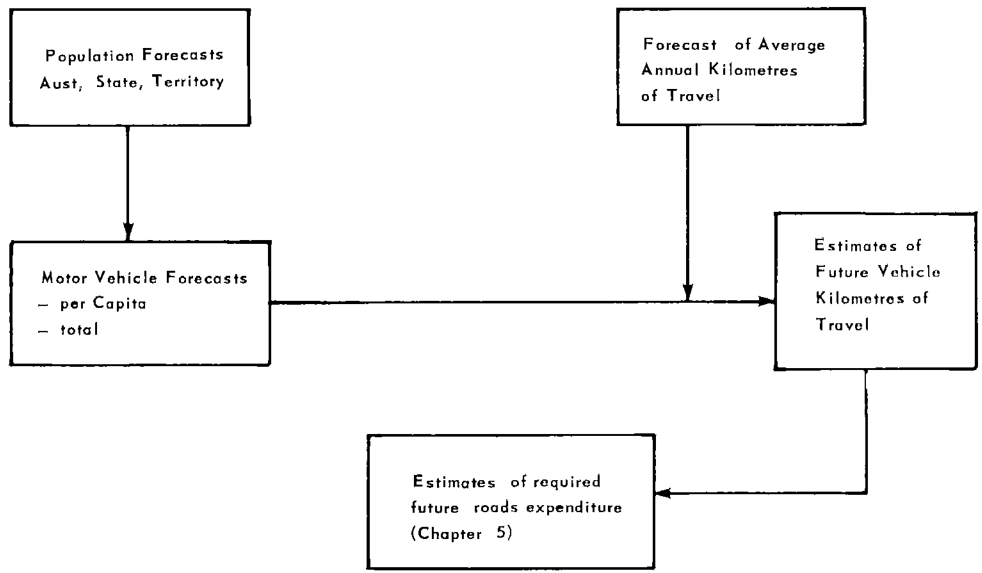
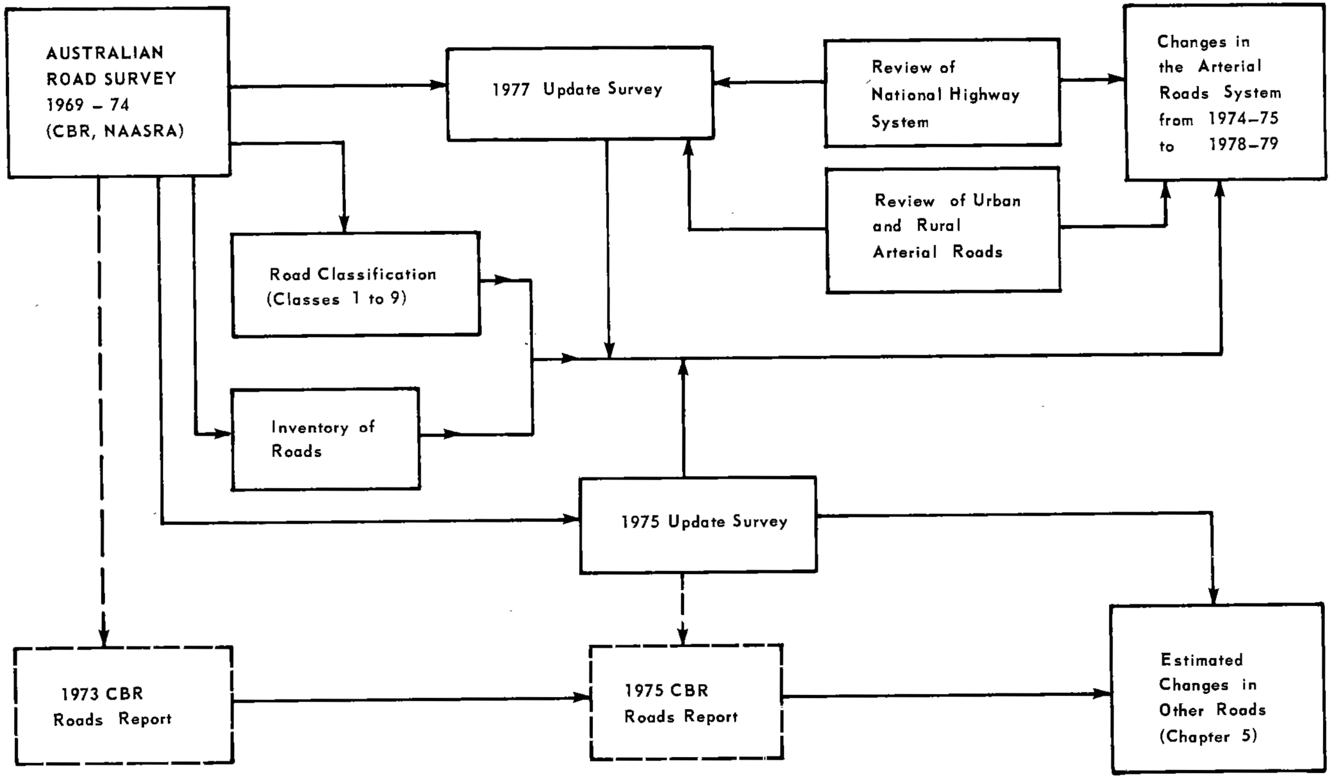
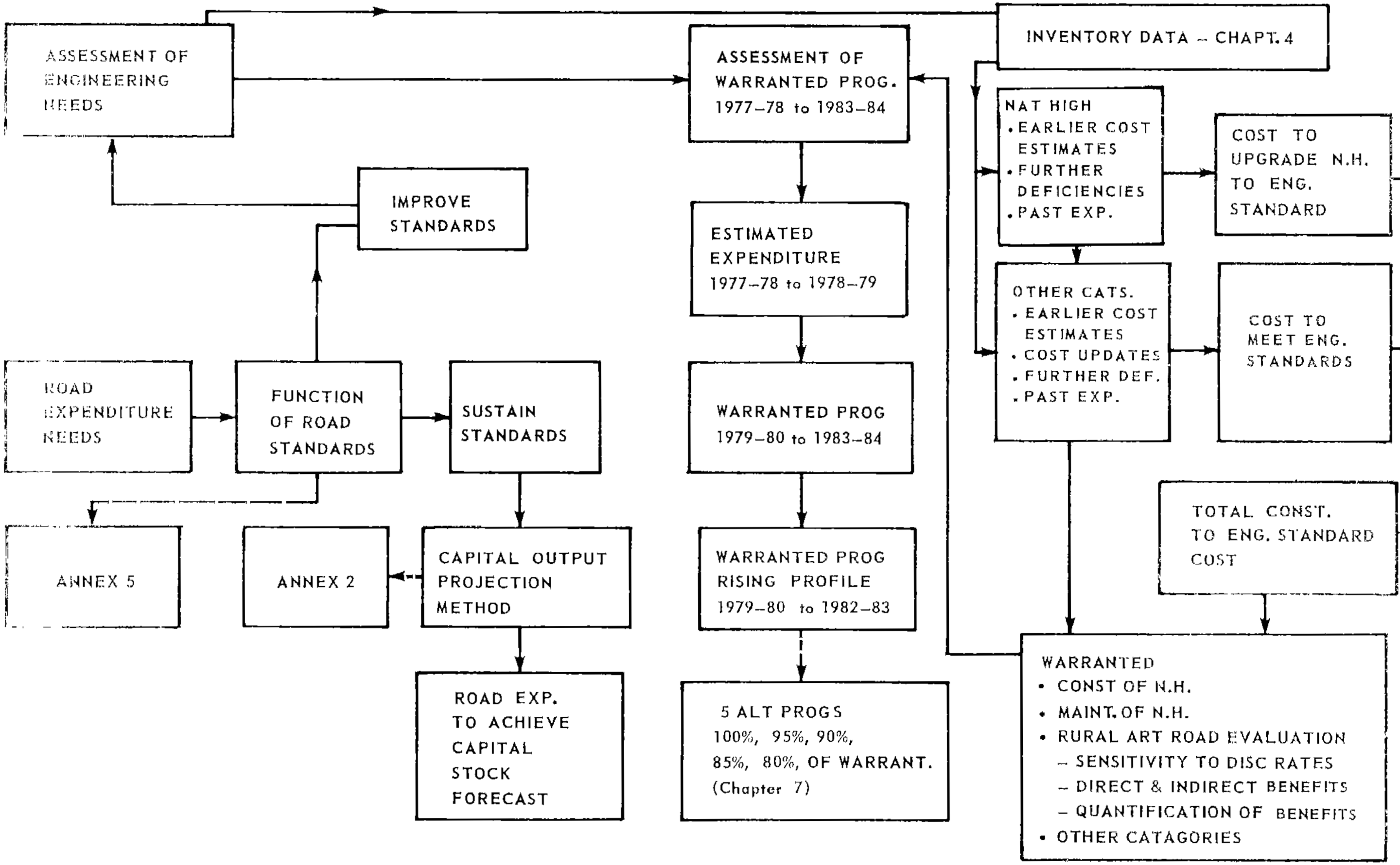


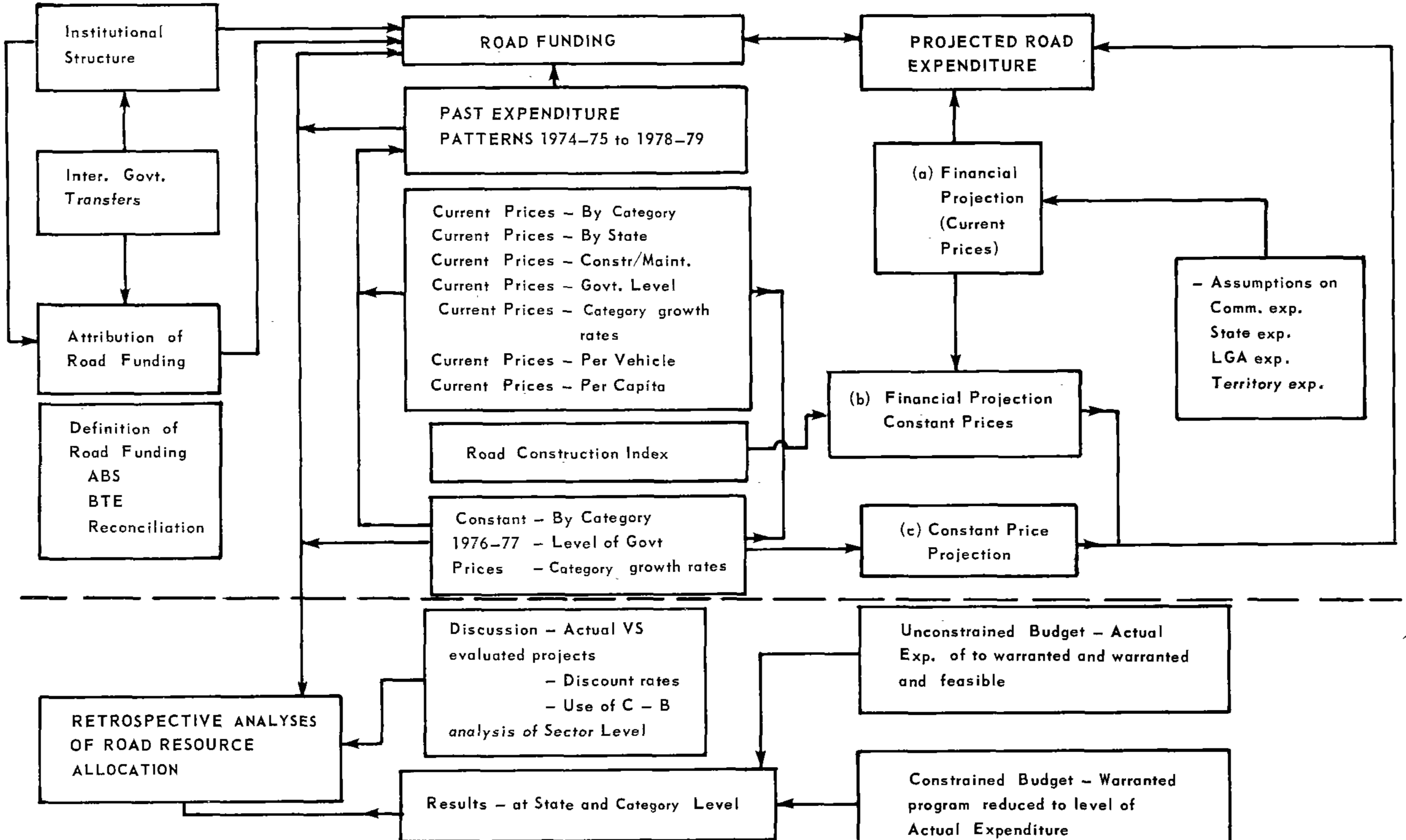
Chapter 4. CHANGES IN CONDITIONS OF THE ROAD NETWORK



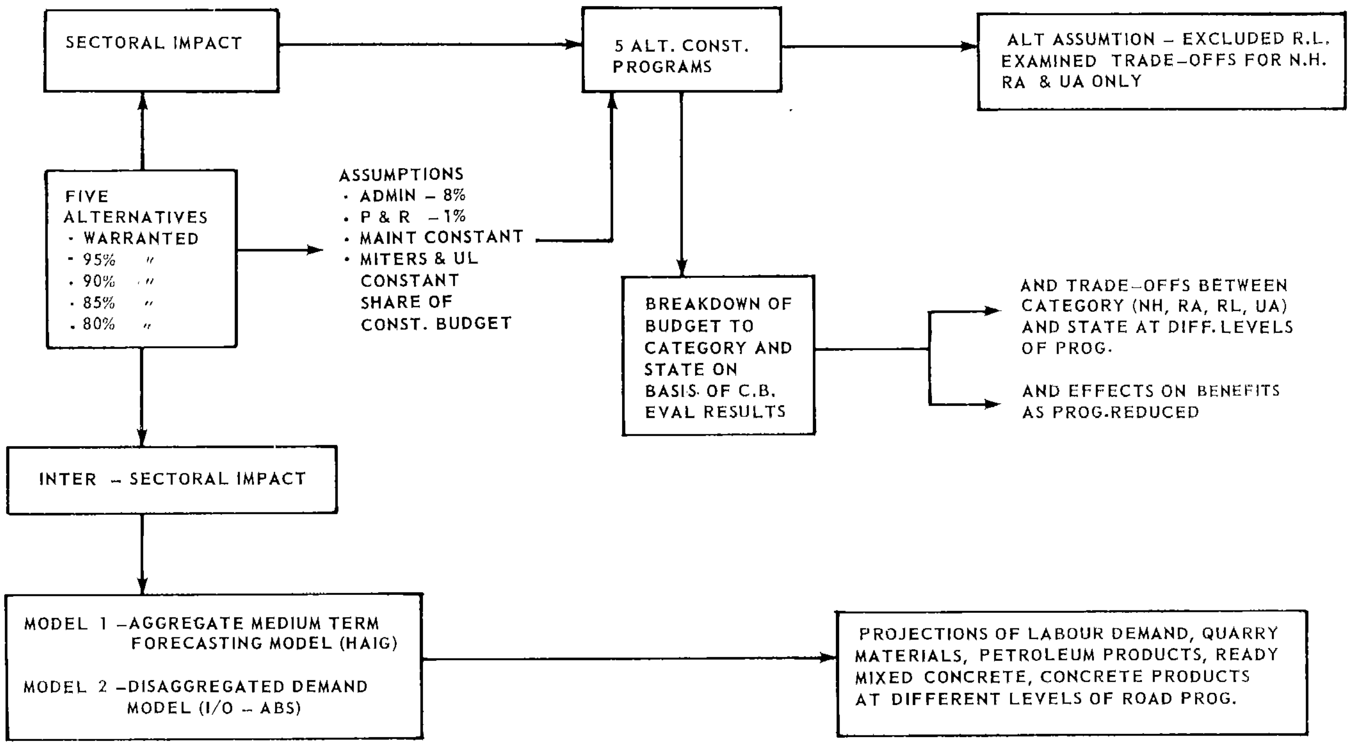
Chapter 5. ROAD NEEDS 1979–80 to 1982–83



Chapter 6. TRENDS IN LEVELS AND PATTERNS OF ROAD FINANCE



Chapter 7. EFFECTS OF ALTERNATIVE LEVELS OF FUTRE ROAD FUNDING



CHAPTER 2 - A REVIEW OF RECENT YEARS

INTRODUCTION

In this Chapter developments in the Australian road transport system over the period 1974-75 to 1978-79 are reviewed in terms of:

- performance of road transport;
- legislation relating to road finance;
- financial arrangements;
- resource allocation; and
- changes in prices of inputs related to expenditure on roads.

THE ROAD TRANSPORT TASK

The performance of road transport may be examined in terms of usage characteristics, the economic activity of capital formation (including replacement of roads and maintenance), and perceived performance. This last measure relates to expressions of the level of satisfaction within the community with expenditures on various aspects of road transport. This latter indicator of performance was developed and measured by the CBR in 1973 and 1974 with the aid of household surveys (1975 roads report, Chapter 4). Such surveys have not been repeated as it would seem that there have been only small changes since then.

The usage characteristics or physical performance of road transport include measures of vehicle-kilometres of travel, fuel consumption, road accidents, and freight and passenger travel. Many other possible indices of physical performance may be advanced; however, available information is not sufficiently comprehensive or accurate to enable their satisfactory estimation.

Motor Vehicle Numbers

Table 2.1 sets out details of the number of motor vehicles on register and the number of vehicles per 1000 persons. The growth in the number of vehicles and particularly the numbers of cars (and station wagons) shows little sign of levelling out although the growth rate is declining. Growth in the number of cars is significantly greater than other vehicles.

Motor Vehicle Travel

Average distance travelled by cars appears to have levelled off, but the utilisation of other vehicles continues to grow as is indicated in Table 2.2. The result for cars can possibly be attributed to the recent decline in economic conditions, the increase in more than one car households, and rises in the cost of fuel.

Fuel Consumption

Table 2.3 shows the fuel consumption by motor vehicles on a time series basis.

These estimates are based on the results of the three motor vehicle usage surveys undertaken by the Australian Bureau of Statistics (ABS) in 1963[1], 1971[2] and 1976[3], the petrol sales information collected by the Department of National Development[4] and automotive diesel fuel clearances by the Bureau of

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(1) Commonwealth Bureau of Census and Statistics, Survey of Motor Vehicle Usage 1963, Canberra, 1975.

(2) Commonwealth Bureau of Statistics, Survey of Motor Vehicle Usage 1971, Canberra, 1973.

(3) Australian Bureau of Statistics, Survey of Motor Vehicle Usage 1976, Canberra, 1978.

(4) Department of National Development, Demand for Primary Fuels Australia 1976-77 to 1986-87, Canberra, 1978.

TABLE 2.1 - MOTOR VEHICLES: ALL STATES AND TERRITORIES[a]

Year as at 31 December	Motor Vehicles on Register (thousands)						Motor Vehicles per Thousand Persons		
	Cars	% Increase	Other	% Increase	Total	% Increase	Cars	Other	Total
1964[b]	2695	-	858	-	3550	-	239	75	315
.	.	.	.	.	.	.	.	.	.
1969	3676	-	950	-	4626	-	296	77	373
1970	3834	4.3	949	0.0	4783	3.4	303	75	378
1971[c]	4058	5.8	982	3.5	5040	5.4	310	75	386
1972	4260	5.0	1020	3.9	5280	4.8	321	77	397
1973	4520	6.1	1078	5.7	5599	6.0	335	80	415
1974	4771	5.6	1131	4.9	5902	5.4	348	82	431
1975	5016	5.1	1200	6.1	6216	5.3	362	87	449
1976	5246	4.6	1284	7.0	6530	5.1	375	92	457
1977[d]	5344	1.9	1318	2.6	6662	2.0	382	94	476
Average Annual Growth Rate 1964 to 1977	5.4%		3.4%		5.0%		3.7%	1.8%	3.2%

(a) Excludes motorcycles.
(b) Statistics for the period 1964 to 1970 are drawn from Burke R.H., Australian Road Travel Information, unpublished Bureau of Transport Economics Staff Paper, Canberra 1978.
(c) Statistics for the period 1971-1976 are derived from Australian Bureau of Statistics, Motor Vehicle Registrations December Quarter 1977, Canberra, 1978.
(d) 1977, Australian Bureau of Statistics, Motor Vehicle Registrations June Quarter 1978, Canberra, 1978.
Australian Bureau of Statistics, Monthly Review of Business Statistics July 1978, Canberra, 1978.

TABLE 2.2 - MOTOR VEHICLE TRAVEL: ALL STATES AND TERRITORIES[a]

Year ended 30 June	Average Annual Kilometres per Vehicle			Vehicle-Kilometres of Travel (millions)		
	Cars	Other	Total	Cars	Other	Total
1965	14186	14648	14298	38220	12564	50759
.	.	.	.	.	.	.
1970	15864	17073	15845	57427	15867	73294
1971	15988	17239	16236	61298	16359	77657
1972	16092	17880	16441	65293	17565	82859
1973	15957	17759	16306	67972	18123	86095
1974	16081	17353	16326	72691	18712	91403
1975	15893	17046	16113	75815	19285	95100
1976	15679	17058	15938	78598	20476	99071
1977	n.a.	n.a.	17448	n.a.	n.a.	111667
1978	n.a.	n.a.	18804	n.a.	n.a.	118610
Average Annual Growth Rate 1964-65 to 1977-78[b]	0.9%	1.4%	1.7%	6.8%	4.5%	6.7%

(a) Excludes motorcycles.
(b) The growth rates for the separate categories of cars and other vehicles relate to the period 1965 to 1976.

Source: Burke R.H., *op.cit.* Table 2.1.

TABLE 2.3 - FUEL CONSUMPTION BY MOTOR VEHICLES: AUSTRALIA

Year ended 30 June	Kilometres of Travel per Litre of Fuel Cars	 Other	 Total	Total Fuel Consumption (million litres)
1965	7.06	5.16	6.47	7841
.	.	.	.	.
1970	7.85	4.80	6.90	10627
1971	8.00	4.72	6.98	11123
1972	7.84	4.92	6.97	11896
1973	7.68	5.11	6.95	12390
1974	7.53	5.31	6.93	13186
1975	7.37	5.50	6.92	13752
1976	7.21	5.69	6.90	14361
Average Annual Growth Rate 1964-65 to 1975-76	-	-	-	5.7%

Source: Burke R.H., op.cit., Table 2.1.

Customs[1]. The estimation procedures have been described in a BTE Staff Paper[2]. The fuel consumption rate for cars exhibited a fall in the 1960s and a subsequent steady rise in the 1970s.

With regard to other vehicles it would seem that there was little change in the 1960s but that there was a small increase in the fuel consumption rate in the 1970s. Overall, average annual fuel consumption grew at a rate of 5.7 per cent between 1964-65 and 1975-76, as against 6.7 per cent for motor vehicle travel over the period 1964-65 to 1977-78.

Road Traffic Accidents

The causes of traffic accidents stem from numerous sources including driver incapacity, defective motor vehicles and road conditions. Consequently, reduction in the incidence of road accidents can be achieved in a variety of ways including the enforcement of appropriate legislation in relation to the capacity of the individual to drive, the incorporation of safety design features in the vehicle and improvement in the standard of the road.

Table 2.4 sets out Australia wide road traffic accident incidence data over the period 1969-1977. As indicated, injuries, fatalities and number of accidents have not changed greatly over the period. However, Table 2.5 which relates traffic accidents to the distance travelled shows a significant fall in accident rates per vehicle kilometre. This fall can be attributed, in part, to improvements in effective road accident prevention legislation, to technological advances and to improvements in road standards.

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(1) Australian Bureau of Statistics, Overseas Trade (various), Canberra.
(2) Burke R.H., *op.cit*. Table 2.1.

TABLE 2.4 - ROAD TRAFFIC ACCIDENT INCIDENCE

Year as at 31 December	Persons Injured	Persons Killed	Number of Accidents (a)
1969	87864	3502	62597
1970	91554	3798	65210
1971	91036	3590	65210
1972	89766	3422	65750
1973	95204	3679	70151
1974	91338	3572	67473
1975	89499	3694	65780
1976	87808	3583	64282
1977	91616	3578	67549

(a) Accidents involving casualties.

Source: Australian Bureau of Statistics, Road Traffic Accidents Involving Casualties, Canberra, 1978.

TABLE 2.5 - ROAD TRAFFIC ACCIDENTS PER DISTANCE TRAVELLED

Year ended 31 December	Rate per hundred million vehicle-kilometres		
	Persons Injured	Persons Killed	Number of Accidents (a)
1969	125	5	89
1970	121	5	86
1971	113	4	81
1972	106	4	78
1973	107	4	79
1974	98	4	72
1975	92	4	68
1976	83	3	61
1977	80	3	59

(a) Accidents involving casualties.

Source: Burke R.H., op.cit., Table 2.1; Australian Bureau of Statistics, op.cit., Table 2.4.

For the 1975 roads report (see Chapter 4 of that report) the CBR, in order to analyse the perceived performance of the roads system, undertook attitude surveys in Melbourne and Sydney in 1973 and 1974. Almost 60 per cent of those surveyed were completely dissatisfied with safety conditions on major roads and residential streets. This compared to 23 per cent who were completely satisfied. For freeways 64 per cent responded that they were completely satisfied and 18 per cent completely dissatisfied. These figures relate to the 1974 survey but very similar results were obtained in 1973. As pointed out above such surveys were not repeated for this report.

Passenger and Freight Task

A broad estimate of the passenger task and freight task may be obtained from the ABS motor vehicle surveys[1]. The details are set out in Table 2.6.

TABLE 2.6 - ROAD FREIGHT AND PASSENGER TASK

Year ended 30 June	Thousand million passenger-kilometres	Thousand million tonne-kilometres
1963	61	17
1971	122	27
1976	157	37
Average Annual Growth Rate 1962-63 to 1975-76	7.5%	6.2%

NOTE: Estimates have been derived from motor vehicles usage surveys undertaken by the Australian Bureau of Statistics for the above years. Accurate estimates for the intermediate years are not available.

Source: Australian Bureau of Statistics, op.cit.

(1) Australian Bureau of Statistics, op.cit.

The average annual growth rate in car passenger travel from 1962-63 to 1975-76 was 7.5 per cent (compared to respective car and station wagon and population annual average growth rates of 3.4 per cent and 1.96 per cent for the same period) indicating a quite large increase in the mobility of the Australian population. Similarly the growth rate in freight has averaged 6.2 per cent per year which is higher than the 4.5 per cent rate of increase in distance travelled by the predominantly goods carrying other vehicles category (see Table 2.2). This higher growth rate can be explained in terms of larger vehicles and/or lower unused capacity.

LEGISLATION RELATING TO ROAD FINANCE

The history of Commonwealth financial assistance to the States for roads within Australia dates back to 1922 when a grant of $0.5 million was made to assist road works to alleviate unemployment. Since that time the scope and magnitude of the Commonwealth's financial involvement in State road programs has increased greatly. A short history of this development to 1972 has been described in BTE Occasional Paper No. 8[1].

The first major Commonwealth roads legislation introduced after 1972 related to the three year period 1974-75 to 1976-77. The legislation consisted of three Acts - the National Roads Act 1974, Roads Grants Act 1974 and Transport (Planning and Research) Act 1974. Total Commonwealth payments to the States of $1256 million were made under this legislation. There were also conditions as to the amount spent by certain road expenditure categories[2], approval of projects, transfer of funds between

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(1) Burke, R.H., History of Commonwealth Legislation Relating to Roads and Road Transport 1900-1972, Bureau of Transport Economics Occasional Paper No. 8, AGPS, Canberra, 1977.

(2) Road expenditure categories assisted under the current Commonwealth legislation are national highways, national commerce roads, rural and urban arterial roads, rural and urban local roads, minor traffic engineering and road safety improvements (MITERS), and transport planning and research. CBR and BTE studies have also distinguished between construction and maintenance expenditures and make allowance for general administration expenses. A fuller definition of these categories is provided at the end of Annex 5.

categories, and details of matching quotas of State funds i.e., funds to be spent on roads from each State's own financial resources.

The National Roads Act 1974 provided assistance for roads which linked the mainland capitals and other selected cities. These roads are known as national highways. In addition capital works assistance was provided for some roads, declared as facilitating trade and commerce, which were referred to as export and major commercial roads. The legislation also provided for grants to be made for the maintenance of national highways.

The Roads Grants Act 1974 encompassed the Commonwealth grants to the States for road construction for urban and rural arterial roads and urban local roads, grants for construction and maintenance for rural local roads, and minor traffic engineering and road safety improvements (MITERS).

Finally, the Transport (Planning and Research) Act 1974 provided grants to the States for projects involving planning and research into roads, road transport and urban public transport generally.

Grants provided under the Roads Grants Act 1974 and National Roads Act 1974 were amended in 1975 and 1976 to provide for increased amounts to be granted to the States due to the escalation in costs of construction. Also additional assistance was provided in 1974-75 as a short-term measure to assist employment in the roads sector.

Similar legislation was enacted in 1977 to provide road grants to the States for the period 1977-78 to 1979-80. In his Second Reading Speech to the States Grants (Roads) Bill, 1977 the Minister for Transport announced the Government's intention to maintain at least the same contribution in real terms by the Commonwealth for the duration of the Act. The announced measure adopted by the Commonwealth for adjusting the grants was the "implicit price deflator for private investment in other building and construction" as set out in the ABS Australian National Accounts.

A number of other provisions which were incorporated in the 1977 roads legislation included the eligibility of payroll tax paid in respect of road programs as part of the States' matching quotas, and a reclassification of the previous export and major commercial roads category as national commerce roads. The administrative arrangements for the Act incorporated a provision for the establishment of planning committees, comprising State and Commonwealth representatives who would develop longer term expenditure plans and determine priorities for particular road programs.

At the same time as the legislation on general grants for roads was enacted, new legislation was passed relating to transport planning and research for the period 1977-78 onwards under the title of Transport Planning and Research (Financial Assistance) Act 1977. This Act provided $2 of Commonwealth assistance for every $1 of State expenditure on approved projects in 1977-78 (as with the previous Act), and $1 for $1 in 1978-79. No funds were appropriated for 1979-80 or later years as funds for each year are decided on an annual basis. A significant change was made to the administration of the Act in that as well as obtaining approval from the Commonwealth Minister for projects and final project reports, a report on progress of projects was required at the end of each financial year.

FINANCIAL ARRANGEMENTS

Beginning in 1976-77 the Commonwealth general purpose financial assistance grants to the States were replaced by personal income tax sharing arrangements between the Commonwealth and the States. This is the main element of the Commonwealth Government's federalism policy. In implementing the arrangements, a two stage formulation was agreed to. Under stage 1 the States would receive a specified proportion of net personal income tax. Under stage 2 the individual States would be free to vary (at its discretion and cost) personal income tax levied on residents of the State. There are four other major elements to the policy:

(a) sharing by local government in the proceeds of personal income tax;

(b) a more selective use of specific purpose payments to the States with the absorption of such payments where appropriate into general purpose funds;

(c) the establishment of an Advisory Council for Inter-government Relations; and

(d) a review of the functions of the different levels of government and the elimination of unnecessary overlapping, waste and interference(1).

Stage 1 of this policy was implemented under the States (Personal Income Tax Sharing) Act 1976 for 1976-77. The States have not proceeded with Stage 2, although the Commonwealth has passed enabling legislation, the Income Tax (Arrangements with the States) Act 1978. This Act allows the States to legislate to impose a State surcharge on personal income tax (but not company taxation or withholding tax on dividends and interest) additional to that imposed by the Commonwealth. Alternatively, States may give a rebate on personal income tax payable under Commonwealth law and authorise the Commonwealth to collect the surcharge or grant the rebate as the State's agent.

In 1976 the Commonwealth and States also reached agreement on arrangements for the sharing of personal income tax collections with local government. These arrangements were incorporated in the Local Government (Personal Income Tax Sharing) Act 1976.

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(1) Treasurer of the Commonwealth of Australia, Payments to or for the States and Local Government 1976-77, 1976-77 Budget Paper No. 7, AGPS, Canberra, 1976.

RESOURCE ALLOCATION

In this section the allocation of resources to roads by the three levels of government is considered. The Commonwealth Government has the direct responsibility of constructing and maintaining roads in the A.C.T.[1], on certain Commonwealth properties and for certain roads leading to Commonwealth properties. It also provides road finance through specific purpose grants to the States and under these arrangements certain funds flow through the States to local government authorities for expenditure on roads which are the responsibility of local government.

Table 2.7 sets out details of Commonwealth Government outlays for selected functions, including roads. The average annual growth rate of expenditure on roads for the nine year period 1969-70 to 1978-79 was 10.9 per cent. This rate was significantly lower than rates achieved in the major "social" expenditure areas and was also lower than the growth of Commonwealth Budget expenditures as a whole (16.6 per cent per annum).

A similar but less significant trend occurred with road funding for all public authorities. Table 2.8 shows that over the eight year period 1969-70 to 1977-78 road expenditures grew at an average of 14.1 per cent per annum compared to the growth rate of 17.8 per cent per annum in total public authority outlays. Tables 2.7 and 2.8 suggest that State and local Government expenditure on roads from their own resources has grown at a faster rate relative to their total outlays than that of the Commonwealth.

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(1) On 1 July 1978 the Northern Territory became a self-governing Territory under the Northern Territory (Self-Government) Act 1978; the Ministers of the Territory have executive authority in respect of roads which are currently financed out of general purpose funds provided to the Territory by the Commonwealth.

TABLE 2.7 - OUTLAYS OF COMMONWEALTH GOVERNMENT: 1969-70 AND 1978-79

Function	1969-70 $m	1978-79[(a)] $m	Average Annual Growth Rate %/p.a.
Education	244	2498	29.5
Health	462	2913	22.7
Social Security and Welfare	1269	8015	22.7
Roads	218	553	10.9
Payments to States, N.T. and local government[(b)]	1757	6557	15.8
All Other	3398	8334	10.5
Total Budget Outlay[(c)]	7348	22870	16.4
Total Commonwealth Outlays[(c)]	7542	30088	16.6

(a) Estimates (see source for this Table).
(b) Tax sharing, net other general revenue assistance, net State Government loan programs, assistance related to State debts, local government tax sharing entitlement etc, net natural disaster relief, payments to the Northern Territory.
(c) For definition see the Appendix to the Budget Statements - (The Functional Classification of Budget Outlays) and pp. 194-195 of Statement No 6, Budget Speech 1978-79.

Source: Treasurer of the Commonwealth of Australia, Budget Speech 1978-79, AGPS, Canberra, 1978.

TABLE 2.8 - OUTLAYS OF ALL PUBLIC AUTHORITIES FOR ROADS AND IN TOTAL

Year ended 30 June	Roads		Total Outlays
	Amount	Percent Total Outlays	
1970	679	7.0	9666
1971	732	6.9	10547
1972	804	6.7	12072
1973	893	6.7	13416
1974	984	6.1	16205
1975	1328	5.8	22915
1976	1728	6.3	27547
1977	1740	5.5	31801
1978[a]	1947	5.4	35902
Average Annual Growth Rate 1970 to 1978	14.1%		17.8%

(a) BTE Estimates.

Source: Australian Bureau of Statistics, Public Authority Finance, Public Authority Estimates, AGPS, (various years).

PRICE CHANGES IN ROAD EXPENDITURE

Inflation has been a continuing problem in the Australian economy over a number of years although there has been a recent slackening in price rises.

The road construction industry has experienced significant cost increases similar to the rest of the economy, as can be seen from Tables 2.9 and 2.10. However they have been generally below those in the economy as a whole. Exceptions occurred in the years 1973-74 and 1974-75, when the road construction industry was affected by the combination of the rapidly rising cost of labour (direct and indirect wages and salaries comprise 64.1 per cent of the total cost of resources used by the road industry) and of the cost of imported crude oils from which bitumen is derived.

Except for 1973-74 the implicit price deflators derived for private and public gross fixed capital expenditure on other building and construction (i.e. on construction other than dwellings) have increased at a higher rate than road construction. However, it appears this can be attributed to the method of estimating the expenditure at constant prices, rather than the cost rises experienced in those activities(1).

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(1) Burke R.H., A Road Construction Price Index, BTE Occasional Paper 27, AGPS, Canberra, 1978.

TABLE 2.9 - PRICE INDEXES (1966-67 = 100)

Year ended 30 June	Road Construction Price Index(c)	GNE[a]	Implicit Deflators[b] Other Building Gross Fixed Capital Expenditure Public	Implicit Deflators[b] Other Building Gross Fixed Capital Expenditure Private
1970	109.5	111.2	113.0	112.7
1971	115.0	118.3	120.6	119.9
1972	120.9	126.7	128.7	128.9
1973	128.9	134.3	139.1	137.1
1974	149.1	151.1	159.2	157.7
1975	178.3	179.9	199.2	199.6
1976	198.1	208.9	231.4	231.5
1977	218.4	231.9	258.7	260.2
1978	234.8	252.9	n.a.	276.0

(a) Gross National Expenditure.
(b) Australian Bureau of Statistics, _Australian National Accounts, National Income and Expenditure_ 1975-76, Canberra, 1977.
Australian Bureau of Statistics, _National Income and Expenditure 1977-78_, Budget Paper No. 9, Canberra, 1978.
(c) Burke R.H., _A Road Construction Price Index_, Bureau of Transport Economics Occasional Paper No. 27, Canberra, 1978.

TABLE 2.10 - RATE OF PRICE INCREASES OVER PRECEDING YEAR

Year ended 30 June	Road Price Index	GNE	Implicit Deflators: Other Building Gross Fixed Capital Expenditure, Public	Implicit Deflators: Other Building Gross Fixed Capital Expenditure, Private
1971	5.0	6.4	6.7	6.4
1972	5.1	7.1	6.7	7.5
1973	6.6	6.0	8.1	6.4
1974	15.7	12.5	14.5	15.0
1975	19.6	19.1	25.1	26.6
1976	11.1	16.1	16.2	16.0
1977	10.2	11.0	11.8	12.4
1978	7.5	9.1	n.a.	6.1

Source: Table 2.9.

CHAPTER 3 - FUTURE DEMAND FOR ROADS

INTRODUCTION

The need for investment in roads is influenced in part by future levels of traffic (as affected by the costs of road resources, including the supply of energy) and various forms of road pricing. Thus, investigatory work related to forecasting the major factors affecting the future demand for road investment has formed an essential part of this report.

The approach adopted has been to forecast population, motor vehicle ownership and motor vehicle usage rates, and to derive from these a forecast of total vehicle-kilometres of travel.

POPULATION GROWTH

In 1971 the CBR developed a population forecasting model to provide forecasts of total population (by age groups) for each State. This model was used in the CBR road reports of 1973 and 1975 in formulating advice to the Minister for Transport. Although the model is considered satisfactory for forecasting purposes, it was developed in the absence of a suitable set of official forecasts. In this report the ABS results have been used.

Because of the timing of the report the 1976 projections have been used. A later set of projections were produced by ABS in 1978. CBR forecasts together with the two sets of ABS projections are set out in Table 3.1.

It will be noted that the projections used (i.e. those produced by ABS in 1976) are lower than both those produced by the CBR and the later ABS figures. In general this may cause the investment needs for roads as estimated in this report to be somewhat understated if in fact the later forecasts are more accurate.

TABLE 3.1 - COMPARISON OF POPULATION PROJECTIONS: AUSTRALIA

(thousands)

As at 30 June	Commonwealth Bureau of Roads (a)	Australian Bureau of Statistics 1976 Projections (b)	Australian Bureau of Statistics 1978 Projections (c)
1980	14649	14244	14563
1985	15797	15070	15415
1990	16962	15921	16311
1995	n.a.	16752	17180
2000	n.a.	17531	17989

(a) Commonwealth Bureau of Roads, Report on Roads in Australia 1975, Melbourne, 1975.
(b) Australian Bureau of Statistics, Projections of the Population of Australia 1977 to 2001, Canberra, 1976.
(c) Australian Bureau of Statistics, Projections of the Population of Australia 1978 to 2011, Canberra, 1978.

Table 3.2 sets out details of population estimates by State and Territory. The total Australian population forecasts are those published by ABS. The State and Territory forecasts are estimated by examination of changes in the States and Territories. Population growth is expected to be much slower from the present to the year 2000 compared with that experienced in the decade up to 1975. The Territories are the only regions where significantly higher than average rates of population growth are expected.

MOTOR VEHICLE FORECASTS

Forecasts of the number of motor vehicles are considered in two categories, cars and station wagons and other vehicles, because of differences between the growth characteristics of these categories.

The growth in the population of cars and station wagons (which constitutes of the order of 80 per cent of the total population of motor vehicles) was estimated by forecasting the population of cars and station wagons per capita and multiplying by the forecast of numbers of persons. The forecasts of cars and station wagons per

TABLE 3.2 - POPULATION PROJECTIONS: STATES AND TERRITORIES

(thousands)

As at 31 Dec.	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.	A.C.T.	AUSTRALIA
1964	4079	3073	1595	1023	799	362	53	85	11059
1969	4439	3385	1762	1140	954	385	76	127	12258
1974	4816	3651	2017	1227	1103	397	70	186	13488
1979	4990	3795	2155	1290	1200	410	105	225	14170
1989	5390	4190	2405	1440	1425	460	180	350	15840
1999	5940	4620	2650	1590	1570	505	195	390	17460
Average Annual Growth Rate									
1964-74	1.7%	1.7%	2.4%	1.8%	3.3%	0.9%	2.8%	8.1%	2.0%
1974-99	0.8%	0.9%	1.1%	1.0%	1.4%	1.0%	4.2%	3.0%	1.0%

Source: ABS Table 3.1 and BTE Estimates.

capita were obtained through regression analysis relating this measure with personal disposable income per capita and the price of cars and station wagons. Personal disposable income forecasts were based on information derived from Haig's medium term forecasting model[1]. Forecasts of the prices of cars and station wagons were estimated by projection of past trends of price indexes of cars and station wagons derived by BTE.

Although extensive econometric work was undertaken no relationships could be found for forecasting the population of other vehicles which improved on a linear approximation. Therefore a linear projection was adopted for forecasting this class of vehicle.

Table 3.3 sets out the forecasts of population of motor vehicles per thousand head of population and Table 3.4 details the estimates of motor vehicles on register.

DISTANCE TRAVELLED FORECASTS

Relationships have been estimated between average annual kilometres of travel, as reported in the three ABS motor vehicle usage surveys[2] and the variables "number of vehicles" and "personal disposable income". Unit vehicle-travel forecasts have been developed from these relationships and are set out in Table 3.5. Forecasts of vehicle-travel are calculated by multiplying the forecasts of motor vehicles by the corresponding forecast average annual kilometres per vehicle. Table 3.6 details the forecasts of vehicle-travel by State which are used as control totals in the analysis of the road investment requirements.

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(1) Haig B.D., A Model for Medium Term Economic Forecasting, Bureau of Transport Economics Occasional Paper 14, AGPS, Canberra, 1978.

(2) Australian Bureau of Statistics and Commonwealth Bureau of Statistics, op.cit., Chapter 2.

TABLE 3.3 - FORECASTS OF MOTOR VEHICLES PER THOUSAND POPULATION

As at 31 Dec.	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.	A.C.T.	AUSTRALIA
1964[a]	305	327	317	358	338	320	250	340	321
1969[a]	366	374	372	393	424	392	300	390	377
1974[a]	416	444	428	464	466	455	494[b]	432	438
1979	456	488	475	504	542	495	357[b]	471	480
1984	500	558	534	535	615	533	405	522	533
1989	555	625	593	691	680	588	466	599	595
1999	660	784	714	667	849	699	574	741	720

(a) 1964 to 1974 - Estimates - Burke R.H., op.cit., Table 2.1.
(b) The effects of Cyclone Tracey are reflected in this estimate.
Source: 1979-1999 - BTE Estimates.

TABLE 3.4 - FORECASTS OF MOTOR VEHICLES ON REGISTER

As at 31 Dec.	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.	A.C.T.	AUSTRALIA
1964(a)	1244	1055	506	366	270	116	13	28	3531
1969(a)	1625	1266	656	448	405	151	23	52	4626
1974(a)	2019	1613	867	569	519	182	39	94	5902
1979	2273	1852	1024	651	650	203	37	106	6796
1984	2595	2213	1214	727	799	231	55	146	7980
1989	2990	2619	1426	864	969	270	84	210	9432
1999	3922	3621	1892	1061	1318	353	112	300	12579

(a) 1964 to 1974 - Estimates - Burke R.H., *op.cit.*, Table 2.1.
Source: 1979-1999 - BTE Estimates.

TABLE 3.5 - FORECASTS OF AVERAGE ANNUAL KILOMETRES PER VEHICLE

Year ended 30 June	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.	A.C.T.[a]	AUSTRALIA
1965[b]	14708	14041	13838	14392	15498	14002	n.a.	n.a.	14298
1970[b]	15728	16301	14923	16363	16584	14448	n.a.	n.a.	15845
1975[b]	16412	16655	14917	15350	16845	14570	n.a.	n.a.	16113
1980	17497	18642	16218	17443	18116	14720	24000	17497	17476
1985	18291	20559	17188	18917	19087	14786	26000	18291	18853
1990	19293	22352	18151	19657	19939	14439	28000	19293	20001
2000	21146	26436	19838	19880	22020	15288	30000	21146	22489

(a) Assumed to be the same as N.S.W.
(b) 1965 to 1975 - Estimates of actual levels - Burke R.H., op.cit. Table 2.1.
Source: 1980-2000 - BTE Estimates.

TABLE 3.6 - ESTIMATES OF VEHICLE-KILOMETRES OF TRAVEL BY STATE

(Millions)

Year ended 30 June	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.	A.C.T.	AUSTRALIA
1965[(a)]	18297	14111	7002	5267	4184	1624	n.a.	n.a.	50486
1970[(a)]	25558	20637	9789	7330	6717	2182	n.a.	n.a.	73299
1975[(a)]	33136	26865	12933	8734	8743	2652	n.a.	n.a.	95099
1980	39771	34525	16607	11355	11775	2988	888	1855	118764
1985	47465	45497	20866	13753	15251	3416	1430	2670	150448
1990	57686	58540	25883	16984	19321	3899	2352	4052	188717
2000	84415	95725	37533	21093	29022	5397	3360	6344	282889

(a) 1965 to 1975 - Estimates of actual levels - Burke R.H., *op.cit.* Table 2.1.

NOTE: A.C.T. and N.T. information is not available except for years of the ABS Motor Vehicle Usage Surveys. The difference between the sum of the States' travel and that for Australia does not represent the sum of the A.C.T. and N.T. levels as such a residual includes estimation errors.

Source: 1980-2000 - BTE Estimates.

The estimates of future vehicle-kilometres of travel in each State are used to develop traffic control totals by broad areas (rural/urban) in each State and Territory. These control totals are applied to check, and where necessary adjust, estimates of traffic volumes for previous, present and forecast years and the traffic growth profiles provided by the States.

These results are used in arriving at estimates of road need expenditures reported in Chapter 5.

CHAPTER 4 - CHANGES IN CONDITIONS OF THE ROAD NETWORK

SCOPE OF THE CHAPTER

This Chapter reports on the term of reference "The condition of the Australian road network and changes to it over the past five years in the light of expenditure undertaken by all levels of Government".

Expenditure on the road network, by category and source of funds over the period 1974-75 to 1978-79 is explored further in Chapter 6 with detailed Tables provided in Annex 3. However, in summary $8798 million (omitting planning and research) will have been spent on the Australian road network in that period, comprising construction expenditure of $5801 million and maintenance of $2997 million.

Of this amount, 53 per cent of construction and 31 per cent of maintenance expenditures (total $4079 million or 46 per cent) has been spent on the arterial network, with the balance of $4719 million (54 per cent) being spent on the local road network.

This Chapter provides an analysis of the changes in conditions of the arterial road system only. The restriction to arterial roads has been necessary for two reasons:

(a) although arterial roads (rural and urban) constitute only 16 per cent of the nation's 821 000 km of road, they carry the bulk (77 per cent) of the nation's road transport; and

(b) the data available for a comparative assessment of changes in road conditions over the past five years is mostly confined to the arterial system as the updating of the Australian Roads Survey data for 1972 has, as outlined below, been directed primarily to arterial roads.

The term "arterial road categories" refers to the categories adopted under current Commonwealth legislation for grants to the States for roads comprising:

- national roads (national highways and national commerce roads)
- rural arterial roads
- urban arterial roads.

These categories derive from the functional classification of roads (see end of Annex 5 for a brief outline of this classification) used as the basis for various studies undertaken by the CBR prior to its 1973 and 1975 roads reports. The functional classes 1, 2 and 3, substantially encompass the national highways and rural arterial categories, while functional classes 6 and 7 are included in the urban arterial category as are some national commerce roads and a very small proportion of national highways. For the purposes of this report the results of the earlier CBR studies were again utilised but additional investigations were conducted for the categories of national highways, rural arterial roads and urban arterial roads. This Chapter is concerned primarily with the results of these additional investigations, and deals with each category separately.

AUSTRALIAN ROADS SURVEY UPDATE

The 1977 Update Survey was designed to revise components of the results of the Australian Roads Survey 1969-74, and of the previous 1975 Update Survey. Update inventory data, reflecting conditions existing at June 1977 for national highways, arterial roads and certain local roads, were provided by the SRA's. Rural and urban areas were defined as in the two previous surveys except for minor variations in the A.C.T. and the Northern Territory. The area of the A.C.T. previously classed as rural was designated as urban. Darwin was also treated as an urban area.

The 1977 Update Survey included arrangements for minor changes in the functional classification of roads resulting from road improvements between 1974 and 1977. However, data submitted for Queensland were based on a major review of functional classifications which resulted in a decrease in the length of roads classed as rural arterial by about 1560 km. Allowances were made in the analyses of the survey data to take account of this reclassification[1].

NATIONAL HIGHWAYS

Existing State of the National Highways System

There have only been small changes to the routing of the national highways system since CBR reported in 1975. Sections bypassing towns, and other reconstructions, have altered lengths in some States and a section of road linking the Bass and Midland Highways at Launceston has been added to the Burnie to Hobart national highway in Tasmania.

Table 4.1 presents a summary of the condition as at June 1977 of the declared national highways system based on information provided by the States and Territories.

As of 1977 there were 444 km of divided carriageway or four lane roads compared with 295 km of divided roads in 1975. Of the total system length, 81.6 per cent is sealed leaving only 3006 km yet to be sealed. This is a significant reduction in unsealed length since 1975, when only 75.8 per cent of the system was sealed.

Extent of the National Highways System

The Bureau sought the views of various State authorities as to the extent of the national highways network. The States were asked to comment on whether there are other (non-declared) parts

(1) This is discussed further in Chapter 5, see also Table 4.6, footnote (c).

TABLE 4.1 - NATIONAL HIGHWAYS SYSTEM INVENTORY ANALYSIS

(kilometres)

National Highway Route	1974 Data				1977 Data						A.A.D.T.[a]	
	Total Length	Length by Surface Type			Total Length	Length by Surface Type			Length by Land use			
		Sealed				Sealed						
		Divided C'way	Other	Unsealed		Divided C'way	Other	Unsealed	Towns	Rural	Maximum[b]	Minimum
Sydney-Melbourne	833	93	740	-	826	161	665	-	69	757	22 300	2 200
Sydney-Brisbane	904	57	847	-	902	66	836	-	96	806	24 400	1 600
Melbourne-Adelaide	708	75	633	-	708	93	615	-	55	653	2 000	1 400
Brisbane-Cairns	1 723	21	1 563	139	1 716	45	1 578	93	106	1 610	1 900	1 000[f]
Brisbane-Darwin[c]	2 441	18	1 974	449	2 438	37	2 066	335	61	2 377	8 800	50
Adelaide-Perth	2 683	16	2 254	408	2 670	21	2 644	-	37	2 628	9 000	250
Adelaide-Darwin[d]	2 920	6	1 769	1 145	2 920	8	1 946	966	28	2 892	5 000	75
Perth-Darwin[e]	3 684	-	1 875	1 809	3 663	-	2 051	1 612	16	3 647	4 500	25
Hobart-Burnie	319	6	313	-	324	10	314	-	49	275	4 500	2 000
A.C.T.	8	-	8	-	8	-	8	-	-	8	4 900	4 800
Canberra Connections	105	3	102	-	105	3	102	-	2	103	5 200	3 500
TOTAL	16 328	295	12 078	3 950	16 280	444	12 825	3 006	519	15 756		

(a) Annual Average Daily Traffic.
(b) Sections close to urban areas may carry higher volumes.
(c) Section from Brisbane to Tennant Creek.
(d) Section from Port Augusta to Darwin.
(e) Section from Perth to Katherine.
(f) Section from Marlborough to Sarina (coast route) is unsealed and carries at present much lower volumes.

Source: ARS Update Surveys 1975 and 1977.

of their road networks which should be considered for declaration as national highways. Their views are contained in submissions which are reported in full in Annex 6 of this report. In general the States consider that the national highways system should not be extended at this time.

Accordingly the investigations reported herein relate to the national highways system as currently declared.

Deficiency Analysis of the National Highways System

(a) By link

A deficiency analysis of the national highways system has been conducted using the updated inventory information provided by the States in 1977. This involved comparing the condition of the national highways system existing at June 1977 and that likely to exist at June 1984, with the National Highway Design Standards[(1)], assuming no construction in the intervening period.

Table 4.2 summarises the results of this analysis and compares these results with the situation pertaining in June 1974[(2)]. A more detailed analysis is presented in Annex 1.

The results indicate that while there has been some progress towards attaining the design standards since 1974 (see Annex 5 for a discussion on road standards), most of the length of the system remains deficient in one respect or another. Ninety-four per cent of the system was deficient in 1974 whereas 90 per cent of the system is deficient now, <u>when compared against the declared design standards</u>.

(1) Detailed standards for each segment of the national highways system have been determined by the Commonwealth in association with the States and the Commonwealth Minister for Transport has notified the States of these.

(2) The inventory data and deficiency analysis reported in Table 4.2 for 1974 is slightly different to that published by CBR in 1975. This results from a revision of the 1974 inventory data to improve its accuracy and to enable valid comparison with 1977 inventory data.

TABLE 4.2 - NATIONAL HIGHWAYS SYSTEM DEFICIENCY ANALYSIS BY LINK

National Route	Inventory Length 1977 (km)	Below N.H. Design Standards 1977-84		Inventory Length 1974 (km)	Below N.H. Design Standards 1974-81	
		length (km)	%		length (km)	%
Sydney-Melbourne	826	769	93	833	803	96
Melbourne-Adelaide	708	504	71	708	523	74
Adelaide-Perth	2 670	2 391	90	2 683	2 415	90
Adelaide-Darwin	2 920	2 711	93	2 920	2 856	98
Perth-Darwin	3 663	3 438	94	3 684	3 583	97
Sydney-Brisbane	902	742	82	904	824	91
Brisbane-Cairns	1 716	1 592	93	1 726	1 681	97
Brisbane-Darwin	2 438	2 322	95	2 441	2 404	98
Hobart-Burnie	324	113 [(a)]	35	319	159	50
Canberra connections	113	113	100	113	113	100
TOTAL	16 280	14 695	90	16 331	15 361	94

(a) BTE estimate based on inventory data and other information provided by the States.

Source: ARS Update Surveys 1975 and 1977 and BTE Estimates.

It should be stressed that practice of staging the upgrading of national highways towards declared design standards often means that ultimate design standards are not met until all proposed work is completed. This is despite the achievement of considerable improvements in road quality in the interim construction stages. Thus a substantial proportion of upgrading work (and associated expenditure) may not be reflected in a reduction in the "measurement" of national highway deficiency. Accordingly changes in the "degree of deficiency" and subject to strong limitations in any inferences that might be drawn from them concerning changes in road quality.

(b) By type of deficiency

Table 4.3 provides information on deficiency by type in 1977 as well as indicating, particularly in the Sydney-Melbourne link, sections of road that are up to geometric design standards but are deficient due to the age of the pavement structure. That is, there has been a greater achievement in reaching geometric design standards than is revealed by the data in Table 4.2 above. This is because the stage has been reached where sections of the national highways system which have been upgraded to geometric standards are becoming structurally deficient.

The link deficiency analysis results shown in Table 4.2 have been recast on a State basis in Table 4.4. This Table also presents a forecast of percentage deficiency. The information serves to highlight the fact that almost all the assessed deficiencies currently exist. The deficiencies occurring after 1977 are due to the ageing of pavement structures. At June 1977, 88.4 per cent of the system was deficient when compared to national highway design standards.

The deficiency analysis provides one type of guide as to the current physical State of the national highways system when compared with the ultimate design standards set for this system. However it should be stressed that the analysis does <u>not</u>, by

TABLE 4.3 - NATIONAL HIGHWAYS SYSTEM DEFICIENCY ANALYSIS BY TYPE OF DEFICIENCY: 1977-78

National Route	Inventory Length (km)	Length Deficient (%)	Length Geometrically Deficient[(a)] (%)	Length Structurally Deficient (%)	Length Structurally, but not Geometrically Deficient (%)
Sydney-Melbourne	826	93	82	58	11
Melbourne-Adelaide	708	71	66	48	5
Adelaide-Perth	2 670	90	85	26	5
Adelaide-Darwin	2 920	93	92	50	1
Perth-Darwin	3 663	94	86	36	8
Sydney-Brisbane	902	82	79	43	3
Brisbane-Cairns	1 716	93	89	71	4
Brisbane-Darwin	2 438	95	94	60	1
Hobart-Burnie	324	35	35	0	0
Canberra Connections	113	100	91	76	9

(a) For this Table, width of seal is used as the measure of geometric deficiency (this excludes alignment or curvature deficiencies).

Source: ARS 1977 Update Survey.

TABLE 4.4 - NATIONAL HIGHWAYS SYSTEM: CURRENT AND FORECAST DEFICIENCIES BY STATE AND TIME DISTRIBUTION OF DEFICIENCY

State	Length (Kilometres)	% of Length Deficient or becoming deficient[a] 1977	1978-79	1982-84	Total
New South Wales	1 335	77.8	0.2	7.8	85.8
Victoria	690	61.3	0.7	7.4	69.4
Queensland	3 922	92.0	0.7	1.4	94.1
South Australia	2 626	87.5	0.1	0.1	87.7
Western Australia	4 631	94.9	0.0	0.1	95.0
Tasmania	324	35.0	0.0	0.0	35.0
Northern Territory	2 739	91.6	0.0	0.1	91.7
A.C.T.	8	100.0	0.0	0.0	100.0
TOTAL	16 275	88.4	0.2	1.4	90.0

(a) Existing deficiencies as at June 1977 and forecast to become deficient up to June 1984 assuming no new construction in the period 1977-84.

Source: ARS 1977 Update Survey and BTE Estimates.

itself, indicate sections which are deficient to the extent that road works are either warranted or necessary to provide safe and efficient road conditions. For example, the final section of the Eyre Highway was recently sealed to a width of 6.8 metres. Although a width of seal for this section of 7.4 metres is specified in the ultimate design standards, this section of road is not in need of reconstruction nor is it likely to be over the period 1977-84.

The deficiency analysis is used, together with economic analysis, to determine the economic merit of upgrading various sections of the national highways system to design standards. The results of this are reported in the next Chapter and provide the basis for BTE estimates of the warranted capital investment needs for the national highways system.

Planning Studies of the National Highways System

In planning improvements to existing routes of the national highways system a number of considerations are important, including improving the alignment, reducing distance, limiting access, removing at-grade railway crossings, reducing closure time due to flooding and improving the social amenity of towns through which highways now pass by providing bypass routes. The CBR in its 1973 roads report(1) identified eight locations where new route alignments may be feasible and should be studied in depth.

In its 1975 roads report(2), the CBR reported on the progress of these corridor studies, some of which had not been completed at that time. Appraisals have now been completed for all sections and the conclusions of those completed since 1975 are summarised below.

- Sydney to Melbourne National Highway - Goulburn to Albury/Wodonga:

(1) CBR (1973), op.cit., paras 7.12-7.18.
(2) CBR (1975), op.cit., paras 8.31-8.51.

The section from Goulburn to Table Top (just north of Albury) was reported upon in 1975. A second report on the alignment of the national highway in the vicinity of Albury/Wodonga was completed in February 1978[(1)].

In this study bypasses both internal and external to the urban area of Albury/Wodonga were considered and the conclusion reached that construction of an internal bypass route and it use as part of the national highways network prior to constructing an external route was the preferred alternative.

. Sydney to Brisbane National Highway - Location in the Vicinity of Newcastle:

An investigation of alternative routes for the national highway in the vicinity of Newcastle was carried out by the CBR (at the request of the Minister) and the study report published in March, 1976[(2)]. The recommendations concerning relocation of the national highway route were that:

"(a) the most appropriate route for the Sydney-Brisbane national highway north from the Warnervale area is on a location west of Lake Macquarie passing east of West Wallsend and joining the existing Pacific Highway in the vicinity of Sandgate;

(b) the national highway between Sandgate and Branxton be relocated in the longer term along a route to the south of the existing highway because the existing highway is both in need of improvement to national highway standard and is flood prone in parts."

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(1) Bureau of Transport Economics, National Highways Linking Sydney, Melbourne and Canberra 1978 (Second Report), AGPS, Canberra, 1978.

(2) Commonwealth Bureau of Roads, Report on the General Location in the Vicinity of Newcastle of the National Highway Linking Sydney and Brisbane, 1976.

In addition, it was recommended that, in the interim, upgrading to a lower than national highway standard of the existing declared national highway between Nords Wharf and Swansea (the Pacific Highway) be undertaken as a matter of urgency and that some upgrading of the present national highway between Hexham and Branxton (the New England Highway) also be undertaken since it would remain as the national highway for ten to fifteen years.

- Brisbane to Cairns National Highway - Marlborough to Sarina:

The outcome of the appraisal of this national highway segment was reported upon in 1975[1].

- Adelaide to Darwin National Highway - Port Augusta to Alice Springs:

A study of the alternatives for the Port Augusta to Northern Territory Border section was undertaken by the South Australian Highways Department under a Steering Committee comprised of Commonwealth, South Australian and CBR officers.

The Steering Committee report[2], tabled in Federal Parliament in October 1976, recommended two possible routes. Both these routes are to the west of Lake Torrens, and generally follow the existing road. Both of these proposed routes are substantially shorter, and would have less unfavourable environmental impact than the existing highway.

The report indicated that the final decision as to which of

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(1) CBR (1975) op.cit, para 8.39.
(2) Report on the National Highway Linking Adelaide and Darwin: Port Augusta to Northern Territory Border, Steering Committee Report, October, 1976.

the two recommended alternative routes is adopted must take into account the long-term future of the Weapons Research Establishment (WRE)[1].

The route passing west of the WRE range at Woomera has since been selected as the future national highway alignment. The location of the highway from the border to Alice Springs had previously been determined.

- Adelaide to Perth National Highway - East of Woomera to Perth:

  An appraisal conducted by CBR indicated that a full corridor study does not appear to be warranted at present.

- Perth to Darwin National Highway - Broome to Katherine:

  A corridor appraisal has been completed. Initial investigations, whilst establishing a case for a more extensive study, indicated that the final location of the national highway will be influenced primarily by the long-term development policies for the North-West region. A full corridor study would best be delayed until such time as these development policies are clearly formulated.

- Brisbane to Darwin National Highway - Camooweal to Daly Waters:

  A corridor study was conducted by the then Commonwealth Department of the Northern Territory under the direction of a Steering Committee. The Committee presented its report in August 1978[2]. It recommended the national highway be constructed basically along the existing declared route. Construction was recommended to be conducted in two stages.

(1) Now called Defence Research Establishment.
(2) Department of the Northern Territory, Report on the National Highway Linking Brisbane and Darwin Berkley Tableland Region, 1978.

- Hobart to Burnie National Highway - Approaches to Hobart:

A study carried out by CBR[1] concluded that the approach to Hobart should remain in the same vicinity as the existing highway and cross the Derwent River at Bridgewater. Although there are significant social problems associated with use of the existing highway, realignment is not justified at this time. However as traffic growth increases a new alignment west of the present highway may be justified in about ten years. Therefore it was suggested that planning should proceed on the development of this new alignment and action taken to reserve the alignment route.

There have also been a number of other planning studies of selected corridors of the national highways system since 1975. Summary reports on these are given below.

- Sydney to Melbourne National Highway - Broadford (Victoria) to N.S.W. Border:

A route location study for the Baddaginnie-Bowser section has been completed by the Country Roads Board of Victoria. Whilst not formally involved in the study, officer level liaison on methodology was established by the CBR.

The final report has recommended a realignment of the Hume Highway between Bowser and Baddaginnie, including by-passes of Benella, Glenrowan and Wangaratta.

For the Broadford to Baddaginnie section, no corridor study has been undertaken. However, a number of projects, including by-passes of Seymour and Euroa and duplication of part of the existing highway, have been approved by the Minister.

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(1) Commonwealth Bureau of Roads, National Highway Linking Hobart, Launceston and Burnie, Approaches to Hobart, Melbourne, 1977.

Consideration of the highway north from Bowser has been substantially covered by investigations into the national highway route in the vicinity of Albury-Wodonga (see above).

- Canberra Connections:

  A study of the future route of the national highways linking Canberra with the Sydney-Melbourne national highway has recently been completed by BTE[1]. The report concludes that there should be two links, generally along the alignment of the Federal and Barton Highways and that Yass should be bypassed.

- Perth to Darwin National Highway - Meekatharra to Port Hedland:

  A study of possible routes through the Pilbara Region is currently being undertaken by the Western Australian Main Roads Department.

- Darwin to Melbourne - North-South Highway via Mount Isa and Broken Hill:

  Upon the request of the Minister, CBR carried out an investigation into the development of a north-south highway. The CBR report[2] suggested that such a highway, as an addition to the national highway system, did not warrant further consideration. The report also indicated that a sealed road even at lower than national highway standard was not presently justified.

- Hobart to Burnie National Highway - Penguin to Burnie:

  The CBR, in its 1975 roads report, recommended that a corridor

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(1) Bureau of Transport Economics, National Highways Linking Sydney, Melbourne and Canberra, 3rd Report, 1978, AGPS, Canberra 1979.

(2) Commonwealth Bureau of Roads, Report on a North-South Highway Connecting Darwin to Melbourne via Mount Isa and Broken Hill, 1976.

study be undertaken for this section. This study has since been carried out[1].

The main alternatives considered were retention of the existing coastal alignment or the adoption of an inland route.

The study concluded that, whilst it is not feasible to upgrade the coastal route between Penguin and Burnie to full national highway design standard, sufficient upgrading can be achieved to adequately cater for expected traffic demand. Based on current traffic forecasts the construction of an inland route was found to be not economically warranted for at least thirty years.

Thus it was concluded that the national highway should remain along the general alignment of the existing coastal route (the Bass Highway) for the foreseeable future. Further, as any upgrading of the coastal route will greatly reduce the economic viability of building an inland route, it is unlikely that the construction of an inland route will be justified for many years beyond the thirty year investigation period. Therefore, action to reserve an inland alignment was not considered necessary.

- Hobart to Burnie National Highway - Eastern Bypass of Launceston:

In April 1976 the Minister requested CBR to evaluate possible eastern by-pass routes of Launceston, including the question of whether such a by-pass should be included in the declared national highway system. A report was published in July, 1977[2].

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(1) Bureau of Transport Economics, National Highway Linking Hobart, Launceston and Burnie: Appraisal of Penguin to Burnie Section, 1978, AGPS, Canberra, 1978.

(2) Bureau of Transport Economics, Eastern Bypass Route for Launceston Evaluation, AGPS, Canberra, 1977.

This report concluded that construction of an eastern by-pass route was not economically warranted at this time. However, a future need may arise to construct such a route and such a 'preferred' route was identified with the further suggestion that steps be taken to provide a planning reservation appropriate to the preferred route and capacity requirements. In addition, improvements to existing roads would be beneficial in the short term and suggested works were outlined.

The BTE is not engaged in further planning of the national highway system at present. The State Road Authorities and the Roads Division of the Commonwealth Department of Transport have a continuing involvement in this regard.

As an outcome of these planning processes, most States have established priorities for the upgrading of the national highways in their States. Some of these priorities are outlined in the State submissions contained in Annex 6 of this report.

RURAL ARTERIAL ROADS

Analysis of Recorded Data

Inventories of length of rural arterial roads by surface type as at 30 June, 1977 (as obtained from the 1977 Update Survey) are shown in Table 4.5.

Changes in the sealed length of rural arterial roads are shown in Table 4.6 for the 1977 Update Survey, and for previous survey results as at 1972 and 1974. Table 4.6 includes national highways to facilitate comparison with the length in 1972, which included roads which were placed in the separate category of national highways in 1974. The Australia-wide increase of about 1 per cent per year in the combined length of sealed rural arterials and national highways between 1972 and 1977, is approximately one half of the percentage increase in Queensland which shows the greatest increase among the States.

TABLE 4.5 - RURAL ARTERIAL ROAD LENGTH[a]

State/ Territory	Length in 1977 (km) Surface Type Sealed	Gravel	Formed	Natural	Total Length
N.S.W.	20 124	6 899	3 161	0	30 184
Vic.	14 888	506	5	3	15 402
Qld	13 362	1 010	4 021	403	18 796[b]
S.A.	7 582	1 724	513	0	9 819
W.A.	11 131	766	3 330	1 154	16 381
Tas.	2 318	280	0	0	2 598
N.T.[c]	1 081	473	587	150	2 291
TOTAL	70 486	11 658	11 617	1 710	95 471

(a) Excludes national highways system.
(b) Figures given for Queensland exclude approximately 1560 km of road treated as arterial road in previous surveys.
(c) The N.T. figures exclude roads in the Darwin Local Government Area which were treated as urban roads.

Source: ARS 1977 Update Survey.

TABLE 4.6 - CHANGES IN SEALED LENGTH OF RURAL ARTERIAL ROADS[a]
1972-77

State/Territory		Year 1972	1974	1977
N.S.W.[b]	Sealed km	21 118	21 506	21 371
	Total km	32 297	32 248	31 432
	Sealed (%)	65.4	66.7	68.0
VIC.	Sealed km	15 480	15 549	15 549
	Total km	16 045	16 063	16 065
	Sealed (%)	96.5	96.8	96.8
QLD[c]	Sealed km	15 551	16 518	17 033
	Total km	24 541	24 520	22 905
	Sealed (%)	63.4	67.4	74.4
S.A.	Sealed km	8 259	8 818	9 217
	Total km	12 408	12 429	12 405
	Sealed (%)	66.6	70.9	74.3
W.A.	Sealed km	13 126	13 301	14 206
	Total km	21 337	21 319	21 067
	Sealed (%)	61.5	62.4	67.4
TAS.	Sealed km	2 498	2 575	2 615
	Total km	2 892	2 900	2 899
	Sealed (%)	86.4	88.8	90.2
N.T.	Sealed km	3 427	3 664	3 808
	Total km	5 063	5 074	5 020
	Sealed (%)	67.7	72.2	75.9
A.C.T.[d]	Sealed km	23	24	0
	Total km	23	24	0
	Sealed (%)	100	100	-
AUST.	Sealed km	79 482	81 955	83 799
	Total km	114 606	114 577	111 793
	Sealed (%)	69.4	71.5	74.9

(a) Includes national highways.
(b) Decreases in road lengths due to errors between surveys caused by changes in various State's systems of recording classification of roads, changes from imperial to metric measure etc.
(c) The figures for 1977 exclude about 1560 km reclassified as local roads by the Queensland Department of Main Roads.
(d) The category of rural arterial road does not apply to the A.C.T. for 1977 due to the incorporation of the rural area into the urban area.

Source: ARS 1969-74, ARS 1975 Update Survey, ARS 1977 Update Survey.

There has been an apparent improvement in length of seal for rural arterials comprising an increase of 2473 km between 1972 and 1974, and a further increase of 1844 km between 1974 and 1977 - giving a total increase of 4317 km sealed between 1972 and 1977. However 896 km of the increase in seal between 1974 to 1977 is due to the increase in length of seal in national highways.

Therefore, omitting national highways, the amount sealed for rural arterials between 1974 and 1977 was 948 km representing an increase of just over 1 per cent in the sealed length.

The increase in travel on rural arterial roads and national highways as recorded in the Australian Roads Survey and the Update Surveys, is indicated in Table 4.7. This indicates an increase in travel between 1972 and 1977 in this category of about 41 per cent or an annual average growth rate between 1972 and 1977 of 7.1 per cent. The increase between 1972 and 1974 averaged about 4.9 per cent per annum while between 1974 and 1977 it was 8.6 per cent per annum.

Deficiency Analysis

Deficiencies on rural arterial roads were estimated by comparing road conditions, as recorded in the 1977 Update Survey, with engineering standards[1]. The procedures and standards used in this analysis were the same as those used previously by the CBR for analysis of the 1975 Update Survey data. Deficiencies were assessed for road conditions existing in July 1977 and also for road conditions arising up to June 1984 due to increased traffic and deterioration of road pavements.

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(1) The engineering standards used for the identification of deficiencies are laid down in the CBR publication Australian Roads Survey 1969-74 - Specification. The standards were jointly agreed upon by NAASRA and the CBR and indicate road conditions which are considered desirable (see Annex 5).

TABLE 4.7 - TRAVEL ON RURAL ARTERIAL ROADS[a]

State/ Territory	Travel Million Vehicle-Kilometres		
	1972	1974	1977
N.S.W.	8 286	9 173	10 956
VIC.	4 989	5 346	7 758[b]
QLD	4 644	5 111	6 936
S.A.	1 724	2 063	2 274
W.A.	2 087	2 145	2 997
TAS.	974	1 120	1 174
N.T.	325	391	387[c]
A.C.T.	11	14	-[d]
TOTAL	23 040	25 363	32 482

(a) Includes national highways.
(b) The Bureau checks indicated that the survey figure for Victoria was considerably higher than the control figure; therefore this adjusted figure was used for subsequent estimates of deficiencies, improvement requirements and warranted expenditure.
(c) Excludes Darwin which is included under urban.
(d) For the 1977 Update Survey, the rural area of the A.C.T. was incorporated with the urban area.

Source: Australian Road Surveys and BTE Estimates.

Table 4.8 shows the length and percentage of rural arterial roads found to be deficient in the analysis of data from both the 1977 and 1975 Update Surveys for all States and the Northern Territory. The general increase in deficient length indicates that arterial road improvements may not be keeping pace with the increase in traffic on the road system. The decreases in deficiencies in Queensland and Western Australia are partly due to changes in the set of roads to which the figures relate. The decrease in Tasmania is partly due to inconsistencies between the data from the two update surveys. This apparently arose from changes in the method of recording inventory data between the two update surveys by that State.

URBAN ARTERIAL ROADS

The 1977 Update Survey provided an updated inventory of road length and travel on the inner and outer urban arterial roads of the capital and major provincial cities (cities with populations exceeding 40 000) as at June, 1977. The details by surface type are shown in Table 4.9.

Travel on arterial roads as derived from the Australian Roads Survey 1969-74 and the two update surveys, is shown in Table 4.10. National highways are included in the update surveys for consistency with the set of roads in the Australian Road Survey 1969-74 which was conducted before the separate category of national highways was created. However the length of national highways, and hence travel on them, in urban areas is very low.

The total of travel on all arterial roads (including national highways), as a proportion of total road travel in Australia, is shown in Table 4.11.

It can be seen from Table 4.11 that 77 per cent of all road travel occurs on the arterial road system. Of all arterial road travel 62 per cent is on urban arterial and 38 per cent is on

TABLE 4.8 - DEFICIENT LENGTH OF RURAL ARTERIAL ROADS

State/ Territory[c]	Inventory Length (km) 1977	Deficient Length			
		1974		1977	
		km	%	km	%
N.S.W.	30 184	21 735	72	25 032	83
VIC.	15 402	5 850	38	6 549	43
QLD	18 796	17 522	73	15 018[a]	80
S.A.	9 819	5 562	57	8 382	85
W.A.	16 381	10 206[b]	62	8 177	50
TAS.	2 598	2 039	78	1 166	45
N.T.	2 291	1 616	71	1 617	71
TOTAL	95 471	64 530	68	65 941	69

(a) The 1977 deficiencies relate to a set of roads some 1560 km less than in 1974 due to the change in functional classifications by the Queensland Main Roads Department.
(b) Includes outer urban arterial roads.
(c) All A.C.T. treated as urban.
Source: ARS 1977 Update Survey.

TABLE 4.9 - URBAN ARTERIAL ROAD LENGTH: JUNE 1977

State/ Territory	Length (km)				
	Surface Type				
	Sealed	Gravel	Formed	Natural	Total
N.S.W.	3 425	33	6	0	3 464
VIC.	3 884	304	14	10	4 212
QLD	1 479	6	0	10	1 495
S.A.	1 087	40	8	0	1 135
W.A.	1 444	0	8	6	1 458
TAS.[a]	472	4	0	0	476
N.T.[b]	30	0	0	3	33
A.C.T.	434	0	0	0	434
TOTAL	12 255	387	36	29	12 707

(a) Tasmanian data is from the 1975 Update Survey, i.e. as at June 1974.
(b) Darwin Local Government Area only.
Source: ARS 1977 Update Survey.

TABLE 4.10 - TRAVEL ON URBAN ARTERIAL ROADS[a] : 1972-1977

State/ Territory	Travel Million Vehicle - Kilometres		
	1972	1974	1977
N.S.W.	15 082	13 607[b]	17 495
VIC.	12 033	13 545[b]	15 704[c]
QLD	4 176	3 920[b]	6 154
S.A.	3 317	4 077	4 915
W.A.	3 981	4 072	5 854
TAS.	958	810[b]	980
N.T.	(e)	(e)	114[d]
A.C.T.	827	1 311	1 379[f]
TOTAL	40 374	41 342	52 595

(a) Includes national highways.
(b) Excludes travel in major provincial cities.
(c) Bureau control figure substituted here since the survey figure was outside the tolerance limits.
(d) For the Darwin Local Government Area.
(e) Not applicable.
(f) Includes roads in the A.C.T. previously classed as rural.

Source: Australian Road Surveys and BTE Estimates.

TABLE 4.11 - TRAVEL ON ARTERIAL ROADS IN 1977[a]

Travel in Million Vehicle-Kilometres

State or Territory	Total Travel[b]	Rural Arterials[c] & National Highways	Urban[d] Arterials	Total Arterials	Arterial Travel as % Total
N.S.W.	36 333	10 956	17 495	28 451	78.3
VIC.	31 900	7 758	15 704	23 462	73.5
QLD	15 460	6 936	6 154	13 090	84.7
S.A.	10 560	2 274	4 915	7 189	68.1
W.A.	10 775	2 997	5 854	8 851	82.1
TAS.	2 964	1 174	980	2 154	72.7
TOTAL STATES	107 992	32 095	51 102	83 197	77.0
N.T.	805	387	114	501	62.2
A.C.T.	1 641	-[e]	1 379	1 379	84.0
TOTAL AUSTRALIA	110 438	32 482	52 595	85 077	77.0

(a) Includes national highways.
(b) From BTE estimates for this report.
(c) From Table 4.7.
(d) From Table 4.10.
(e) For the 1977 Update Survey, the rural area of the A.C.T. was incorporated with the urban area.

Source: 1977 Update Survey and BTE Estimates.

rural (including national highway system). Travel on the urban arterial network has grown by 12 221 million vehicle-kilometres (30 per cent) since 1972 (an annual average growth rate of 5.4 per cent), compared with an increase of 9 442 million in vehicle-kilometres (41 per cent) since 1972 on the rural arterial and national highway system (or an annual average increase of 7.1 per cent).

In urban areas, while road surface conditions are not insignificant factors affecting travel comfort, the predominant feature determining travel cost is the condition of the road network as measured by a comparison of usage with capacity and reflected in the extent, severity and daily duration of traffic congestion.

Traffic Accidents

One indicator which can provide some information on changes in road and traffic conditions is the road accident rate. As shown in Chapter 2, the number of car passenger-kilometres and freight tonne-kilometres has increased substantially since 1971 by a factor of about 30 per cent for passengers and 37 per cent for freight. Despite this, the number of road accidents involving casualties has remained fairly static at 1972 levels although there is some annual variation in the pattern.

The result is a declining casualty accident rate, falling from seventy-eght casualty accidents per hundred million vehicle kilometres in 1972 to fifty-nine in 1977 - a decrease at 24 per cent. It is not possible with present knowledge and data sources to accurately attribute the proportion of this decline to improvements in roads resulting from road expenditures over the period, as distinct from other likely causative factors such as:

- introduction of compulsory wearing of seat belts;
- driver training and education programs;
- traffic regulation and enforcement; and
- increased driver awareness and levels of skills.

In sum, the information presented in this Chapter concerning the changes in road and travel conditions is not conclusive as it does not adequately indicate the effect on the road system of the $8859 million spent on roads in the five years 1974-75 to 1978-79. To analyse the effectiveness of total road expenditures an extensive study would need to be undertaken. Such a study would monitor changes in the road system, in operational and safety conditions, and in the cost of operating the Australian vehicle fleet and relate these to road expenditure. A study of this magnitude has not yet been attempted in Australia. More limited corridor based studies are more feasible and they may provide more useful results.

CHAPTER 5 - ROAD NEEDS 1979-80 TO 1982-83

INTERPRETATION OF ROAD NEEDS

This Chapter reports on the term of reference "Total road needs 1979-80 to 1982-83". The phrase "road needs" is capable of many interpretations. In this report it has been broadly interpreted as that level of expenditure on road construction and maintenance, plus associated expenditures (general administration, planning and research) required to achieve given objectives for the road system.

Objectives for the road system can, in turn, range from improving, sustaining or even reducing the overall standard. Standards (in this context representing a guide to net economic/social contributions of roads) of the road system in terms of structural and design characteristics, of the system's capacity to carry traffic, of the level of service provided (e.g., travel speed and safety), and so forth.

In this Chapter road needs to achieve two of these objectives - i.e., improving and/or sustaining road standards are analysed. The possible objective of reducing road standards is not explicitly examined, although it will be apparent that levels of expenditure ranging from zero up to that level of expenditure which just sustains road standards will provide a range of expenditure options meeting that objective. In view of the significance of road standards inherent in both the concepts and the methods adopted for this report, further discussion of the application of road standards by the Bureau is given in Annex 5.

As discussed in this Chapter the objectives of sustaining and improving road standards are part and parcel of the major objective of this report. That is to identify a level of economically justifiable or "warranted" expenditure on roads based on an assessment of expenditure by use of economic evaluation procedures.

ENGINEERING NEEDS AND WARRANTED EXPENDITURE

Improving Road Standards

The two main approaches to road needs identified under this heading are:

- Engineering Standards - under this criterion, road needs are assessed as the financial cost of improving deficient parts of the road network to specified engineering standards of design.

- Economically Warranted Expenditure - under this criterion, road needs are assessed as the financial cost of road works over a given period for which the discounted future benefits to the community at least as great as the discounted costs of undertaking the works and where no single expenditure in the period yields less than a specified rate of return.

The economic analysis recognises that funds committed to road investment have an opportunity cost, and that, in order to maximise economic efficiency, expenditure to improve roads should only be pursued up to that point where the future discounted time stream of benefits of the least worthwhile road project just equals the discounted cost of that project. The discount rate adopted in these assessments is assumed to represent the community's opportunity cost of capital(1).

Sustaining Road Standards

- Capital-Output Projection Method - the levels of road expenditure required to sustain road standards are approximated in this report by projection of the historical ratios of capital (road) stock required to produce a given output (vehicle-kilometres of travel) for predicted future usage.

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(1) There has been a longstanding debate as to the theoretical (and indeed empirical) basis of the discount rate applied in economic evaluation procedures. This debate has produced two discounting concepts - one based on the social opportunity cost of capital (SOC) which, in general terms, approximates the real rate of return to alternative investments based upon social benefits and costs. The other concept, the social time preference rate (STP), purports to reflect the attitude of the community as a whole to the consumption of goods and services in the future compared to current consumption. It is accepted that in a "perfect world" the SOC and STP rates would be equal, but that this is not the case in fact. It is common to assume in the real world that the STP rate is probably the lower. (If this is the case, use of an SOC rate results in a bias towards short-term projects at the expense of projects which generate benefits further forward in time.)
The major problem with the STP concept is one of empirical measurement; while approximations of the SOC rate can be reached by observing commercial investment and various capital market patterns there is no readily available or acceptable data reflecting the community's STP rate. It can be further argued that it is inherently indeterminate. Evaluations conducted by Government agencies in Australia have tended in the main to use discount rates which are loosely related to SOC rates. This has been the practice of the CBR and BTE. In addition, for this report the Bureau has assumed that the proportionate share of the total warranted program at the State and category level is insensitive to changes in the discount rate. However, this is clearly an area of analysis that deserves further consideration.

The capital-output projection method for identifying aggregate road needs embodies the assumption that historical ratios of past capital road stock to road service output (as measured by vehicle-kilometres of travel) have provided acceptable (quality) levels of service, and that projection of trends in these ratios will provide estimates of road needs which will sustain a similar level or rate of change in the level and quality of road services. The method yields an estimate of road needs which can be said to approximate that required to sustain a given constant historical rate of change in road service given predicted usage(1).

As this method embodies trends over time in the level of utilisation of road stock and accompanying changes in the level of service, it is probably more correct to describe it as a means of identifying road needs given a constant (historical) rate of change in the level of service provided by the road network.

APPROACH TO EVALUATION OF ROAD NEEDS

The following briefly outlines the methods used for assessment of the economically warranted expenditures.

. Data Collection

In the discussions which laid the basis for the determination of warranted road needs for the 1979 report it was agreed between NAASRA members and the CBR that the 1977 Update Survey would provide limited information only. As indicated in Chapter 4, the updated inventory data related primarily to national highways and rural and outer urban arterial roads. Further details of improvement projects for inner urban arterial roads were updated for the 1975 Update Survey, but not for the 1977 Update Survey.

. Procedures Adopted by the Bureau

The seven years 1977-78 to 1983-84 were chosen as the period for

(1) Further discussion of this approach is given in Annex 2.

economic evaluation. Financing options were identified for the four years 1979-80 to 1982-83, which covers the last year of the current legislation and the subsequent three years.

For rural and outer urban arterial roads the 1977 inventory data were analysed to determine the required improvements to achieve ARS road standards and to provide economic evaluations of the resulting improvement projects.

For this report warranted expenditure programs for national highways, rural local roads, urban roads and MITERS were based on the warranted programs prepared by the CBR for previous reports using updating procedures similar to those used for these categories for the 1975 roads report.

Warranted expenditure for maintenance, planning and research and general administration(1) were assessed by the CBR in previous reports without the benefit of economic analysis. Some investigations of actual expenditure for these categories have been undertaken since 1975, but no economic evaluation of such expenditures was attempted. The warranted amount for maintenance for the seven year period 1977-78 to 1983-84 was estimated by projecting maintenance expenditure from observed patterns.

The results of these assessments, for the seven years 1977-78 to 1983-84, are included below for each category.

ROAD NEEDS 1977-78 TO 1983-84

Cost of Upgrading the National Highways System to Design Standard

The costs of bringing the national highway system to design standards from the condition existing at June 1977 and to overcome

(1) General administration excludes administration costs incurred directly in the process of planning, designing and constructing road facilities. The latter administration costs are termed engineering administration and are included in construction costs estimates.

deficiencies arising between that date and June 1984 were required for this report. Since design standards are fixed and independent of traffic volumes, it is possible to assess these costs largely by updating earlier cost estimates. This procedure is described below.

The costs of upgrading the national highways system from the condition existing at June 1974 and to overcome deficiencies arising between that date and June 1981 were estimated by the CBR in 1975[(1)]. The projects deemed necessary to overcome deficiencies at that time will still be needed now if they have not been carried out in the interim. The cost of projects carried out between June 1974 and June 1977 is equivalent to the construction expenditure over that period. This is shown in current and constant prices in Table 5.1. Netting this expenditure from the CBR's cost estimates for upgrading provided an estimate of the expenditure still required over the period June 1977 to June 1981.

Further deficiencies will arise over the period June 1981 to June 1984 due to ageing of the pavement structure. The proportion of segment length effected in this way was shown in Table 4.4. The Bureau estimated that these projects would have half the average costs of all projects assessed in 1975.

The resultant expenditure required to upgrade the national highways system to design standards from the condition existing at June 1977 and to overcome deficiencies arising between that date and June 1984 is shown in Table 5.2.

Rural Arterial Roads - Engineering Needs

Unit costs of rural arterial road improvements were provided by State Road Authorities for each type of terrain (such as flat, undulating, hilly and mountainous) and type of project. These

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(1) CBR (1975), op.cit., Table 8.9.

TABLE 5.1 - HISTORICAL EXPENDITURE ON NATIONAL HIGHWAYS CONSTRUCTION BY YEAR[(a)]

($ million)

State/Territory	Actual			Constant 1976-77 Prices[(b)]		
	1974-75	1975-76	1976-77	1974-75	1975-76	1976-77
New South Wales	26.7	37.8	45.3	32.7	41.7	45.3
Victoria	18.5	20.5	22.5	22.6	22.6	22.5
Queensland	16.1	20.3	24.8	19.7	22.4	24.8
South Australia	14.9	21.4	25.7	18.2	23.6	25.7
Western Australia	6.3	11.4	9.7	7.8	12.6	9.7
Tasmania	4.9	6.5	8.1	6.0	7.2	8.1
Northern Territory	3.7	3.9	4.1	4.5	4.2	4.1
Australian Capital[(c)] Territory	-	-	-	-	-	-
TOTAL	91.1	121.8	140.2	111.5	134.3	140.2

(a) Estimated expenditure on national highways construction net of general administrative expenditure calculated at 8 per cent of total.
(b) The BTE road construction price index is employed to convert actual price series to constant price series.
(c) Approximately $10 000 per annum.

Source: BTE estimates derived from NAASRA and SRA expenditure estimates.

TABLE 5.2 - PROJECT COSTS TO UPGRADE THE NATIONAL HIGHWAYS SYSTEM TO DESIGN STANDARD[(a)]

($ MILLION, 1976-77 PRICES)

State or Territory	Project Costs
New South Wales	647
Victoria	268
Queensland	335
South Australia	133
Western Australia	159
Tasmania	52
Northern Territory	164
A.C.T.	11
TOTAL	1 769

(a) Base condition of national highways system relates to June 1977 and upgrading costs include an allowance for deficiencies (due to ageing) arising up to June 1984. Costs exclude maintenance, general administration and planning and research.

costs were then used to estimate the costs of improvements to bring them up to the appropriate engineering standards as shown in Table 5.3.

TABLE 5.3 - COST OF IMPROVING RURAL ARTERIAL ROADS TO ENGINEERING STANDARDS 1977-78 TO 1983-84[a]
($ MILLION, 1976-77 PRICES)

State							A.C.T.	Total
N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.		
2919	948	1328	439	321	280	72	-	6307

(a) Excludes maintenance, general administration and planning and research.

Other Categories - Engineering Needs

For categories other than national highways and rural arterial roads engineering needs were generally determined by revising the estimates made for the 1975 roads report.

Urban arterial road needs incorporate the estimates for outer urban areas from the 1977 Update Survey information together with updated estimates for the inner urban areas of capital and major provincial cities. The updating procedure for the latter included allowances for improvements carried out during the three-year period 1974 to 1977 and a change to 1976-77 prices.

For rural and urban local roads, the results of the ARS 1969-74 were revised on the basis of cost increases. Allowances for construction and for additional deficiencies arising over the period 1974-1977 due to increased traffic were made in rural areas.

MITERS needs in rural and urban areas were estimated for the 1975 roads report for a five-year period. These estimates were extended to a seven-year period and updated to allow for price changes.

Table 5.4 shows the resulting costs of upgrading to engineering standards by category.

TABLE 5.4 - COSTS OF OTHER CATEGORIES - ENGINEERING STANDARDS: 1977-78 TO 1983-84[a]

($ MILLION, 1976-77 PRICES)

State/ Territory	Urban Arterials	Rural Locals	Urban Locals	MITERS	Total
N.S.W.	1490.7	2196.0	417.2	175.4	4279.3
VIC.	1602.8	1812.0	812.5	153.9	4381.2
QLD	560.1	3092.0	137.6	162.6	3952.3
S.A.	341.1	413.0	83.5	42.8	880.4
W.A.	544.7	905.0	105.4	77.0	1632.1
TAS.	143.7	505.0	48.3	47.0	744.0
SUB-TOTAL	4683.1	8923.0	1604.5	658.7	15869.3
N.T.	5.6	215.0	47.0	4.3	271.9
A.C.T.	65.8	-	30.7	8.5	105.0
TOTAL	4754.5	9138.0	1682.2	671.5	16246.2

(a) Excludes maintenance, general administration and planning and research.

Total Needs Based on Engineering Standards

Table 5.5 shows the total costs of improving the road system to engineering standards. This incorporates the costs shown in Tables 5.2 to 5.4 inclusive.

TABLE 5.5 - ESTIMATE OF COST OF IMPROVING ROADS TO DESIGN AND OPERATIONAL STANDARDS: 1977-78 TO 1983-84[a] ($ MILLION, 1976-77 PRICES)

Category	Amount
National Highways	1769
Rural Arterials	6307
Rural Locals	9138
Urban Arterials	4755
Urban Locals	1682
SUB-TOTAL	23651
MITERS	672
TOTAL	24323

(a) Excludes maintenance, general administration and planning and research.

National Highways - Economic Evaluation

(a) Evaluation of National Highways Project Costs

The warranted expenditure program for national highways for the seven year evaluation period was obtained by adjusting the aggregate NHUPAC/RURAL evaluation results generated in 1975 for:

- additional projects arising due to deterioration in pavement condition over the period 1981-82 to 1983-84;
- additional benefits to take account of increased traffic in the period 1977-84 compared with that in the period 1974-81;
- construction expenditure over the period up to and including 1978-79; and
- price changes between 1973-74 and 1976-77.

Over 97 per cent of the project costs shown in Table 5.2 are for deficiencies arising prior to June 1981 and thus were evaluated by the CBR in 1975. These evaluation results have been updated to determine the level of project costs that are warranted in the period July 1977 to June 1984.

The economically warranted capital expenditure program for the period 1977-78 to 1983-84 by this process is shown in Table 5.6.

TABLE 5.6 - WARRANTED CONSTRUCTION EXPENDITURE PROGRAM FOR NATIONAL HIGHWAYS: 1977-78 TO 1983-84 [(a)]

($ MILLION, 1976-77 PRICES)

State or Territory	Amount	Per cent
New South Wales	563	38.1
Victoria	231	15.6
Queensland	295	20.0
South Australia	101	6.8
Western Australia	138	9.3
Tasmania	51	3.4
Northern Territory	90	6.1
Australian Capital Territory	11	0.7
TOTAL	1480	100.0

(a) Excludes maintenance, general administration and planning and research.

(b) National Highways Maintenance

Bureau investigations into the economics of road maintenance have not progressed greatly since CBR reported in 1975. Thus the Bureau is not in a position to report on the level of expenditure that is economically warranted.

Past, and projected future, levels of expenditure for national highways maintenance are given in Table 5.7.

TABLE 5.7 - PAST, AND PROJECTED FUTURE, NATIONAL HIGHWAYS MAINTENANCE EXPENDITURE[a]

($ MILLION, 1976-77 PRICES)

Year Ended 30 June	State or Territory								Total
	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	N.T.	A.C.T.(c)	
1975	7.3	2.0	5.5	2.6	2.4	0.5	5.6	-	25.9
1976	7.5	2.0	6.0	3.0	2.9	0.6	2.7	-	24.7
1977	2.4	2.7	7.2	3.2	1.8	0.5	3.3	-	21.1
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1978	7.1	2.4	7.5	3.5	3.9	0.7	2.9	-	28.0
1979	6.9	2.6	7.8	3.7	3.6	0.8	2.7	-	28.1
1980	6.9	2.6	7.8	3.8	3.7	0.8	2.8	-	28.4
1981[b]	7.0	2.7	8.0	3.9	3.8	0.8	2.9	-	29.1
1982	7.2	2.7	8.1	4.0	3.8	0.8	2.9	-	29.5
1983	7.3	2.8	8.3	4.0	3.9	0.8	3.0	-	30.2
1984	7.4	2.8	8.4	4.1	4.0	0.9	3.0	-	30.6
TOTAL 1978-84	49.8	18.6	55.9	27.0	26.7	5.6	20.2	0.1	203.9

(a) Excludes general administration costs.
(b) 2 per cent growth used for 1981 and beyond.
(c) Approximately $20 000 per annum ($0.1m included in total).

Source: 1974-75 to 1976-77 - Annex 3.

(c) National Commerce Roads

This category of road is defined under the States Grants (Roads) Act 1977 as roads which facilitate interstate or international trade and commerce and are declared under the Act by the Minister. Those declared as at January 1979 are listed in Table 5.8.

TABLE 5.8 - DECLARED NATIONAL COMMERCE ROADS (AS AT JANUARY 1979)

State	National Commerce Road
N.S.W.	Botany Bay Foreshore Road Maldon Road Deviation
VIC.	Johnson Street Bridge Essendon Airport Interchange
QLD.	Lytton Road and Access Road to New Brisbane Port Kingsford Smith Drive (access to Brisbane Airport) Bundaberg Port Road Mackay Port Access (Glenpark, Bedford, Andergrove and Keeleys Road) Townsville Port Access
S.A.	Lincoln Highway (Lincoln Gap to Whyalla) Port Pirie (Three Chain Road between Esmond and Wandereal Roads)
W.A.	Leach Highway (between Barbican Street and Hordey Road, Perth)
TAS.	East Tamar Highway (Launceston to Bell Bay)

It is anticipated that construction on all these roads except the East Tamar Highway will be completed by 1979-80. Expenditure of approximately $700 000 may be required for completion of the East Tamar Highway in 1980-81.

The Bureau has not conducted special studies of roads which could be candidate projects for declaration and special assistance under this road category. Thus no warranted program of expenditure is reported separately for this category.

However, several of the State Ministries of Transport and State Road Authorities provided comments on this road category. Their views are summarised in Chapter 8 and included verbatim in Annex 6.

Economic Evaluation of Rural Arterial Roads

The Bureau applied the same economic evaluation methods used for the 1975 Update Survey in analysing the rural arterial improvement project data[1]. Table 5.9 includes the levels of warranted expenditures for rural arterial roads by State for the seven year period 1977-84 and Table 5.10 indicates the sensitivity of the warranted program to various discount rates.

TABLE 5.9 - WARRANTED PROGRAM FOR RURAL ARTERIAL ROADS - 1977-78 TO 1983-84[a]

($ MILLION, 1976-77 PRICES)

States									
N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	Sub-Total	N.T.	A.C.T.	Total
1581.6	458.7	872.8	364.0	209.5	73.7	3560.3	25.6	-	3585.9

(a) Excludes maintenance, general administration and planning and research.

TABLE 5.10 - WARRANTED CONSTRUCTION EXPENDITURE - RURAL ARTERIAL ROADS: SENSITIVITY TO DISCOUNT RATE

($ MILLION, 1976-77 PRICES)

Warranted Construction Expenditure 1977-78 to 1983-84[a]			
State	Discount Rate		
	7%	10%	15%
N.S.W.	1938.4	1581.6	1048.8
VIC.	554.1	458.7	315.8
QLD	1013.3	872.8	614.6
S.A.	397.7	364.0	223.9
W.A.	239.0	209.5	171.7
TAS.	96.7	73.7	48.1
N.T.	28.3	25.6	18.6
A.C.T.	-	-	-
TOTAL	4267.5	3585.9	2441.5

(a) Cost of undiscounted economically warranted program.

(1) Both G.J. and Bayley C., Evaluation Procedures for Rural Road and Structure Projects, ARRB Conference Proceedings, Vol. 8, 1976.

Table 5.11 shows the affect on the benefits of the warranted program (at 10 per cent discount rate) of the inclusion of the indirect benefits i.e., benefits due to reduction in delays, dust, reduced losses in production and benefits attributable to increased number of trips generated by improved roads. The inclusion of indirect benefits has its main impact on warranted programs in Queensland, New South Wales and Western Australia, which together have some 68 per cent of all rural arterial roads.

TABLE 5.11 - RURAL ARTERIAL ROADS - WARRANTED PROGRAM 1977-78 TO 1983-84 - BENEFITS
($ MILLION, 1976-77 PRICES)

Benefits of Warranted Program at 10% Discount Rate			
State	Indirect Benefits	Direct and Indirect Benefits (a)	Indirect benefits as a % of Direct
N.S.W.	2660.0	3284.7	23.5
VIC.	856.5	951.7	11.1
QLD	1396.8	1973.9	41.3
S.A.	436.8	453.6	3.8
W.A.	442.9	523.1	18.1
TAS.	125.3	128.7	2.7
N.T.	210.9	219.1	3.9
A.C.T.	-	-	-
TOTAL	6129.2	7534.8	22.9

(a) Includes reduction in delays, dust, reduced losses in production and benefits attributable to increased number of trips generated from improved roads.

Table 5.12 illustrates the components of the benefits and costs associated with the warranted expenditure for rural arterial roads and their sensitivity to the discount rate.

TABLE 5.12 - COST-BENEFIT ANALYSIS, WARRANTED PROGRAM RURAL ARTERIAL ROADS: 1977-78 TO 1983-84 ($ MILLION: 1976-77 PRICES)

Item	Discount Rate		
	7%	10%	15%
Construction Expenditure			
Undiscounted	4268	3586	2442
Discounted[a]	3668	2945	1878
Monetary Benefits			
Vehicle Operating Costs	4554	2964	1456
Accident Costs	473	294	143
Occupant Travel Time Savings			
- Private	630	398	196
- Commercial	3871	2421	1152
Road Maintenance	69	52	28
Total Direct Benefits	9597	6129	2975
Indirect Benefits[b]	2091	1406	783
Total Net Benefits	11688	7535	3758
Ratio of Total Net Benefits to Discounted Construction Expenditure	3.2	2.6	2.0

(a) Discounted to 1976-77 present value.
(b) Includes reduction in dust, delays, and losses in production and benefits attributable to increased numbers of trips generated by improved roads.

Other Categories

With the exception of outer urban arterial roads, which were evaluated in the same way as rural arterial roads, the economically warranted expenditure for other categories was calculated by updating the previous estimates for the 1975 roads report to allow for price increases. Adjustments were also made to allow for traffic increases for local roads, inner urban arterials, and MITERS. Estimates of maintenance requirements were based on past and projected actual maintenance costs.

Table 5.13 summarises the economic needs for all categories.

TABLE 5.13 - WARRANTED ROAD PROGRAM 1977-78 TO 1983-84[(a)]

($ MILLION, 1976-77 PRICES)

Category	State							N.T.	A.C.T.	Total
	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	TOTAL			
National Roads										
National Highways Construction	563.0	231.0	295.0	101.0	138.0	51.0	1379.0	90.0	11.0	1480.0
National Highways Maintenance	49.8	18.6	55.9	27.0	26.7	5.6	183.6	20.2	0.1	203.9
TOTAL (A)	612.8	249.6	350.9	128.0	164.7	56.6	1562.6	110.2	11.1	1683.9
Roads other than National Roads										
Construction										
Rural Arterial	1581.6	458.7	872.8	364.0	209.5	73.7	3560.3	25.6	-	3585.9
Rural Local	404.1	148.4	785.9	108.5	126.4	0.0	1573.3	61.9	-	1635.2
Total Rural	1985.7	607.1	1658.7	472.5	335.9	73.7	5133.6	87.5	-	5221.1
Urban Arterial	903.1	1091.9	264.8	210.3	367.7	71.5	2909.3	5.6	17.8	2932.7
Urban Local	308.3	220.3	133.3	58.6	81.7	14.2	856.4	13.5	12.5	882.4
Total Urban	1251.4	1312.2	348.1	268.9	449.4	85.7	3765.7	19.1	30.3	3815.1
TOTAL	3237.1	1919.3	2056.8	741.4	785.3	159.4	8899.3	106.6	30.3	9036.2
MITERS										
Rural	27.6	22.0	32.9	4.1	5.5	9.2	101.3	0.8	-	102.1
Urban	83.2	73.1	65.2	29.5	42.2	20.6	313.8	2.6	5.3	321.7
TOTAL	110.8	95.1	98.1	33.6	47.7	29.8	415.1	3.4	5.3	423.8
TOTAL (B)	3347.9	2014.4	2154.9	775.0	833.0	189.2	9314.4	110.0	35.6	9460.0
Maintenance										
Rural Arterial	402.0	143.0	121.0	79.0	86.0	36.0	867.0	19.0	-	886.0
Rural Local	518.0	306.0	233.0	110.0	126.0	91.0	1384.0	39.0	-	1423.0
Total Rural	920.0	449.0	354.0	189.0	212.0	127.0	2251.0	58.0	-	2309.0
Urban Arterial	331.0	98.0	45.0	31.0	19.0	10.0	534.0	5.0	7.0	546.0
Urban Local	609.0	449.0	143.0	83.0	104.0	35.0	1423.0	8.0	13.0	1444.0
Total Urban	940.0	547.0	188.0	114.0	123.0	45.0	1957.0	13.0	20.0	1990.0
TOTAL (C)	1860.0	996.0	542.0	303.0	335.0	172.0	4208.0	71.0	20.0	4299.0
TOTAL (A + B + C)	5820.7	3260.0	3007.8	1260.0	1332.7	417.8	15085.0	291.2	66.7	15442.9

(a) Excludes general administration and planning and research.

NOTE: Totals may differ due to rounding.

ESTIMATED ACTUAL EXPENDITURES 1977-78 TO 1978-79

The Bureau's estimate of actual expenditure on roads during the two year period 1977-78 to 1978-79 is given in Table 5.14 for all construction categories and for maintenance.

WARRANTED PROGRAM 1979-80 TO 1983-84

Estimated actual expenditure in the two year period 1977-78 to 1978-79 was subtracted from the seven year warranted program to obtain the five year future warranted program shown in Table 5.15[1]. Table 5.15 includes expenditure estimates for planning and research as well as general administration. Where the actual expenditure in the two year period exceeded the seven year warranted program the difference is shown as zero. This gives rise to some apparent anomalies when comparing figures from Tables 5.13 and 5.14 with subsequent Tables. As for the 1975 roads report, planning and research expendiure has been taken as 1 per cent of total warranted expenditure.

In the 1973 and 1975 CBR roads reports a general administration cost of 4 per cent of total program cost was applied. The Bureau has carried out further investigation of actual administrative expenditure. Estimates of administrative expenditure as a proportion of total expenditure vary significantly between States (i.e. SRAs and local government), but in most States average proportions appear to be around the 8 per cent level. For this reason a flat rate of 8 per cent of total expenditure was accepted (without assessment) for general administration as shown in Table 5.15.

WARRANTED PROGRAM 1979-80 TO 1982-83

Since the warranted programs are assessed on a block basis for a

(1) The basic assumption underlying this procedure is that, for each State sub-category, projects are implemented over time in descending order of economic warrant.

TABLE 5.14 - ESTIMATED EXPENDITURE 1977-78 AND 1978-79[a]

($ MILLION, 1976-77 PRICES)

Category	State							N.T.	A.C.T.	Total
	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	TOTAL			
National Roads										
National Highways Construction	102.3	44.8	51.9	35.4	28.2	13.1	275.7	14.6	3.8	294.1
National Highways Maintenance	14.0	5.0	15.3	7.2	7.5	1.5	50.5	5.6	0.0	56.1
TOTAL (A)	116.3	49.8	67.2	42.6	35.7	14.6	326.2	20.2	3.8	350.2
Roads other than National Roads										
Construction										
Rural Arterial	156.4	57.6	83.6	23.7	43.0	18.6	382.9	0.6	-	383.5
Rural Local	190.2	108.1	112.7	23.6	53.3	25.4	513.3	2.7	-	516.0
Total Rural	346.6	165.7	196.3	47.3	96.3	44.0	896.2	3.3	-	899.5
Urban Arterial	136.1	159.7	58.3	24.6	46.7	14.0	439.4	2.1	36.1	477.6
Urban Local	182.2	153.6	59.6	37.9	44.9	11.1	489.3	12.8	11.0	513.1
Total Urban	318.3	313.3	117.9	62.5	91.6	25.1	928.7	14.9	47.1	990.7
TOTAL	664.9	479.0	314.2	109.8	187.9	69.1	1824.9	18.2	47.1	1890.2
MITERS										
Rural	2.4	1.2	2.2	0.4	0.5	0.7	7.4	0.0	-	7.4
Urban	12.6	5.0	2.2	2.8	2.5	0.4	25.5	0.0	0.0	25.5
TOTAL	15.0	6.2	4.4	3.2	3.0	1.1	32.9	0.0	0.0	32.9
TOTAL CONSTRUCTION (B)	679.9	485.2	318.6	113.0	190.9	70.2	1857.8	18.2	47.1	1923.1
Maintenance										
Rural Arterial	101.2	37.0	30.5	19.1	19.4	8.5	215.7	3.7	-	219.4
Rural Local	134.2	80.9	64.8	30.2	30.8	23.9	364.8	8.4	-	373.2
Total Rural	235.4	117.9	95.3	49.3	50.2	32.4	580.5	12.1	-	592.6
Urban Arterial	76.1	24.8	10.6	7.4	4.6	1.8	125.3	0.6	2.3	128.2
Urban Local	158.8	117.5	38.2	21.0	25.7	8.5	369.7	1.8	3.0	374.5
Total Urban	234.9	142.3	48.8	28.4	30.3	10.3	495.0	2.4	5.3	502.7
TOTAL MAINTENANCE (C)	470.3	260.2	144.1	77.7	80.5	42.7	1075.5	14.5	5.3	1095.3
TOTAL (A + B + C)	1266.5	795.2	529.9	233.3	307.1	127.5	3259.5	52.9	56.2	3368.6

(a) Excludes general administration and planning and research. In deriving these statistics a flat rate of 8 per cent was assumed for general administration.

NOTE: Totals may differ due to rounding.

TABLE 5.15 - WARRANTED ROAD PROGRAM 1979-80 TO 1983-84

($ MILLION, 1976-77 PRICES)

Category	State							N.T.	A.C.T.	Total
	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	TOTAL			
National Roads										
National Highways Construction	460.7	186.2	243.1	65.6	109.8	37.9	1103.3	75.4	7.2	1185.9
National Highways Maintenance	35.8	13.6	40.6	19.8	19.2	4.1	133.1	14.6	0.1	147.8
TOTAL (A)	496.5	199.8	283.7	85.4	129.0	42.0	1236.4	90.0	7.3	1333.7
Roads other than National Roads										
Construction										
Rural Arterial	1425.2	401.1	789.2	340.3	166.5	55.1	3177.4	25.0	-	3202.4
Rural Local	213.9	40.3	673.2	84.9	73.1	0.0	1085.4	59.2	-	1144.6
Total Rural	1639.1	441.4	1462.4	425.2	239.6	55.1	4262.8	84.2	-	4347.0
Urban Arterial	767.0	932.2	206.5	185.7	321.0	57.5	2469.9	3.5	0.0	2473.4
Urban Local	166.1	66.7	73.7	20.7	36.8	3.1	367.1	0.7	1.5	369.3
Total Urban	933.1	998.9	280.2	206.4	357.8	60.6	2837.0	4.2	1.5	2842.7
TOTAL	2572.2	1440.3	1742.6	631.6	597.4	115.7	7099.8	88.4	1.5	7189.7
MITERS										
Rural	25.2	20.8	30.7	3.7	5.0	8.5	93.9	0.8	-	94.7
Urban	70.6	68.1	63.0	26.7	39.7	20.2	288.3	2.6	5.3	296.2
TOTAL	95.8	88.9	93.7	30.4	44.7	28.7	382.2	3.4	5.3	390.9
TOTAL (B)	2668.0	1529.2	1836.3	662.0	642.1	144.4	7482.0	91.8	6.8	7580.6
Maintenance										
Rural Arterial	300.8	106.0	90.5	59.9	66.6	27.5	651.3	15.3	-	666.6
Rural Local	383.8	225.1	168.2	79.8	95.2	67.1	1019.2	30.6	-	1049.8
Total Rural	684.6	331.1	258.7	139.7	161.8	94.6	1670.5	45.9	-	1716.4
Urban Arterial	254.9	73.2	34.4	23.6	14.4	8.2	408.7	4.4	4.7	417.8
Urban Local	450.2	331.5	104.8	62.0	78.3	26.5	1053.3	6.2	10.0	1069.5
Total Urban	705.1	404.7	139.2	85.6	92.7	34.7	1462.0	10.6	14.7	1487.3
TOTAL MAINTENANCE (C)	1389.7	735.8	397.9	225.3	254.5	129.3	3132.5	56.5	14.7	3203.7
TOTAL (A + B + C)	4554.2	2464.8	2512.9	972.7	1025.6	315.7	11850.9	238.3	28.8	12118.0
Planning & Research (D)[a]	50.0	27.0	27.6	10.7	11.3	3.7	130.3	2.6	0.3	133.2
Administration (E)[b]	400.0	216.0	220.8	85.6	90.4	29.0	1041.8	21.0	2.5	1065.3
TOTAL (A+B+C+D+E)	5004.2	2707.8	2766.3	1069.0	1127.3	348.4	13023.0	261.9	31.6	13316.5

(a) 1 per cent of total program.
(b) 8 per cent of total program.

NOTE: Totals may differ due to rounding.

seven and then five year period, as comprising total expenditures warranted over the whole period, no unique set of expenditures scheduled on a year by year basis was determined. Scheduling of expenditures was therefore taken to be flexible with regard to financing and other considerations. Table 5.16 provides one possible approach to scheduling the warranted program over the five years 1979-80 to 1983-84 to arrive at a program for the four year period 1979-80 to 1982-83 (as required by the terms of reference).

This approach allocates the five year warranted needs in a rising profile after setting expenditure in 1979-80 at the level projected for that year.

TABLE 5.16 - WARRANTED ROAD EXPENDITURE - (RISING PROFILE)

($ MILLION, 1976-77 PRICES)

1979-1980[a]	1980-1981	1981-1982	1982-1983	Total 1979-80 1982-83	1983-84	Total 1979-80 1983-84
1933	2244	2605	3025	9807	3511	13317

(a) Projected (from Table 30 Annex 3).

TABLE 5.17 - ROAD EXPENDITURE NEEDED TO ACHIEVE PROJECTED CAPITAL STOCKS

($ MILLION 1976-77 PRICES)

Period	Construction Investment			Maintenance	Planning and Research	Total
	Replacement	Net	Gross			
1975-76 to 1978-79	2 060	2 678	4 738	2 457	50	7 245
1979-80 to 1982-83[(a)]	2 671	3 435	6 106	3 037[(b)]	101[(b)]	9 244

(a) Derived from Annex 2. To convert capital output projected needs from national accounting terms to values equivalent to those used in the projected expenditure and warranted program estimates the capital output results are divided by a factor of 0.81.

(b) Maintenance and planning and research expenditures have been projected to grow at the rate prevailing over recent years.

NOTE: General administration costs are incorporated into construction, maintenance and planning and research expenditures. Data for 1975-76 to 1978-79 is derived from estimated actual expenditure Tables in Annex 3.

CAPITAL-OUTPUT RATIO PROJECTION METHOD

This method estimates likely future road construction needs by treating roads as a capital stock which produces (in combination with other inputs) an output: vehicle kilometres of travel. The historical ratios between previous levels of output and the historical capital stock are used as a basis for projecting future capital stocks to meet future predicted usage.

The first step in this procedure is to estimate historical capital stocks for roads.

The road capital stock at any point in time is developed using the perpetual inventory method. This consists of developing an historic capital expenditure series, adjusting this for price changes, asset retirements and changes in the productive capacity of roads over time and accumulating the resulting values.

These capital stock values are then combined with historic output measures to develop a time series of capital-output ratios. This time series forms the basis of a projection of capital-output ratios. Combining these capital-output ratios with independent projections of output provides a projection of the capital stock required.

For the purpose of the gross and net capital formation forecasts it is assumed that the historically observed relationship between capital and output applies in the future. This relationship accounts for gradual technological or structural changes and secular shifts in the substitution of labour for capital, but does not account for rapid technological or structural change. Further, trends over time in the level of utilisation of the asset stock are embodied in the relationship. That is, any consistent patterns of change in the utilisation of assets, and any accompanying change in the level of services provided by the capital stock, are built into the relationship.

The method is described in more detail in Annex 2 to this report. The results of that analysis are shown in Table 5.17.

Road investment needs projected by this method are very sensitive to assumptions of the service life of road assets. Road assets vary widely in their service life, by:

- type of asset (road, structures - bridges, tunnels, crossings etc.)
- location - climate, local materials,
- extent and type of maintenance
- usage.

Since it is difficult to arrive at a meaningful average service life for 'roads' the capital output projection method suffers from quite severe empirical difficulties but is included in this report (on an assumption of twenty-five years average service life) as a supplementary means of assessing road needs[1].

COMPARISON OF ROAD NEEDS

Table 5.18 summarises the results of the three assessments of overall road needs.

(1) The capital-output method may also be used as a basis for comparison with the benefit-cost approach. However, the empirical procedures used in both methodologies have much in common and therefore cannot be regarded as "independent".

TABLE 5.18 - COMPARISON OF ROAD CONSTRUCTION NEEDS[a]

($ MILLION 1976-77 PRICES)

	1977-78 to 1983-84	%	1979-80 to 1983-84	%	1979-80 to 1982-83	%
Engineering Needs	24323	222	22106[b]	258	18746	306
Warranted Program	10940	100	8767	100	6133[c]	100
Capital-Output Ratio Projection Needs	9369	86	7153	82	5614	92

(a) Excludes maintenance, general administration and planning and research.

(b) Engineering needs and the warranted program for 1979-80 to 1983-84 equals 1977-78 to 1983-84 less estimated expenditures for 1977-78 and 1978-79.

(c) Derived from Table 5.16.

CHAPTER 6 - TRENDS IN LEVELS AND PATTERNS OF ROAD FINANCE

INTRODUCTION

This Chapter reports on the term of reference "Trends in the levels and patterns of funding of road programs by the different levels of government in Australia". The Chapter contains:

(a) a discussion of the sources and attribution of road funding;

(b) a discussion of the concept of "road expenditure" adopted by the Bureau and an explanation of the major differences between that concept and approaches to estimating road expenditures adopted by other government agencies, such as the ABS;

(c) an outline of the approaches adopted by the Bureau for estimating actual road expenditures for 1974-75 to 1978-79 and projecting road expenditures for 1979-80 to 1983-84;

(d) analysis of trends in patterns of road funding by all levels of government, for each road category, for each State and Territory and for Australia overall;

- in current prices and in constant 1976-77 prices
- in total and on a per capita and per motor vehicle basis;

(e) a discussion of the relationship between resources allocated to roads and the estimated warranted program; and

(f) a retrospective review over the period 1974-75 to 1978-79 of

   (i) estimated expenditures compared with economically warranted expenditures on roads; and

(ii) an analysis of a financially constrained economically efficient allocation of road construction expenditure by road category and State.

The analyses in this Chapter draw on the road finance data contained in Annex 3 to this report.

SOURCES AND ATTRIBUTION OF ROAD FUNDING

Institutional Structure

In Australia, roads are provided and financed by both the public sector (comprising all three levels of government; Commonwealth, State and local) and by private land development firms. In a number of States the latter are required to provide roads (particularly residential streets), when developing suburban areas. Such expenditure is estimated to be of the order of $50 million per annum, but as this is small in proportion to the national total government road expenditure (currently around $2140 million per annum), only public sector investment in roads is considered in this report.

The sources of public finance for roads are notable for their large number and the complexity of the legislative and administrative conditions imposed on their use. This is a result of several historical factors, including the rapid growth of roadworks associated with expanding motor vehicle use since the 1950s, the pressure upon all levels of governments to tap all available financial sources, and the nature and structure of the federal system of government, which results in considerable disparity between responsibilities for roadworks and financial capacities to undertake them. Hunter(1) found that vertical intergovern-

(1) Hunter J.S.H., Vertical Inter-Governmental Financial Imbalance - A Framework for Evaluation, Finanzarchiv, Vol. 32 No. 3, (ANU Centre for Research on Federal Financial Relations, Reprint Series No 4, 1974).

mental fiscal imbalance is considerably greater in Australia than in the three other industrialised federations (Canada, West Germany and the U.S.A.), and this applies as much to road funding and expenditure, as it does generally.

Inter-Government Road Fund Transfers

The Commonwealth has the greatest financial capacity of the three levels of government, but the least direct road responsibility. Under the Constitution it is empowered to make grants to the States and this has resulted in the development over time of a system of providing funds for roads. In addition, a further system of grants from State to local government authorities has developed.

These systems of transfers lead to differences between self-sourced road funding and road expenditures actually undertaken at any given level of government. The Australian pattern of road financing and expenditure is further complicated by:

(a) the existence of several authorities in each State, in addition to the State Road Authority, with responsibility for roads within their jurisdiction (e.g. Housing Commission, Forest Commission); and

(b) differences between the responsibility for care and expenditure on roads and the actual carrying out of the roadworks.

Thus, in most States local government authorities may act as contractors for the State Road Authority; such arrangements are often accompanied by a system of offsets, both imputed and in cash, between levels of government within the overall system of transfers from the higher to lower levels of government.

Attribution of Road Funding

Because of these complexities the approach adopted in this report is to describe trends in road funding expenditure patterns by source of funds, rather than by the application of these funds by particular authorities.

Thus road grants from the Commonwealth to the States, whether spent by the State or local government, will be treated as Commonwealth road expenditure. Similarly State grants to local governments for roads will be treated as State, not local government expenditure. This approach is carried throughout in attributing various arrangements between State and local Governments, referred to above e.g., where local governments act as contractors for the State Road Authority, the expenditure incurred is attributed to the State level of government.

The major exception to the above general rule of attribution of expenditure by source of funds, is the case of general revenue assistance grants by the Commonwealth to both State and local governments. These are considered in this report as constituting sources of funds available for these levels of government to spend according to their own priorities. To the extent that road expenditures occur from these sources of funds, they are considered as being sourced from, and are therefore attributed to, the level of government exercising discretion over expenditure of the funds.

This is particularly significant for local government, and the description of road expenditures as being sourced from local government should be interpreted to include all expenditures from self raised revenues, such as rates, surpluses of business undertakings, loans and general revenue assistance grants from the Commonwealth and "non-road" grants from the Commonwealth and the State e.g., natural disaster assistance, unemployment relief etc.

The following provides a necessarily brief summary of the many diverse sources of public road funds by level of government.

Commonwealth Government

About 29 per cent of total road funds are provided[1] by the Commonwealth, the major proportion as road grants to the States. The traditional source of these funds is the Consolidated Revenue Fund[2] as there is no hypothecation of monies to roads through trust funds as occurs in some overseas countries. The Constitution permits conditions to be attached to these grants (commonly referred to as Section 96 grants). These conditions principally take the form of requiring the grants to be spent on particular road categories and in requiring the States to match in total from their own sources an amount of designated road expenditure. More recently the Commonwealth has imposed expenditure approval conditions at the project or program level prior to the use of Commonwealth road funds.

State Governments

The six State Governments provide about 30 per cent of total road funds from their own sources. While there is variation by State, on average about 80 per cent of State-sourced road finance is generated by charges relating to motor vehicle ownership and usage; of this, about three-quarters comes from vehicle registration fees and driver licences. Road maintenance charges on certain classes of vehicles are levied in all but one State and account for about 15 per cent[3]. The remainder is obtained from loan funds and miscellaneous departmental spending and other contributions. A minor amount of road finance is provided from State consolidated revenues.

Local Governments

There are 862 local government authorities in Australia, which in

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(1) Derived from Table 6.4.
(2) However the States Grants (Roads) Act 1977 included a "duel appropriation" clause which allows payments to be made from either the Consolidated Revenue Fund or the Loan Fund.
(3) Such charges, and alternatives to them, are at present under review by various State Governments.

total, provide just over 40 per cent[1] of total national road finance. Approximately 70 per cent of this finance comes from rate income, some 25 per cent from loan borrowings and the remainder from miscellaneous sources. Road work is a significant activity for many local governments and on average is estimated at about 35 per cent of their total spending[2] - though the percentage is much lower in urban and much higher in rural areas and there is some variation between States. About 54 per cent of all local authorities, containing about 10.6 per cent of the total population, are rural or small town centred and expenditure on roadworks can be a very high proportion of their annual budgets. For these authorities financial transfers from other levels of government whether directly for roads, or by way of general assistance, are very important.

DEFINITION OF ROAD EXPENDITURE

The frequent references to "road expenditure", in this report, and the fact that statistical data concerning aspects of road expenditure are presented in several ABS publications requires comment as to the way in which the BTE concept of road expenditure is defined. Further comment is required on some of the principal ways in which it differs from another concept of that term which is represented by a group of the ABS's statistical classifications selected by the BTE for the purposes of reconciliation.

The BTE concept is most easily comprehended by considering it from two separate aspects. The first aspect concerns its scope in terms of both the authorities whose road expenditures are included and the roads in relation to which expenditures are incurred. The second aspect concerns the kinds of expenditures covered.

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(1) Derived from Table 6.4.
(2) Derived from BTE's estimates of expenditure by local government and Australian Bureau of Statistics, Public Authority Finance 1977-78, Canberra 1977.

The scope of the BTE concept is such as to include, with few exceptions (the most significant of which is the roadwork resulting from the Tasman Bridge Disaster), expenditures by all public authorities on all roads (including toll roads) bridges, structures, and vehicular ferries which are open for public use.

Such authorities include the Commonwealth Department of Housing and Construction, State Road Authorities, State departments or statutory authorities involved in land development, forestry, mining, housing, electricity etc., and local government authorities.

The principal kinds of expenditure embraced by the BTE concept are land acquisition, construction, maintenance, operating costs, planning, research, and administration as defined in the specification for the Australian Roads Survey 1969-74. These definitions are sufficiently broad to encompass expenditures on both MITERS and other roadworks undertaken for road safety purposes.

Under the BTE concept the total road expenditure by all State authorities in a particular State, from other than Commonwealth sources, is not necessarily synonymous with the expenditure which is eligible for quota purposes in terms of the criteria prescribed in the Notes on Administration relating to the States Grants (Roads) Act 1977.

RECONCILIATION WITH OTHER CONCEPTS OF EXPENDITURE

To ensure that its recent estimates of actual road expenditures were capable of being related to official statistical data, the BTE closely reconciled its estimates with the combined totals of several ABS statistics for the financial year 1975-76. These statistics, collectively, could be regarded as defining the content of another concept of road expenditure, referred to hereunder as "the statistical concept". The BTE estimates of expenditures by State authorities, from Commonwealth and State sources of funds, respectively, in that year, were mainly based on information provided by the State Road Authorities. On the other hand, estimates of expenditures by the local authorities, from their own resources, including in some cases non-road government grants, were mainly based on statistical data published, or provided, by the ABS's State offices. The year 1975-76 was chosen because it was the most recent year for which substantially all of the regular local government statistics required by the BTE were available from all of the ABS's State offices.

The reconciliations were carried out for each State separately, and for the Territories combined. Separate State reconciliations were carried out for expenditures by State authorities and local authorities, respectively. Statistics of expenditure on road-related functions for the Territories were also supplied by the ABS. For the State reconciliations, the Bureau selected the following 1975-76 statistics from the "Public Authority Finance - State and Local Authorities, 1976-77" publication of the ABS:

- Road Systems and Regulation (Final Consumption Expenditure),
- Road Systems and Regulation (Expenditure on New Fixed Assets),
- Road Systems and Ancillaries (Expenditure on Existing Assets (Net)).

The BTE reconciliations revealed that the types of items which generally contributed most to the differences between the expenditure estimates derived using the BTE concept and the statistical concept were:

(a) Items relating to State spending authorities

(i) Included in BTE concept but not in official statistical concept

Expenditures

- Road grants (excluding reimbursements) paid to local government authorities

- Expenditures by State authorities other than State Road Authorities

- Payroll Tax

- Interest

(ii) Included in statistical concept but not in BTE concept

<u>Expenditures</u>

- Transport regulation

<u>Offsets</u>

- Contribution by councils

(b) Items relating to local government authorities

(i) Included in BTE concept but not in statistical concept

<u>Expenditures</u>

- Street cleaning and watering

- Administration (not elsewhere included)

- Interest

<u>Offsets</u>

- Road grants received (excluding reimbursements for works on behalf of State authorities)

(ii) Included in the official statistical concept but not in BTE concept

Offsets

. Car parking receipts.

PAST EXPENDITURE PATTERNS (CURRENT PRICE SERIES)

This section analyses estimates of past levels and patterns of road expenditure in Australia in out-turn amounts (i.e. not adjusted for price increases). Detailed Tables, from which this analysis derives, are contained in Annex 3.

Total Expenditures 1974/75-1978/79

In this period, road expenditure has totalled $8859 million, comprising $5801 million on construction (65.5 per cent), $2997 million on maintenance (33.8 per cent) and $61 million on planning and research (0.7 per cent).

Categories

Table 6.1 shows the expenditure by category over this five year period, at the total program level.

As can be seen from this Table, expenditure on maintenance grew somewhat faster than that for construction. Within the major construction categories national highways had the fastest average annual growth (17.4 per cent) and urban arterials the lowest (4.9 per cent per annum).

The split of construction expenditures by region was approximately $2682 million urban and $3119 million rural - i.e., 46 per cent and 54 per cent respectively.

Table 6.2 shows State and Territory expenditure patterns over the period from all sources of funds.

TABLE 6.1 - ESTIMATED ROAD EXPENDITURE: BY CATEGORY AND YEAR 1974-75 TO 1978-79 (ALL LEVELS OF GOVERNMENT)

($ MILLION, CURRENT PRICES)[a]

Category	1974-75	1975-76	1976-77	1977-78	1978-79	Total 5 Years	Average Annual Growth Rate
CONSTRUCTION							
National Highways	99.0	132.5	152.4	167.5	188.1	739.5	17.4
National Commerce Roads	8.9	13.6	19.8	17.5	18.4	78.2	19.9
Rural Roads							
Arterial	131.0	160.6	182.0	213.8	240.6	928.0	16.4
Local	209.2	251.8	287.8	300.4	323.6	1372.8	11.5
Total	340.2	412.4	469.8	514.2	564.2	2300.8	13.5
Urban Roads							
Arterial	236.0	216.9	223.1	265.9	285.3	1227.2	4.9
Local	209.1	261.5	281.2	304.0	316.4	1372.2	10.9
Total	445.1	478.4	504.3	569.9	601.7	2599.4	7.8
MITERS	6.3	20.2	17.2	18.9	20.4	83.0	34.1
TOTAL CONSTRUCTION	899.5	1057.1	1163.5	1288.0	1392.8	5800.9	11.6
MAINTENANCE	454.2	550.1	599.2	662.8	730.8	2997.1	12.6
PLANNING & RESEARCH	9.2	11.6	12.1	11.8	15.8	60.5	14.5
TOTAL	1362.9	1618.8	1774.8	1962.6	2139.4	8858.5	11.9

(a) Table 6.10 provides this data in constant 1976-77 prices.
Source: BTE Estimates based on NAASRA, SRA and ABS data.

TABLE 6.2 - ESTIMATED ROAD EXPENDITURE: BY YEAR AND STATE/TERRITORY 1974-75 TO 1978-79 (ALL LEVELS OF GOVERNMENT)

($ MILLION, CURRENT PRICES)

State/ Territory	1974-75	1975-76	1976-77	1977-78	1978-79	Total 5 Years	Average Annual Growth Rate
N.S.W.	479.7	609.8	632.8	734.2	806.9	3263.4	13.9
VIC.	346.4	381.5	424.8	463.7	504.1	2120.5	9.8
QLD	224.3	258.6	293.4	310.2	336.1	1422.6	10.6
S.A.	101.6	116.0	133.4	136.3	149.2	636.5	10.1
W.A.	122.6	142.0	164.1	175.6	198.6	802.9	12.8
TAS.	46.9	58.9	70.1	73.7	82.5	332.1	15.2
ALL STATES	1321.5	1566.8	1718.6	1893.7	2077.4	8578.0	12.0
N.T.	18.0	23.7	26.1	28.3	35.2	131.3	18.3
A.C.T.	23.4	28.3	30.1	40.6	26.8	149.2	3.5
TOTAL	1362.9	1618.8	1774.8	1962.6	2139.4	8858.5	11.9

Source: BTE Estimates based on NAASRA, SRA and ABS data.

Analysis of this Table reveals some changes in the pattern of road expenditures, principally a higher rate of growth of roads expenditure in Tasmania than all other States with New South Wales having the second highest growth rate. The lowest rate of growth of expenditure was in Victoria (although only marginally below that in Queensland and South Australia).

The consequence of these differential growth rates was a change in the proportions of road expenditures by State, comparing 1978-79 with 1974-75.

Notable changes were:

(a) an increase in New South Wales' share of all road expenditures from 35.2 per cent to 37.7 per cent;

(b) an increase by Tasmania from 3.3 per cent to 3.9 per cent; and

(c) falls in the proportions for Victoria (from 25.4 per cent to 23.6 per cent) and Queensland (from 16.5 per cent to 15.7 per cent).

Allocation Patterns

The allocation of funds within the roads system is shown in Table 6.3.

Fifty-three per cent of construction funds were devoted to the arterial system and 47 per cent to local roads; but in the maintenance category the pattern was reversed, comprising 34 per cent on arterial roads and 66 per cent on locals. Overall road allocations was 46 per cent to arterial roads and 53 per cent to locals. Construction activities accounted for 65 per cent and maintenance 35 per cent of total expenditure.

TABLE 6.3 - ESTIMATED EXPENDITURE ON ROADS: BY CATEGORY AND TYPE OF EXPENDITURE: 1974-75 TO 1978-79 (ALL LEVELS OF GOVERNMENT)

($ MILLION, CURRENT PRICES)

Category	Construction	Per cent	Maintenance	Per cent	P & R	Per cent	Total	Per cent
National Highways	739.5	12.8	137.7	4.6	-	-	877.2	9.9
National Commerce	78.2	1.3	-	-	-	-	78.2	0.9
Rural Arterials	928.0	16.0	585.6	19.5	-	-	1513.6	17.1
Urban Arterials	1227.2	21.2	300.1	10.0	-	-	1527.3	17.2
MITERS	83.0	1.4	-	-	-	-	83.0	0.9
TOTAL ARTERIALS	3055.9	52.7	1023.4	34.1	-	-	4079.3	46.0
Rural Local	1372.8	23.7	983.3	32.8	-	-	2356.1	26.6
Urban Local	1372.2	23.6	990.4	33.1	-	-	2362.6	26.7
TOTAL LOCALS	2745.0	47.3	1973.7	65.9	-	-	4718.7	53.3
Other								
Planning & Research	-	-	-	-	60.5	100.0	60.5	0.7
TOTAL	5800.9	100.0	2997.1	100.0	60.5	100.0	8858.5	100.0
Per cent		65.5		33.8		0.7		100.0

Road Funding - 1974-75 to 1978-79

Trends in road funding by the three levels of government from their own sources are shown in Tables 6.4 and 6.5. Table 6.4 shows that State Government funds allocated to roads grew at the greatest rate, averaging 18.3 per cent per annum over the period. Commonwealth funding (in both in the States and Territories) grew at the lowest rate (7.4 per cent per annum).

The consequence of these variations in growth in road expenditures, was a changing pattern of shares in road funding as shown by Table 6.5. Over the period the Commonwealth share averaged 29.2 per cent, State Governments share 30.0 per cent and local governments 40.8 per cent of the total funding of roads expenditure. However the Commonwealth share fell over the period, from 32.2 per cent in 1974-75 to 27.3 per cent in 1978-79. The local government share remained relatively constant (falling from 41.7 per cent to 40.1 per cent) while the State Government share rose from 26.1 per cent to 32.6 per cent.

The pattern of funding of categories by level of government for the period is shown in Table 6.6.

The pattern which emerges from this analysis at the category level comprises the following.

(a) The emphasis by the Commonwealth on funding national highways and urban local and rural arterial roads as compared to rural local and urban arterial roads.

(b) The compensating changes in State expenditures on urban arterial roads (up 23.6 per cent per annum) and the relatively low growth on urban local roads. Also noticeable was a 16

TABLE 6.4 - ESTIMATED ROAD FUNDING: BY LEVEL OF GOVERNMENT BY YEAR: 1974-75 TO 1978-79

($MILLION, CURRENT PRICES)[a]

Level of Government	1974-75	1975-76	1976-77	1977-78	1978-79	Total 5 Years	Average Annual Growth Rate
Commonwealth	439.1	486.5	521.1	558.2	584.0	2588.9	7.4
State	356.1	446.7	533.3	619.0	696.4	2651.5	18.3
Local	567.7	685.6	720.4	785.4	859.0	3618.1	10.9
TOTAL	1362.9	1618.8	1774.8	1962.6	2139.4	8858.5	11.9

(a) Table 6.11 provides this data in constant 1976-77 prices.

TABLE 6.5 - PERCENTAGE SHARE OF ROAD FUNDING: BY LEVEL OF GOVERNMENT 1974-75 TO 1978-79

Level of Government	1974-75	1975-76	1976-77	1977-78	1978-79	Average for Period
Commonwealth	32.2	30.0	29.4	28.5	27.3	29.2
State	26.1	27.6	30.0	31.5	32.6	30.0
Local	41.7	42.4	40.6	40.0	40.1	40.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: BTE Estimates based on NAARSA, SRA and ABS data.

TABLE 6.6 - AVERAGE ANNUAL PERCENTAGE GROWTH RATE IN ROAD FUNDING BY CATEGORY BY SOURCE OF FUNDS: 1974-75 TO 1978-79[(a)]

Selected Category	Commonwealth	State	Local	Total
National Highways Construction	17.5	16.0	-	17.4
National Commerce Roads	82.9	-46.7	-	19.9
Rural Arterials	11.3	19.2	-	16.4
Rural Locals	7.1	19.2	11.4	11.5
Urban Arterials	-10.0	23.6	12.7	4.9
Urban Locals	17.2	7.1	10.6	10.9
MITERS	32.1	40.2	-	34.1
Total Construction	7.1	19.0	11.0	11.6
Maintenance	8.7	17.2	10.8	12.6
Planning & Research	12.9	16.1	-	14.5
TOTAL	7.4	18.3	10.9	11.9

(a) Current prices; Table 6.12 provides this data in real terms.
Source: BTE Estimates based on NAASRA, SRA and ABS data.

per cent growth rate in State expenditure on national highway construction although the States spent only $52.4 million (7 per cent) out of a total $739.5 million in this category[1].

(c) The relatively even rates of growth in road expenditures by local government. The highest growth rate of local government expenditure was on urban arterial roads, although in absolute amounts this totalled only $71 million (4 per cent) out of total construction expenditures on these three categories of $1973.3 million.

<u>Road Expenditure on a Per Unit Basis</u>

One method of getting some perspective on road expenditures is to examine them in terms of allocations per unit of tax base. Two ways of assessing road funding is on a per vehicle basis (particularly for State expenditures) and on a per capita basis (particularly for local government).

Changes in road financing over the period 1974-75 to 1978-79 assessed in these terms, are shown in Tables 6.7 and 6.8.

Table 6.7 shows that the lowest rate of growth of expenditure per vehicle was at the Commonwealth level and the highest at the State Government level, but in absolute terms local government spends the most on roads on a per vehicle basis.

The per capita pattern is similar to the per vehicle expenditure pattern; the Commonwealth having the lowest growth rate, the States the highest, and local government in absolute terms spending more per capita on roads than the other levels of government.

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(1) Under the States Grants (Roads) Act 1977 the Commonwealth meets up to 100 per cent of the cost of approved national highway projects. However the States are not precluded from spending their own funds on national highways if they so desire.

TABLE 6.7 - ROAD EXPENDITURES PER VEHICLE - TOTAL AUSTRALIA BY SOURCE OF FUNDS: 1974-75 TO 1978-79

($, CURRENT PRICES)

Source of Funds	1974-75	1975-76	1976-77	1977-78	1978-79	Annual Average Growth Rate
Commonwealth	69	72	74	77	81	4.0
State	62	74	85	96	107	14.8
Local	99	113	114	122	132	7.6
TOTAL	230	260	274	295	321	8.7

TABLE 6.8 - ROAD EXPENDITURE PER CAPITA-TOTAL AUSTRALIA BY SOURCE OF FUNDS: 1974-75 TO 1978-79

($, CURRENT PRICES)

Source of Funds	1974-75	1975-76	1976-77	1977-78	1978-79	Annual Average Growth Rate
Commonwealth	30	33	34	36	38	6.3
State	27	33	39	45	51	17.3
Local	43	51	53	57	62	10.0
TOTAL	99	117	127	138	151	11.1

Source: BTE Estimates based on NAASRA, SRA and ABS data.

Tables 6.7 and 6.8 show Australia wide averages. There are some significant changes in the pattern of dispersion around these averages over time, when individual States and levels of government are considered. Table 6.9 is derived from Tables 20 and 21 in Annex 3, and shows the degree of variability in funding by level of government by State for both unit bases of road expenditure for two selected years (in current prices).

The pattern which emerges from this Table is that:

(a) expenditure (from all sources of funds) on roads in South Australia in 1978-79 was the lowest at $232 per vehicle and $117 per capita, or respectively 72 per cent and 77 per cent of the Australian average;

(b) similarly expenditure in Tasmania, in 1978-79 on both a per vehicle and a per capita basis, was highest at $408 per vehicle and $203 per capita, or respectively 27 per cent and 34 per cent more than the Australian average; and

(c) this ranking has broadly held since 1974-75.

(d) At the total level, the average annual growth rate achieved by the Commonwealth and local governments (for both per unit measurements) were less than the overall average, while those of the States (as a whole) were higher than average. For the period 1974-75 to 1978-79 it is estimated that an average annual rate of 10.1 per cent will be exhibited by the "implicit price deflator of all public final expenditure". It can be seen that the average annual expenditure on the per vehicle measurement is estimated to fall short of this (8.7 per cent compared to 10.1 per cent) while expenditure growth on the per capita measure (11.1 per cent) will exceed it. In both cases average annual growths in State expenditures are estimated to exceed this measure of general price rises.

TABLE 6.9 - RANKING OF ROAD EXPENDITURES PER VEHICLE AND PER CAPITA BY STATE BY SOURCE OF FUNDS: 1974-75 AND 1978-79

($, CURRENT PRICES)

	Road Expenditures per vehicle				Road Expenditures per capita			
State and Source of Funds	1974-75	1978-79	1974-75 Ranking by Fund Source	1978-79 Ranking by Fund Source	1974-75	1978-79	1974-75 Ranking by Fund Source	1978-79 Ranking by Fund Source
NSW			COMMONWEALTH				COMMONWEALTH	
Cwlth	59	78	WA	TAS	25	35	WA/TAS	TAS
State	71	132	TAS	QLD	30	59	-	WA
Local	109	156	QLD	WA	45	70	QLD	QLD
Total	239	365	NSW	NSW	100	163	SA	NSW
VIC			SA	SA			NSW	SA
Cwlth	54	60	VIC	VIC	24	28	VIC	VIC
State	58	84	STATE		26	40	STATE	
Local	101	138	NSW	TAS	45	65	TAS	TAS
Total	214	281	TAS	NSW	95	134	NSW	NSW
QLD			VIC/QLD	WA			VIC	WA
Cwlth	99	114	-	QLD	42	53	QLD/SA/WA	QLD
State	58	102	WA	VIC	24	48	-	SA
Local	106	121	SA	SA	45	57	-	VIC
Total	263	337	LOCAL		111	157	LOCAL	
SA			NSW	NSW			NSW/VIC/QLD	NSW
Cwlth	58	68	QLD	VIC	27	34	-	VIC
State	51	82	VIC	TAS	24	42	-	TAS
Local	70	82	TAS	QLD	32	41	TAS	QLD
Total	179	232	WA	WA	83	117	SA/WA	WA
WA			SA	SA			-	SA
Cwlth	109	104	TOTAL[a]		47	56	TOTAL[a]	
State	56	105	QLD	TAS	24	56	TAS	TAS
Local	74	103	TAS	NSW	32	55	QLD	WA
Total	238	312	NSW	QLD	104	167	WA	NSW
TAS			WA	WA			NSW	QLD
Cwlth	103	117	VIC	VIC	47	58	VIC	VIC
State	68	168	SA	SA	31	84	SA	SA
Local	88	123			40	61		
Total	259	408			118	203		
TOTAL[b]			AVE ANNUAL GROWTH				AVE ANNUAL GROWTH	
Cwlth	69	81	4.1% p.a.		30	38	6.1% p.a.	
State	62	107	14.6% p.a.		27	51	17.2% p.a.	
Local	99	132	7.5% p.a.		43	62	9.6% p.a.	
Total	230	321	8.7% p.a.		99	151	11.1% p.a.	

(a) Total refers to all levels within the State.
(b) Total refers to all States.

NOTE: Totals may not add due to rounding.

Source: BTE Estimates based on NAASRA, SRA and ABS data.

The dispersion of expenditure patterns by source of funds within States comprises the following.

(a) Commonwealth Grants per Unit by State

The highest outlays by the Commonwealth on a per unit basis have been in the States of Western Australia and Tasmania. The lowest allocations on both bases have been to Victoria. On a per capita basis in 1978-79 this represented an allocation 53 per cent more than the national average to Tasmania and an allocation of 26 per cent below average to Victoria.

(b) State Government Expenditures

Generally the highest level on both unit bases was in Tasmania; on a per capita basis Tasmania averaged 65 per cent more than the Australian average. The lowest 1978-79 level on a per vehicle basis was in South Australia, and on a per capita basis in Victoria. South Australian expenditure, at $82 per vehicle was 77 per cent of the national average for this level of government; while Victorian expenditure, at $40 per capita, was 78 per cent of the national average. In terms of rates of change, State unit expenditure increased more than the Australian average in Tasmania and Western Australia while the increase in Victoria was below the Australian average.

(c) Local Government

The highest 1978-79 expenditure on both unit bases by local government was in New South Wales; $156 per vehicle and $70 per capita, or respectively 18 per cent and 13 per cent over the Australian average for local government.

The lowest level of per unit expenditure (both bases) on roads by local government was in South Australia. At $82 per vehicle and $41 per capita in 1978-79, this represented only

62 per cent and 66 per cent respectively of the national average for this level of government. Unit expenditure by local governments has increased at about the national average rate in all States except Queensland and South Australia where it was considerably below average.

PAST EXPENDITURE PATTERNS (CONSTANT PRICE SERIES)

The Bureau's Road Construction Price Index was used in deriving a constant price series from current price estimates. The index is set out below; the derivation of the index has been explained in Bureau Occasional Paper 27[1].

ROAD CONSTRUCTION PRICE INDEX

Year Ended 30 June	Base Year 1968-69 = 100	Base Year 1976-77 = 100
1969	100	48.1
1970	104.4	50.2
1971	109.6	52.7
1972	115.2	55.4
1973	122.8	59.0
1974	142.1	68.3
1975	169.9	81.6
1976	188.8	90.7
1977	208.1	100.0
1978	223.8	107.5
1979	239.5	115.1

The current price road expenditure data contained in the foregoing analysis, and in Annex 3 Tables 1 to 31 can be also shown in real terms using constant 1976-77 prices.

(1) Burke, R.H., A Road Construction Price Index, BTE Occasional Paper 27, AGPS, Canberra, 1978.

These are shown in Annex 3 in Tables 51 to 81. Certain summary Tables, derived from the set in the Annex, are provided in the following analysis.

Table 6.10 shows estimated actual road expenditure by category and year (and corresponds to expenditures shown in current price Table 6.1).

Whereas Table 6.1 revealed an average growth in money terms over the period of 11.9 per cent per annum, Table 6.10 shows that in real terms, total road expenditure rose on average by only 2.7 per cent per annum.

Within that overall average, expenditure in real terms was negative for urban arterial roads involving an average decline of 3.9 per cent per annum, due primarily to a sharp fall in expenditure in 1974-75 and 1975-76.

The greatest real growth occurred in MITERS (23.7 per cent per annum) due mainly to the increased expenditure in 1975-76. In the major construction categories there was a 7.8 per cent per annum increase in national highways real expenditure and 6.9 per cent per annum increase in real expenditure on rural arterial roads.

Maintenance grew faster (at 3.4 per cent per annum) than the construction categories (2.4 per cent per annum).

Figures 6.1 to 6.5 show annual estimated construction expenditure for the major categories in constant prices for the years 1974-75 to 1978-79 and average annual expenditures derived from the 1973 CBR warranted and recommended programs and the 1979 warranted program as developed in Chapter 5.

Road Funding Shares

In constant prices, changes in road funding by level of government are shown in Table 6.11.

TABLE 6.10 - ESTIMATED EXPENDITURE ON ROADS: BY CATEGORY AND YEAR 1974-75 TO 1978-79 (ALL LEVELS OF GOVERNMENT)

($ MILLION, 1976-77 PRICES)

Category	1974-75	1975-76	1976-77	1977-78	1978-79	Total 5 Years	Average Annual Growth Rate
CONSTRUCTION							
National Highways	121.2	146.0	152.4	155.9	163.7	739.2	7.8
National Commerce Roads	10.9	15.1	19.8	16.4	16.0	78.2	10.1
Rural Roads							
Arterial	160.3	177.0	182.0	198.9	209.2	927.4	6.9
Local	256.3	277.3	287.8	279.6	281.2	1382.2	2.4
Total	416.6	454.3	469.8	478.5	490.4	2309.6	4.2
Urban Roads							
Arterial	289.1	239.0	223.1	247.3	248.0	1246.5	-3.9
Local	256.3	288.0	281.2	282.7	275.0	1383.2	1.8
Total	545.4	527.0	504.3	530.0	523.0	2629.7	-1.1
MITERS	7.6	22.2	17.2	17.6	17.8	82.4	23.7
TOTAL CONSTRUCTION	1101.7	1164.6	1163.5	1198.4	1210.9	5839.1	2.4
MAINTENANCE	556.2	606.4	599.2	616.4	635.0	3013.2	3.4
PLANNING & RESEARCH	11.2	12.8	12.1	11.1	13.7	60.9	5.2
TOTAL	1669.1	1783.8	1774.8	1825.9	1859.6	8913.2	2.7

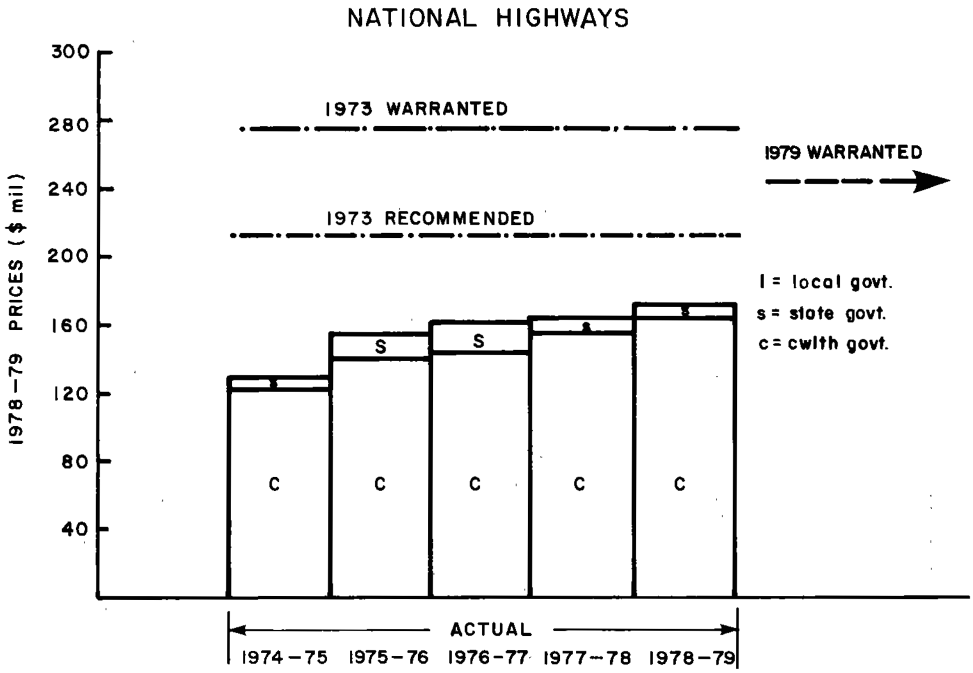

FIGURE 6·1

1973 WARRANTED AND RECOMMENDED PROGRAMS, 1974–75 TO 1978–79

ACTUAL EXPENDITURE, 1979 WARRANTED PROGRAM

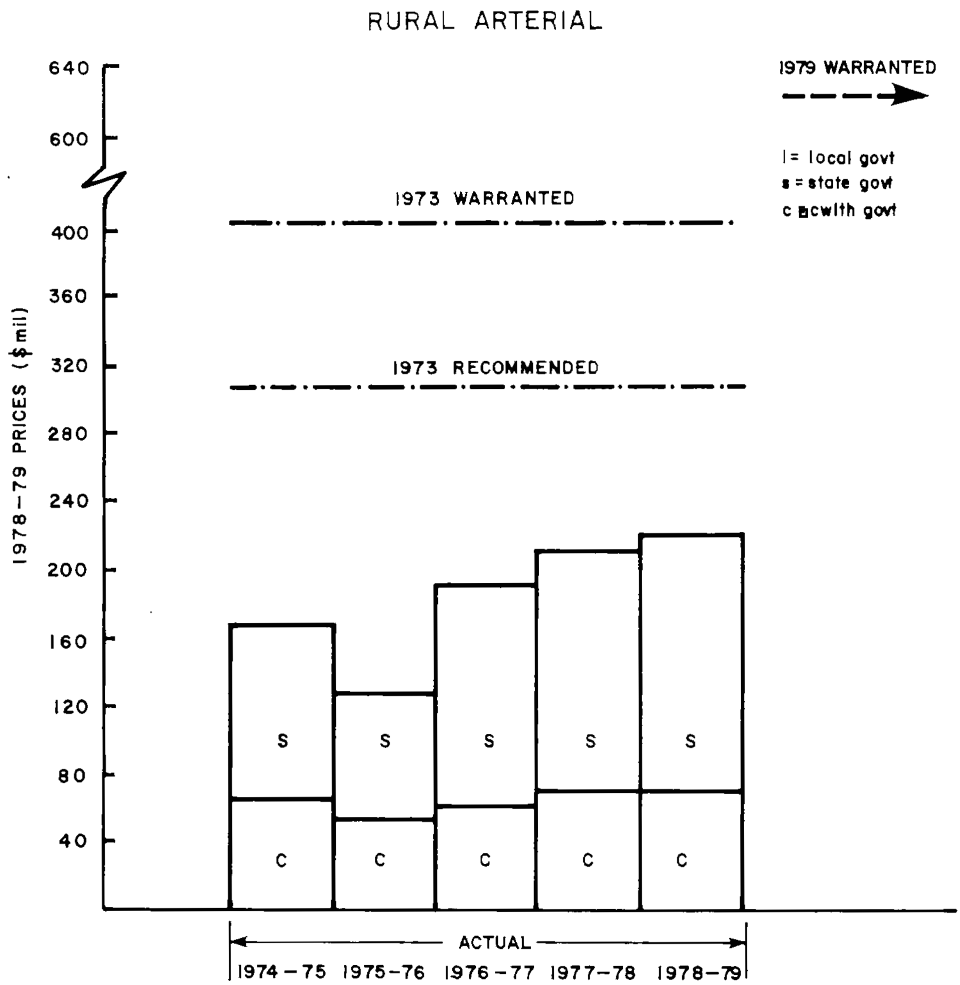

FIGURE 6·2

1973 WARRANTED AND RECOMMENDED PROGRAMS, 1974-75 TO 1978-79

ACTUAL EXPENDITURE, 1979 WARRANTED PROGRAM

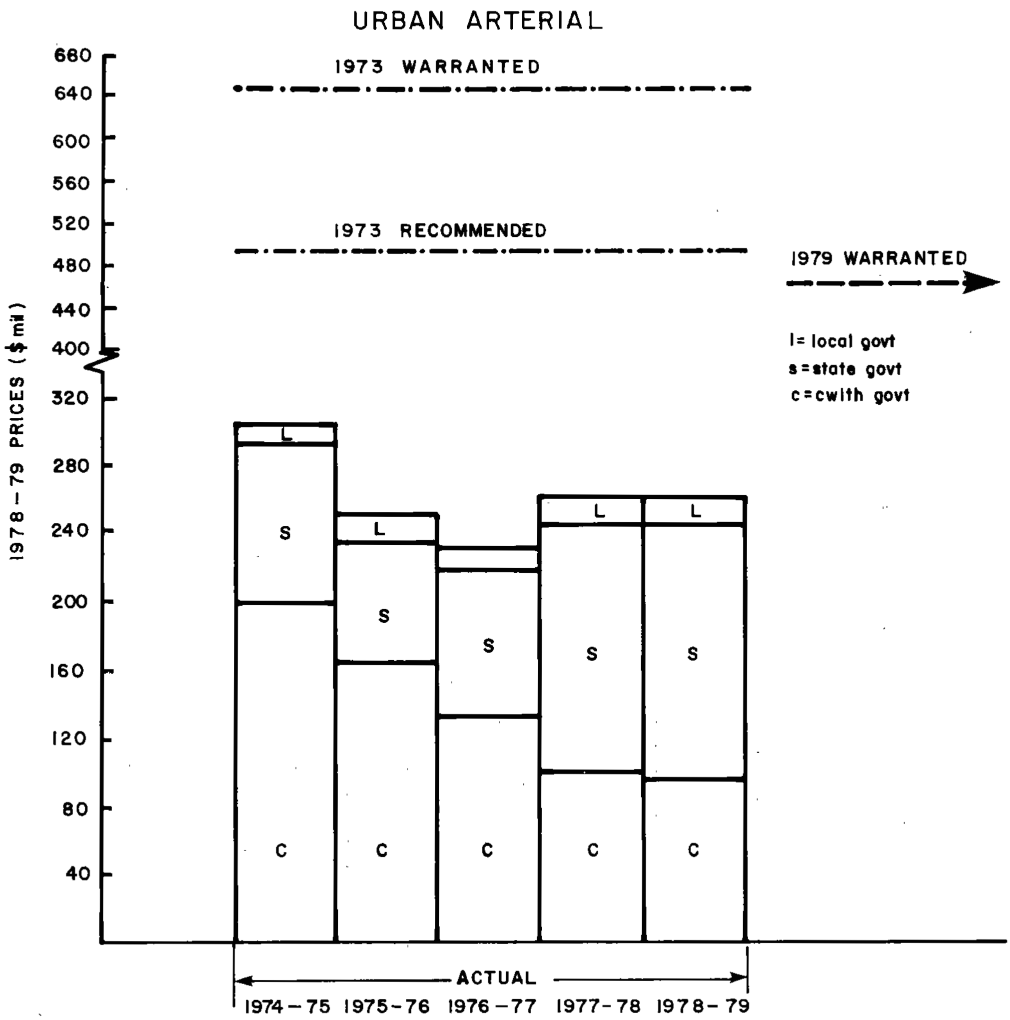

FIGURE 6·3

1973 WARRANTED AND RECOMMENDED PROGRAMS, 1974-75 TO 1978-79 ACTUAL EXPENDITURE, 1979 WARRANTED PROGRAM

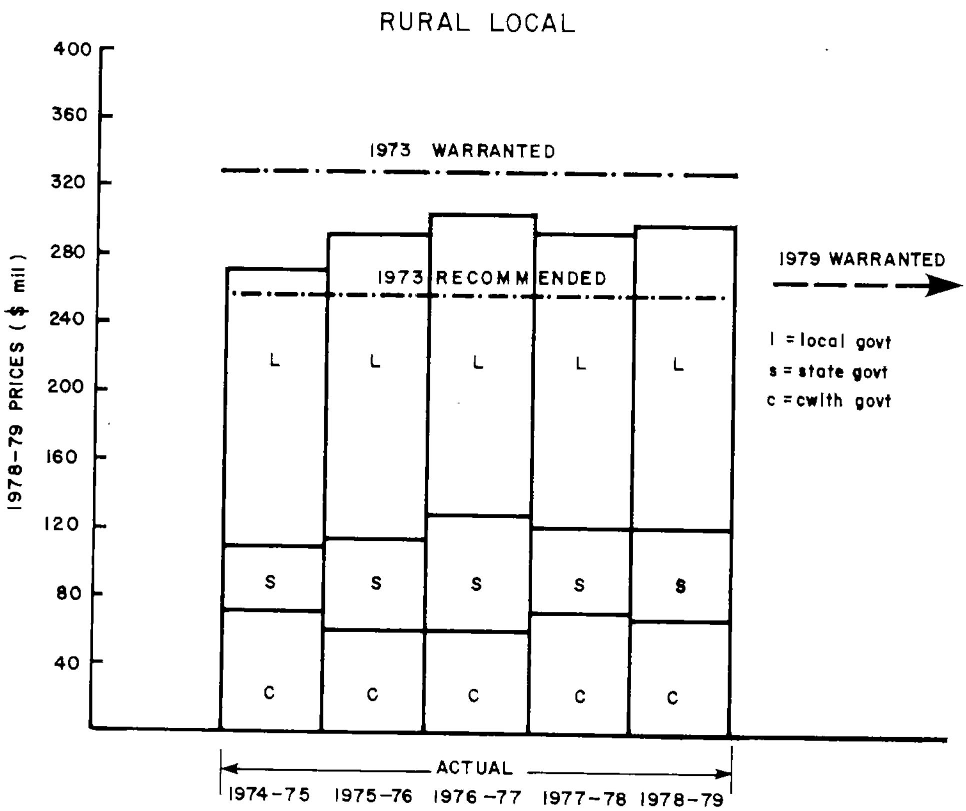

FIGURE 6·4

1973 WARRANTED AND RECOMMENDED PROGRAMS, 1974-75 TO 1978-79 ACTUAL EXPENDITURE, 1979 WARRANTED PROGRAM

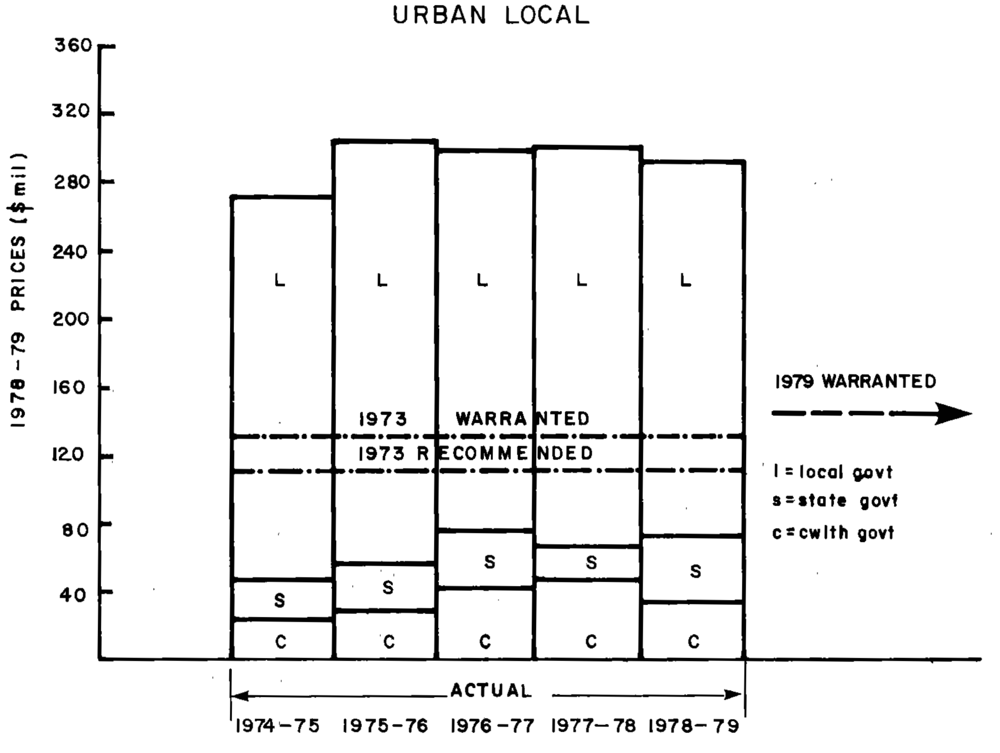

FIGURE 6·5

1973 WARRANTED AND RECOMMENDED PROGRAMS, 1974-75 TO 1978-79 ACTUAL EXPENDITURE, 1979 WARRANTED PROGRAM

TABLE 6.11 - ESTIMATED ROAD FUNDING: BY LEVEL OF GOVERNMENT BY YEAR 1974-75 TO 1978-79

($ MILLION, 1976-77 PRICES)

Level of Government	1974-75	1975-76	1976-77	1977-78	1978-79	Total 5 Years	Average Annual Growth Rate
Commonwealth	537.7	535.7	521.1	519.5	508.0	2622.0	-1.4
State	436.0	492.5	533.3	576.1	605.2	2643.1	8.5
Local	695.4	755.6	720.4	730.3	746.4	3648.1	1.8
TOTAL	1669.1	1783.8	1778.4	1825.9	1859.6	8913.2	2.7

In real terms, allocation of funds to roads by:

- the Commonwealth fell by 1.4 per cent per year;
- State Governments grew by 8.5 per cent; and
- local government grew by 1.8 per cent.

The shares of road funding in constant prices are the same as those in current prices, shown in Table 6.5.

The change in allocation of funds to categories by source of funds for the period is shown in Table 6.12.

TABLE 6.12 - ANNUAL AVERAGE PERCENTAGE CHANGE IN ROAD FUNDING: BY CATEGORY BY SOURCE OF FUNDS: 1974-75 TO 1978-79 [(a)]

Selected Category	Commonwealth	State	Local	Total
National Highways Construction	7.9	7.1	-	7.8
National Commerce Roads	68.8	-59.7	-	10.1
Rural Arterials	2.3	9.4	2.2	6.9
Rural Locals	-1.8	9.5	2.3	2.4
Urban Arterials	-19.9	13.5	3.3	-3.9
Urban Locals	7.8	-1.9	1.5	1.8
MITERS	21.6	29.7	-	23.7
Total Construction	-1.7	9.2	1.9	2.4
Maintenance	-0.2	7.5	1.7	3.4
Planning & Research	3.2	7.2	-	5.2
TOTAL	-1.4	8.5	1.8	2.7

(a) In constant prices; all changes in real terms.

The reduction in urban arterial road grants by the Commonwealth shown in Table 6.6, is more strongly highlighted in real purchasing terms in Table 6.12 as a decline of 19.9 per cent. This was only partially compensated by growth in State Government expenditures for this category of 13.5 per cent per annum so that overall expenditure in this category declined in real terms over the five years.

It may also be noted from Table 6.12 that there was a decline in real expenditure on urban local roads by State Governments and a strong increase in real spending in that category by the Commonwealth and further that the pattern was reversed for rural locals.

Overall, during the period under consideration resources were directed away from urban roads, particularly arterials, and towards rural arterials and national highways.

As for the current price series, estimates have been made of expenditures on a per vehicle and per capita basis in constant prices. These are shown as Tables 70 and 71 in Annex 3.

In summary they reveal:

- a decline over the period for Commonwealth road expenditures in real terms on both per vehicle and per capita basis;
- a decline in local government expenditures per vehicle but slight increase on a per capita bases; and
- a relatively strong growth by State Government on per capita and per vehicle bases.

PROJECTED ROAD EXPENDITURE

Three projected road expenditure series were developed by the Bureau, for each financial year from 1979-80 to 1983-84, inclusive. These series are based on financial projections at current prices and constant prices and a constant price projection.

Although projected road expenditures in each State and Territory in 1979-80 were allocated to road categories, the projections for subsequent years were not so allocated. The reasons for this were:

(a) 1979-80 is the last year of the present Commonwealth road grant legislation and Commonwealth grants by category for this period are known; and

(b) the Bureau had reasonable confidence in projecting from estimates of State and local Government expenditures for road categories up to one year ahead but not beyond.

The allocations of the expenditures by State authorities for 1979-80 from each of the Commonwealth and State level-of-government sources, were made by assuming that, in each State, they will be distributed to road categories in the same proportions as were the corresponding estimates of expenditures for 1978-79.

Financial Projection 1979-80 to 1983-84 (Current Prices)

On the basis of observed roads expenditure trends for Commonwealth, State and local Government outlays over recent years assumptions on future roads expenditures were developed. It was assumed for this projection the Commonwealth Government's aim would be to maintain a constant contribution to roads in real terms.

Table 6.13 presents a summary of the financial projection. (Further detailed projections are available in Annex 3 - Tables 30 and 31.)

This Table provides projections of existing and past expenditure patterns, and shows that the highest growth rate in road expenditure was at the State level (11.1 per cent per annum) and lowest at the Commonwealth level (5.0 per cent per annum).

Financial Projection 1979-80 to 1983-84 (Constant Prices)

Projections were also made in constant 1976-77 prices on assumption of the financial projections and price increases outlined earlier in this Chapter.

Table 6.14 summarises the results of this analysis.

TABLE 6.13 - PROJECTED ROAD EXPENDITURES (FINANCIAL PROJECTION): BY LEVEL OF GOVERNMENT BY YEAR: 1979-80 TO 1983-84

($ MILLION, CURRENT PRICES)

Level of Government	1979-80	1980-81	1981-82	1982-83	1983-84	Total 5 Years	Annual Average Growth Rate
Commonwealth	622.9	652.2	684.1	719.2	758.2	3436.6	5.0
State	773.4	858.8	953.9	1059.8	1177.5	4823.4	11.1
Local	939.2	1027.5	1124.5	1230.8	1347.6	5669.6	9.5
TOTAL	2335.5	2538.5	2762.5	3009.8	3283.3	13929.6	8.9

TABLE 6.14 - FINANCIAL PROJECTION OF ROAD EXPENDITURE BY LEVEL OF GOVERNMENT BY YEAR: 1979-80 TO 1983-84

($ MILLION, 1976-77 PRICES)

Level of Government	1979-80	1980-81	1981-82	1982-83	1983-84	Total 5 Years	Average Annual Growth Rate
Commonwealth	515.5	524.0	533.6	544.6	557.7	2675.4	2.0
State	640.2	690.0	744.1	802.4	865.8	3742.7	7.8
Local	777.2	825.6	877.2	932.1	990.9	4403.0	6.3
TOTAL[(a)]	1932.9	2039.7	2154.8	2279.4	2414.5	10821.3	5.7[(b)]

(a) Minor differences due to rounding effects.
(b) The reason the projected real rate of growth is higher than the historical is because the projections are in money terms and the rate of inflation is expected to slacken. In other words the twin assumptions of growth in financial outlays together with decreasing rates of inflation result in projected real road expenditures greater than those achieved in recent years.

Constant Price Projection 1979-80 to 1983-84

An alternative method is to project on the basis of recent trends in outlays in real terms. The results of such an analysis are presented in Table 6.15. Because of fairly wide fluctuations in the historic expenditure series, judgements were made about likely trends in real expenditure on the basis of the most recent information available.

The method results in a total road budget for the five year period 1979-80 to 1983-84 of $10 109 million (1976-77 prices) compared to the financial projection of $10822 million and a warranted program of $13318 million.

RESOURCE ALLOCATION AND THE WARRANTED ROAD PROGRAM

When considering resource allocation it must be remembered that the analysis used for the warranted program in Chapter 5 develops a total roads program which can be supported on economic grounds for the five year period 1979-80 to 1983-84 at a discount rate of 10 per cent. All projects contained in the program would yield discounted benefits greater than the discounted costs of undertaking them (and no project included in the program would show a rate of return lower than 10 per cent to the community).

Evaluated and Actual Projects

There may not (and probably will not) be a one to one correspondence between the projects which are ultimately funded and that mix of simulated (indicative) projects and real projects which were evaluated in the cost-benefit analyses leading to the identification of the warranted program.

The extent to which such correspondence will occur will in turn depend on:

TABLE 6.15 - CONSTANT PRICE PROJECTED ROAD EXPENDITURE (ALL LEVELS OF GOVERNMENT) BY YEAR: 1979-80 TO 1983-84

($ MILLION: 1976-77 PRICES)

Level of Government	1979-80	1980-81	1981-82	1982-83	1983-84	Total 5 Years	Average Annual Growth Rate
Commonwealth	516	523	531	539	547	2656	1.5
State	634	665	697	730	765	3491	4.8
Local Government	761	777	792	808	824	3962	2.0
TOTAL	1 911	1 965	2 020	2 077	2 136	10 109	2.8

(a) planning practices of road authorities (State and local Government), including the priorities those authorities assign to economic criteria in selecting road projects and road development strategies;

(b) the standards used in road building - which may themselves be adjusted according to available funds; and

(c) the actual outcome with respect to traffic growth and composition compared with the forecasts used in the evaluations.

Appropriate Discount Rate

The warranted program is established by comparing the benefits and costs of projects developed to remedy deficiencies already existing or likely to develop in the road system up to 1983-84. These projects would bring roads and structures up to agreed engineering standards and result in reduced operating and time costs, reduced accident costs, and reduced maintenance. In comparing the costs of improvements with the benefits that result, regard has to be given to the fact that goods and services have to be foregone in the present for a stream of benefits in the future. Hence the need to discount future benefits and costs to the present.

The actual discount rate which is used has a profound effect on the size of the economically warranted program. The evaluation results in Chapter 5 for rural arterial roads show substantial sensitivity of the warranted expenditures to the discount rate:

- $4268 million at 7 per cent,
- $3586 million at 10 per cent,
- $2442 million at 15 per cent,

a difference of $1826 million between highest and lowest levels of warranted expenditure or on average $228 million per one percentage point of discount rate. Similar results apply to the other categories.

Unfortunately, there is in practice no unambiguous answer as to the appropriate discount rate for cost-benefit analysis. The Bureau has chosen 10 per cent as its base rate with some sensitivity testing at 7 per cent and 15 per cent. On this point, it has to be appreciated that the warranted road program at 10 per cent discount rate is not a conclusive indication as to the level of expenditure which should be undertaken as the question of the appropriate discount rate is itself open to some judgement.

Limits to the Use of Economic Analysis

Given an overall budget constraint, an efficient allocation of resources is achieved if they are allocated to different uses so that the marginal benefit is equalised across all competing uses (i.e., the cost-benefit ratios of projects at the margin are equalised in all uses).[1]

There are substantial difficulties in implementing this concept in practical terms; for example, resources are not homogeneous and there are substantial institutional and other barriers to their ready transfer between locations and uses.

A further difficulty, particularly common in the public sector (where free markets often do not exist), is the lack of an explicit value for many products e.g., road improvements, even when their cost is known. One response to this has been to derive a cost-benefit ratio in which values are imputed or derived for the benefits of given expenditure. It is on this basis that the Bureau has adopted cost-benefit analyses to assess "road needs".

Theoretically then, investment in infra-structure provided through the agency of governments, should be undertaken until the cost-benefit ratio of the least warranted project in each major sector just equals unity, or if budget constraints apply, either overall

(1) Assuming indivisibilities are negligible.

or in certain sectors or sub-sectors, (as they usually do), then funds available under the budget constraints are allocated so that the cost-benefit ratios of the least warranted project in each sub-sector spanned by the constraint are equal.

It would be difficult to implement such an approach because public sector investments do not all have greater benefits which are susceptible to imputed market price type valuation. Assessments of public sector programs must inevitably involve political judgement as to the trade offs between the benefits and the magnitude of the costs which may be incurred in sectors such as education with those in sectors where more comprehensive economic analyses can be more easily applied (e.g., transport).

Hence available techniques of micro-economic analysis (i.e. cost-benefit analysis, cost-effectiveness analysis etc.) can not of themselves yield a prescriptive sectoral budget - other techniques and other issues have to be considered, including:

- questions of sectoral balance;
- the trade-off between public and private expenditures;
- the trade-off between current and capital expenditures;
- requirements of short-term economic management, including management of growth of expenditures and the monetary-income implications of government debt funding; and
- financial arrangements and responsibilities between levels of governments.

Cost-benefit analysis is much more appropriate in assessing resource allocation patterns within sectors (e.g. transport, or roads) both in a spatial sense (i.e. between regions such as States or rural/urban locations) and in a strategic sense (categories of the road system e.g. arterials versus local roads, construction versus maintenance). The usefulness of cost-benefit analysis for this purpose hinges on the establishment of budget constraints on a sectoral basis. In the next section a retrospective analysis is made of recent expenditures on roads in comparison to expenditures estimated to be warranted in the 1973 roads report.

RETROSPECTIVE ANALYSIS OF ROAD RESOURCE ALLOCATION[1]

The following analysis is directed to a retrospective review of road resource allocation patterns over the period 1974-75 to 1978-79. Two comparisons are made. In the first, actual[2] expenditures are compared to the patterns of expenditures reported as the warranted and recommended programs by the CBR in its 1973 roads report. For these comparisons the warranted program can be thought of as the maximum level and pattern of expenditure under economic criteria and the recommended program as a level of expenditure constrained by non-economic considerations to a level below the warranted program.

In the second set of comparisons the budget constraint as reflected by actual expenditure is recognised. Basically the aim is to determine the economically efficient pattern of expenditure given that the total budget, as realised, was less than the warranted program.

Actual, compared to Economically Warranted, Expenditures 1974-75 to 1978-79

In 1973, after an exhaustive road survey, conducted jointly with NAASRA, and the analysis of that data by a set of complex and comprehensive economic evaluation programs for road construction, the CBR developed economically warranted and recommended road

(1) In the rest of this Chapter a reference to expenditure by State refers to total roads expenditures within the State from all sources (Commonwealth, State and local Government) and not to expenditures from State funds only.

(2) It should be noted that actual expenditure has, in fact, been estimated for the later years of the period under review. It corresponds to the estimated expenditures set out earlier in this Chapter.

programs for the period 1974-75 to 1978-79. The CBR recommended a lower level i.e., a "warranted and feasible program" (referred to in this section as the recommended program), of road funding effort over the period 1974-75 to 1978-79, in recognition of the practical difficulties of implementing the assessed warranted program. These included:

(a) the financing implications of the annual fund requirements of the warranted program compared to historical expenditure patterns to that time; and

(b) the need to maintain some continuity in road programs at the category, regional and State level to avoid disruption to planning, and because of the lack of mobility in labour, i.e. it is not feasible nor possibly desirable to rapidly switch labour from rural local road programs, to say urban arterial programs.

As there is now sufficient data available to allow an estimate of actual road expenditures for that period to be made, it was considered that there may be interest in comparing recent patterns of road allocations by all levels of government with the CBR's estimated economically warranted and recommended road programs.

The results of this comparison, made in aggregate form for the whole of Australia, are shown in Table 6.16. The comparison is made in 1971-72 prices, as it was on that basis that the original estimate of warranted road needs and recommended programs were calculated by the CBR.

Some allowances have to be made in this comparison. For example, the category national commerce roads did not exist in 1973, while general administration, for which the CBR allowed a warrant of 4 per cent of construction and maintenance costs, is included throughout the various categories in the estimates of expenditure made by the BTE. The most recent estimate of general administration as a proportion of estimated expenditure is about 8 per cent.

TABLE 6.16 - COMPARISON OF ACTUAL EXPENDITURES WITH ASSESSED ROAD NEEDS: TOTAL AUSTRALIA - 1974-75 TO 1978-79 BY CATEGORIES

($ MILLION, 1971-72 PRICES)

	Total Warranted Needs[(a)] (A)	Recommended Program[(b)] (B)	Total Estimated Expenditure[(c)] (C)	VARIATION under (over) $\frac{A-C}{A}$ %	VARIATION under (over) $\frac{B-C}{B}$ %
Construction					
National Highways	656	518	409	38	21
National Commerce	-	-	43	-	-
Sub-Total	656	518	452	31	13
Rural Arterials	978	740	513	48	31
Rural Locals	794	617	765	4	(24)
Sub-Total	1772	1357	1278	28	6
Urban Arterials	1553	1176	690	56	41
Urban Locals	321	272	766	(139)	(182)
Sub-Total	1874	1448	1456	22	(1)
MITERS	157	89	46	71	48
Total Construction	4459	3412	3232	28	5
Maintenance	1105	1105	1669	(51)	(51)
Planning & Research	47	37	34	28	8
General Administration	218	176	-[(d)]	n.a.	n.a.
TOTAL	5829	4730	4935	15	(4)

(a) Total Warranted Needs as per Table 13.1, Report on Roads in Australia 1973 (after reclassifying functional class 3 roads as rural arterials).
(b) Recommended program as per Table 13.2, Report on Roads in Australia 1973.
(c) Estimated by the BTE.
(d) General Administration cost is included in expenditure estimates. All dollar amounts and percentages rounded to nearest whole number.
(e) Cannot be obtained from addition of above column due to General Administration cost allocation procedure (see footnote (d)).

Therefore the variations of actual expenditure from warranted shown in Table 6.16 understate the downwards differences and overstate upward differences (e.g. urban locals and maintenance). However, this bias is likely to be consistent across categories and is not considered to be very substantial[1]. The results contained in the Table are considered to be valid if accepted in terms of "order of magnitude accuracy" for the individual categories.

The comparison reveals a difference between actual road expenditure and warrant of 15 per cent. Within that, expenditure on the construction categories was 28 per cent less than warranted, while maintenance was 51 per cent greater than previously estimated as warranted.

Within the construction categories the only category to be above the economic warrant (by 139 per cent) was urban local roads. This has to be read against the knowledge that no satisfactory evaluation procedures have been developed for this category and that the CBR's original estimate of warrant was itself developed from a combination of projections of actual expenditures and some analyses of warrant derived from rural local roads in rural towns. Nevertheless, even allowing for this, it seems possible that there has been overinvestment in this particular category. This appears to be borne out by some of the findings of a study of urban residential streets commissioned by the CBR, which concluded that many local government authorities adhere to quite high standards of design and construction of urban residential streets (e.g. road widths, drainage and pavement strengths) possibly in excess of those that likely usage would indicate.

Of the other construction categories expenditure on arterial roads was substantially less than the warranted amount (48 per cent and 56 per cent for rural and urban arterials, respectively) compared

(1) For example, for construction overall the ratio of actual to warranted expenditure should be .70 rather than .72 (derived from Table 6.16).

with expenditure or national highways which was 38 per cent less. Expenditures on rural local roads, were 4 per cent overall less than the warranted amount, while the MITERS category was 71 per cent less than warranted.

Comparisons of actual expenditure with the recommended program reverse this result overall; total expenditure exceeding that recommended by 4 per cent. However total construction expenditure fell short of the recommended level by 5 per cent. Within this total the pattern exhibited with respect of the warranted program tended to be repeated; with expenditure on local roads exceeding, and that on arterial roads falling short of, the recommended level of expenditure.

These variations apply at the total program level. At the State and Territory level there were significant individual variations to the general pattern described above. These are illustrated in Tables 6.17 and 6.18. Table 6.17 examines the variability from warranted and recommended expenditure by State and Territory.

There is quite a large variation in the proportion of warranted road expenditures achieved in the different States and Territories.

Particularly marked is the gap between actual and economically warranted expenditure in the A.C.T. (168 per cent over economically warranted level).

The apparent "overrun" in the A.C.T. is predominantly due to the large component of total road expenditures in that Territory which is undertaken within the general scope of land development activities and which was not the subject of economic evaluations by CBR. Similar road expenditures are carried out by various agencies and private land development firms in the States, and likewise were not subjected to formal economic evaluation by CBR. But the proportion of such expenditures to total State road expenditure is quite small, and does not materially affect the comparative analysis, in the way it does in the A.C.T.

TABLE 6.17 - COMPARISON OF ACTUAL EXPENDITURES WITH ASSESSED ROAD NEEDS: TOTAL AUSTRALIA - 1974-75 TO 1978-79 BY STATE AND TERRITORY[a]

($ MILLION, 1971-72 PRICES)

State/ Territory	Total Warranted Needs (A)	Recommended Program (B)	Total Estimated Expenditure (C)	Variations under (over) $\frac{A-C}{A}$ %	Variations under (over) $\frac{B-C}{B}$ %
N.S.W.	2038	1643	1814	11	(10)
VIC.	1343	1187	1185	12	0
QLD	1198	790	793	34	0
S.A.	388	386	356	8	8
W.A.	503	410	447	11	(9)
TAS.	209	164	184	12	(12)
ALL STATES	5679	4580	4779	16	(4)
N.T.	119	119	73	39	39
A.C.T.	31	31	83	(168)	(168)
TOTAL AUSTRALIA	5829	4730	4935	15	(4)

(a) See footnotes Table 6.16.

TABLE 6.18 - SELECTED SIGNIFICANT VARIATIONS FROM NATIONAL PATTERNS: BY CONSTRUCTION CATEGORY - ACTUAL AND WARRANTED ROAD EXPENDITURES 1974-75 TO 1978-79[a]

Category	National Average Actual Under (Over) Warranted %	Selected Variations by State/Territory Under	 %	 (Over)	 %	Comments
National Highways	38			S.A. A.C.T.	(26) (2224)	Only 2 States/Territories greater than warranted
Rural Arterials	48	VIC.	9	W.A.	(14)	WA is the only State greater than warranted
Rural Locals	4	QLD S.A.	36 37	N.S.W. VIC. W.A. TAS.	(25) (25) (21) (5)	3 States well above 2 States well below warranted
Urban Arterials	56			A.C.T.	(239)	All States and Territories except A.C.T. well below warranted
Urban Locals	(139)			S.A. A.C.T.	(349) (1545)	All regions well above warranted

(a) Based on 1971-72 prices.

NOTES: (1) Northern Territory has been excluded from this listing for convenience, as expenditures on all categories in that Territory have been appreciably under warranted levels.
(2) MITERS was significantly under warranted levels in all States.
(3) Planning & Research expenditures were also well under in all States, except in South Australia where it was 37 per cent greater than the warranted level.

In the case of Queensland, the reason for the comparatively large "underrun" of actual compared with warranted expenditure was attributable largely to the relatively low expenditure on rural local roads compared to warrant. Table 6.18 shows that Queensland along with South Australia, were the only States where estimated expenditure on rural local roads was less than the warranted amount (all other States exceeded warranted expenditure for this category). The low levels of expenditure compared to warrant in the rural local road category in South Australia is counter-balanced by higher national highway expenditure which was in proportion to warrant, the highest of all the States. The result is that overall expenditure levels in South Australia were only 8 per cent below the warranted amount for the period.

From Table 6.17, on a State and Territory basis, expenditures over the period in question were less than the recommended levels for Victoria ($2 million), South Australia ($30 million) and the Northern Territory ($46 million), whereas they were greater in New South Wales ($171 million), Queensland ($3 million), Western Australia ($37 million), Tasmania ($20 million) and the A.C.T. ($52 million)(1).

The salient points to emerge from Table 6.18 are that:

(a) national highways achievement was less than warranted except in South Australia and A.C.T.;

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(1) In 1978-79 prices total estimated expenditure for the period 1974-75 to 1978-79 was $1859 million less than the 1973 warranted program, but $426 million greater than the recommended program. On a State and Territory basis expenditure in Victoria was estimated to have been $4.2 million less than that State's recommended program for the same period, with expenditure $62.4 million less in South Australia, $95.6 less in the Northern Territory, $6.2 million greater in Queensland, $52 million less in Queensland, $355.5 million greater in N.S.W., $76.9 million greater in Western Australia, $41.6 million greater in Tasmania and $108.1 million greater in the A.C.T..

(b) in only one State (Western Australia) was expenditure on rural arterials greater than warranted;.

(c) rural local roads, as a category, came closest to equalling warranted expenditures, but at the State level there were some marked disparities; with

  (i) expenditures in Queensland and South Australia much less than warranted; and

  (ii) expenditures in the other four States greater than warranted;

(d) urban arterial and expenditure in all regions was significantly below warranted levels except in the A.C.T.; and

(e) urban local road expenditure was significantly above warranted levels in all regions.

It may be concluded from these analyses that allocation of resources to roads in the period 1974-75 to 1978-79 was significantly less than that indicated as warranted by economic analysis (constrained only by benefits being at least equal to costs at a 10 per cent discount rate). In particular, these differences when assessed by criteria of expenditure level and distribution by State and category, appeared to favour the local road system at the expense of the arterial and national road network and maintenance at the expense of construction. It may well be that the higher than estimated expenditure on maintenance was related to lower than warranted expenditures on construction.

The recommended program as developed by the CBR by the application of non-economic constraints, was, in fact exceeded by estimated expenditure. This was particularly marked in New South Wales and in an overall sense reflects heavy expenditure on maintenance and rather less than recommended levels on construction.

Estimated Expenditure Compared to Economically Efficient Allocations of Road Expenditures - 1974-75 to 1978-79 (The Constrained Budget Approach)

As discussed earlier in this Chapter cost-benefit analysis is considerably more reliable in assessing the appropriate allocation of resources within a sector than in establishing desirable sectoral budgets. The following analysis takes total road expenditures for 1974-75 to 1978-79 as constituting a road sectoral budget for the period. The analysis provides a comparison between actual expenditure patterns, by categories and location, with those assessed as economically efficient.

The scope of this analysis excludes the Commonwealth Territories and covers the major construction categories of national highways, rural and urban arterial and rural local roads.

The reason for this is that the four categories listed above have been subjected to formal cost-benefit analysis procedures over the past decade and profiles of benefit-cost ratios, over expenditure levels, can be estimated for them.

To explain the technique by which an economically efficient distribution of a given road budget is developed, it is first necessary to briefly explain the relationship between warranted road funds and benefit-cost ratios. At a discount rate of 10 per cent, the last project economically warranted for each category has a benefit-cost ratio of one. It is the sum of the cost of this project and all those with higher benefit-cost ratios which constitutes the warranted construction program in the CBR's roads reports and in Chapter 5 of this report. At lower budget levels, lower than the warranted program, the amount of economically warranted expenditure relates to a higher cut-off benefit-cost ratio.

In other words there is an inverse relationship between the total roads budget and the benefit-cost ratio of the least worthwhile project just warranted in a given program.

Relationships between expenditure and benefit-cost ratio have been developed from previous cost-benefit analyses undertaken by the CBR over the past decade and it is possible to use these relationships to derive economically efficient distributions of expenditure by category and State for given budget levels.

The method adopted in this analysis is to adjust the distribution of warranted expenditures by category and State, until the marginal benefit-cost ratios of road expenditure in each sub-category are equal, and total expenditure for all categories is equal to the road budget for the period.

The data used in this analysis comprise the actual expenditures from 1974-75 to 1978-79 and the evaluation results reported in the CBR's 1975 roads report for the period June 1974 to June 1981.

This is considered appropriate since:

- the profiles for these evaluations do not differ significantly from relationships developed in earlier evaluations by CBR;
- most deficiencies (over 99 per cent for national highways and 75 per cent for rural arterials) occur in the early years of the evaluation period; and
- projects not undertaken but deferred will become more warranted in all cases, as traffic is growing in all categories analysed.

Estimated construction expenditures and the economically efficient allocation of the construction budget for selected categories are compared in Table 6.19. Constant 1971-72 prices are used to facilitate comparison with the earlier analysis in this Chapter. In this analysis, general administration has been eliminated from the estimates of actual expenditure by an allowance of 4 per cent, so that the comparisons are between estimates of actual and economically efficient construction expenditures.

TABLE 6.19 - ACTUAL AND ECONOMICALLY EFFICIENT ROAD EXPENDITURES 1974-75 TO 1978-79 : SELECTED CONSTRUCTION CATEGORIES BY STATE[(a)] ($ MILLION, 1971-72 PRICES)

Category	Actual Basis	State N.S.W.	VIC.	QLD	S.A.	W.A.	TAS.	Total States
National[(b)] Highways	Actual	123	62	66	57	32	19	359
	Efficient	192	107	179	43	50	8	579
	Diff. $	69	45	113	(14)	18	(11)	220
	per cent	36	42	64	(33)	36	(138)	38
Rural Arterials	Actual	178	78	115	24	57	20	472
	Efficient	164	55	225	32	57	7	540
	Diff. $	(14)	(23)	110	8	-	(13)	68
	per cent	(9)	(42)	49	25	-	(186)	13
Rural Locals	Actual	255	141	158	31	81	34	700
	Efficient	96	44	142	26	49	1	358
	Diff. $	(159)	(97)	(16)	(5)	(32)	(33)	(342)
	per cent	(166)	(220)	(11)	(19)	(65)	(3300)	(96)
Urban Arterials	Actual	196	208	71	35	65	20	595
	Efficient	277	209	77	19	62	4	648
	Diff. $	81	1	6	(16)	(3)	(16)	53
	per cent	29	0	8	(84)	(5)	(400)	8
Total	Actual	751	490	410	147	234	93	2125
	Efficient	729	415	623	120	218	20	2125
	Diff. $	(22)	(75)	213	(27)	(16)	(73)	
	per cent	(3)	(18)	34	(23)	(7)	(365)	-

(a) Excludes general administration expenses of 4 per cent, from estimates of expenditure, a 4 per cent reduction was used as this was the allowance made by the CBR in reaching its warranted program.

(b) Excludes Commerce roads,

NOTE: All data and percentages rounded to nearest whole number; totals may not tally due to rounding. Differences in $ million and in percentages shown, represent under (over) economically efficient.

Analysis of Results

When judged by economic criteria, there appears to have been misallocation in road expenditures both between States and between categories.

(a) Between States: More of the total roads budget from all sources appears to have been spent in New South Wales, South Australia, Victoria, Western Australia and Tasmania than would have been spent on the basis of economic efficiency criteria. Expenditure in Queensland was two thirds of the efficient allocation with under allocations in all categories other than rural local roads.

(b) Between Categories: Expenditure on rural local roads was double that indicated by the calculated economically efficient allocation with expenditure on the other categories at levels less than efficient allocation. National highway expenditure exhibited the greatest proportionate gap below efficient levels.

(c) Categories by State

   (i) National Highways: Expenditure in South Australia and Tasmania was in excess of the efficient level and in all other States less: expenditure in Queensland being one third of the efficient allocation for this category.

   (ii) Rural Arterials: Expenditure in Queensland exhibited the largest misallocation with expenditure half the efficient allocation. Expenditure in South Australia was less than the efficient allocation, expenditure in Western Australia at the efficient allocation level with expenditure in the other States at levels greater than those indicated as an economically efficient allocation.

(iii) Rural Locals: Expenditure in all States was above the efficient allocation, but relatively speaking, expenditure in Queensland was lowest.

(iv) Urban Arterials: Expenditure in Victoria, Queensland and Western Australia approximated efficient levels. Expenditure in South Australia and Tasmania exceeded efficient allocation levels and in New South Wales fell considerably short of efficient allocations.

The above analysis is limited as it only considers selected construction expenditures. Ideally all possible "trade-offs", should be assessed; for example, maintenance versus construction.

Furthermore it should be noted that urban locals are not included in this analysis; as explained earlier, no satisfactory formal evaluation procedures have been developed for this category so that a warranted program and associated profiles of benefit-cost ratio expenditure levels were not available. However, on limited first hand Bureau knowledge it would appear that expenditures do appear to exceed "warranted" levels: (if this category had been formally included in this analysis, it is likely the actual expenditures would have exceeded efficient levels).

The Territories have also been omitted from this analysis as they involve some elements of difference in the type of road expenditures and their evaluation compared with the States.

Comparison of the Unconstrained and Constrained Budget analyses

It will be noted that the constrained budget pattern of over or under efficient allocation by State and category differs somewhat from the earlier analysis (unconstrained case) which compared actual expenditures with the economically warranted road budget.

The main differences by State and category are:

(a) State

In the unconstrained budget case, expenditure in all States were below warranted expenditure although only South Australia and the Northern Territory fell short of the recommended program. In the constrained case total expenditure in Queensland was lower than the economically efficient level.

(b) Category

(i) National highways: In the unconstrained case, actual expenditure in South Australia exceeded the economic warrant; in the constrained case, actual expenditures in both South Australia and Tasmania exceeded the efficient level for this category.

(ii) Rural arterials: In the unconstrained case, total actual expenditures in Western Australia exceeded the warranted level in the constrained situation, actual expenditures in New South Wales, Victoria and Tasmania exceeded the efficient level.

(iii) Rural locals: In the unconstrained case expenditures in Queensland and South Australia were under the warranted level; in the constrained case, expenditures in all States exceeded efficient levels of spending.

(iv) Urban arterials: In the unconstrained case, no State exceeded economic warranted levels in this category but in the constrained case expenditure in South Australia, Western Australia and Tasmania exceeded efficient levels.

The reason for the differences in patterns of warranted contrained expenditures lies in the different relationships between expenditure levels and benefit-cost ratios for each category and State.

For example, in New South Wales, at a cut off benefit-cost ratio of 1.2 there is a higher proportion of urban arterial expenditure warranted than for rural arterials. As the total road budget diminishes, and the cut-off marginal benefit-cost ratio increases the converse applies - i.e., a higher proportion of rural arterial expenditure is warranted compared with urban arterials. This indicates that more potential urban arterial projects have benefit-cost ratios in the lower ranges of acceptability than do potential rural arterial road projects.

Figure 6.6 depicts the relationship between the CBR's 1973 warranted program, the economically efficient (constrained case) program and actual expenditures from 1974-75 to 1978-79 for the major construction categories. Although urban local roads are included the economically efficient allocation is based on the other four categories only.

A major conclusion of the above analyses is that when considering the economically efficient allocation of resources within the roads sector using economic criteria there is no one unique distribution of expenditures across State and category which can be adopted in constant proportion terms despite variation in road budgets. That is, for each expected or intended total road budget, the proposed distribution of expenditures across categories and States or Territories should be assessed for economic efficiency.

Development of methods of analysis that will allow assessment of given road budgets to determine efficient allocation is at present under consideration by the BTE. Both budget constrained but otherwise "free" situations, as well as those constrained by policy considerations, need to be addressed. An example of the latter case might be a stated desire to ensure no single category in any State receives less funds in money and/or in real purchasing terms, than in the previous year. It might also be necessary to make a distinction between the criteria which should be applied to investment in arterial roads and those which are appropriate for access or local roads.

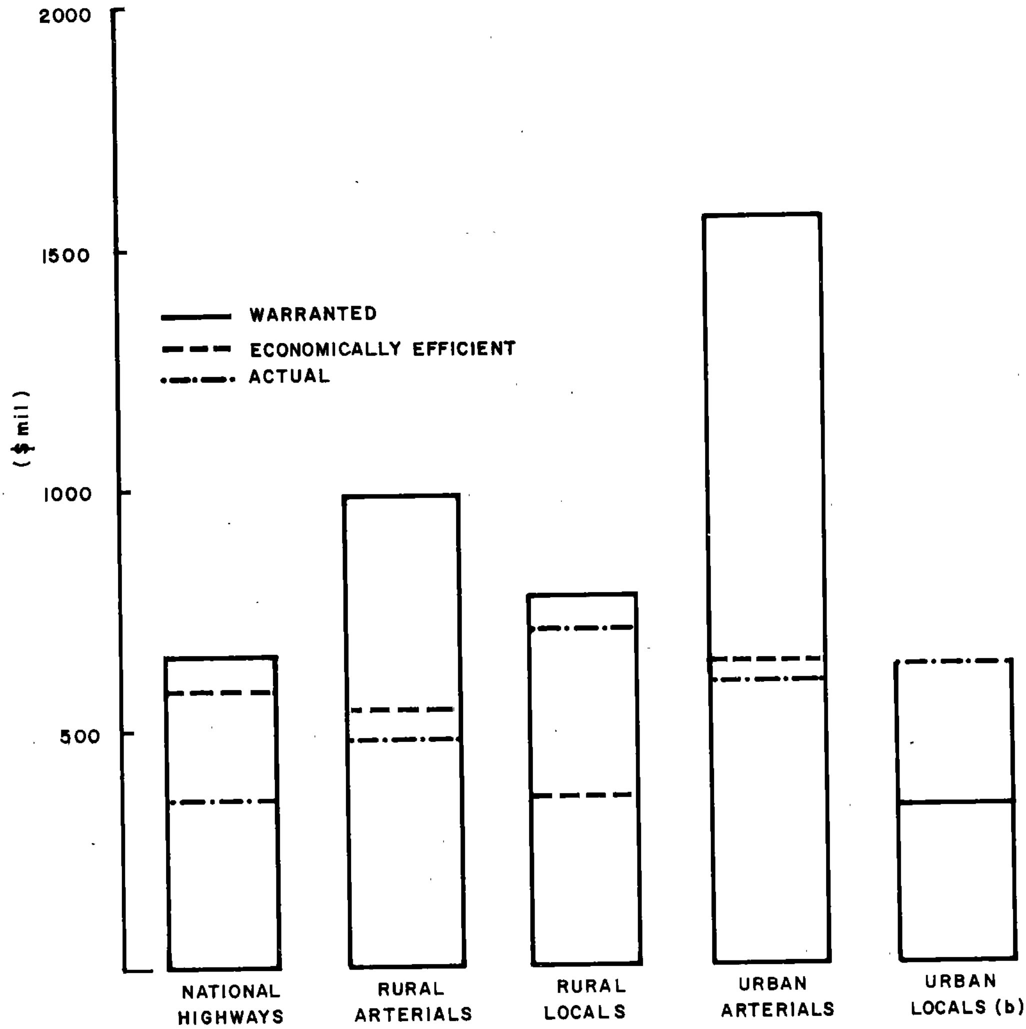

FIGURE 6·6

WARRANTED, ACTUAL AND ECONOMICALLY EFFICIENT EXPENDITURES : 1974–75 TO 1978–79 : BY CATEGORY (a) (1971–72 PRICES)

(a) Construction in States only ; excludes general administration

(b) No constrained economically efficient data

SOURCE :– Table 6·16, 6·19, Table 51 – Annex 3

CONCLUSIONS

Past Patterns of Road Resource Allocation

On the basis of the road expenditure evaluations reported by the CBR in 1973 and 1975, the allocation of resources to roads over the period 1974-75 to 1978-79 was sub-optimal in economic terms, whether judged by the criterion of an unconstrained economically warranted road budget, or in terms of an efficient allocation of the total road expenditures which actually did eventuate for the period. Nevertheless, in total the allocation of resources to roads over this period did exceed the level recommended by the CBR in 1973.

In terms of warranted road needs at a discount rate of 10 per cent for the period 1974-75 to 1978-79, there was:

(a) under expenditure on roads in all States; especially in Queensland;

(b) under expenditure in all States on urban arterials; on national highways except in South Australia; and on rural arterials except in Western Australia; and

(c) over expenditure in all States on rural local roads except in Queensland and South Australia; and on urban locals.

In terms of a comparison between an economically efficient allocation of road expenditures and that which actually occurred in the five years 1974-75 to 1978-79, there was:

(a) under expenditure in Queensland.

(b) under expenditure on national highways in all States, except in South Australia and Tasmania;

(c) under expenditure on rural arterials in Queensland and South Australia, and on urban arterials in New South Wales and Queensland; and

(d) over expenditure on rural local roads in all States.

CHAPTER 7 - EFFECTS OF ALTERNATIVE LEVELS OF FUTURE ROAD FUNDING

THE PROGRAMS

In this Chapter the economic effects of different levels of total road expenditure are assessed. Five alternatives are considered. The first is the warranted program as derived in Chapter 5. In addition, four alternative programs involving lower expenditure are developed (as proportions of the warranted program) and the effect of the reduced expenditure levels considered. The five levels of expenditure and the assumed growth profiles[1] of these expenditures are as set out in Table 7.1.

TABLE 7.1 - ALTERNATIVE TOTAL ROAD EXPENDITURE PROFILES
($ MILLION: 1976-77 PRICES)

Year ended 30 June	Proportion of Warranted Program				
	100%	95%	90%	85%	80%
1980	1933	1933	1933	1933	1933
1981	2244	2177	2105	2030	1952
1982	2605	2451	2292	2131	1972
1983	3025	2760	2496	2238	1992
Total 1979-80 to 1982-83	9807	9321	8826	8336	7849
1984	3511	3108	2719	2350	2011
Average Annual Growth Rate 1979-80 to 1982-83	16.1%	12.6%	8.9%	5.0%	1.0%

ECONOMIC IMPACT ACROSS STATE/TERRITORIES AND ROAD CATEGORIES

In this section assessments are made of the economically efficient allocation of the five alternative levels of total expenditure and of the effects on construction costs resulting from their adoption.

(1) The growth profiles for each level of total expenditure is established by applying an appropriate uniform annual growth rate to the estimate of expenditure in 1979-80 (i.e., $1933 million).

Differences in benefits to road users and in construction costs between the alternative program levels are also considered.

The five alternative levels of total road funding are set out in Table 7.1. These programs relate to total road finance in constant prices and have to be allocated between States and Territories and also between road categories. Although in theory there is one allocation of these budgets which will produce the greatest economic benefits for the Australian community as a whole, in practice there are measurement problems associated with determining that allocation. However, the Bureau has, at least for road construction needs for categories other than urban local roads and MITERS, carried out cost-benefit analyses which can assist in this task. For the other categories of expenditure, judgement and experience remain, in practice, the main bases for determining the appropriate allocation of fixed budgets.

In keeping with its role of an independent professional research organisation the Bureau has not made such implicit value judgements. Rather, a set of explicit assumptions about future expenditure levels, in categories for which cost-benefit results are not available, have been made for the purposes of this section. These assumptions make it possible to arrive at a residual budget for the categories to which cost-benefit analysis may then be applied. This enables the derivation of budget-constrained efficient levels of expenditure for the construction of national highways, rural arterial, urban arterial and rural local roads.

The assumptions adopted (based primarily on past trends) are that:

- general administration comprises 8 per cent of the total program;
- planning and research comprises 1 per cent of the total program;
- maintenance remains constant regardless of budget size at levels determined by projection of the expenditure patterns observed over recent years(1); and

(1) This is the same approach that was adopted in determining the warranted program reported in Chapter 5.

- urban locals and MITERS represent a constant share of the construction budget, with that share determined by the warranted program reported in Chapter 5[1].

Given this set of assumptions, the five road funding programs given in Table 7.1 can be assigned allocations as shown in Table 7.2. It is to be emphasised that these budget allocations are not intended to be prescriptive, but rather are applied as a means of reducing the total warranted program to a set of budget constraints applicable to the four categories of roads subject to review by cost-benefit analysis.

The funds available for construction of roads other than urban locals and MITERS are then allocated amongst States and Territories and road categories. This is done using the cost-benefit analyses undertaken to develop the warranted program of roads expenditure for 1979-80 to 1982-83. This approach enables the examination of the economic impact upon the fund allocations between both categories and the States and Territories of varying the budget available for the evaluated categories. Since this approach results in an economically efficient allocation of a given budget any other allocation would result in a loss of economic welfare and hence could be viewed, in these terms, as being less desirable[2].

As indicated above, prior to the assessment of the economic impact of the construction expenditure, those components of the program which do not have a previously determined cost-benefit relationship were removed.

The outcome of applying the economic assessment technique for each of the construction budgets given in Table 7.2 is provided in tabulated form in Table 7.3. The benefits expected to flow from these budget allocations are given by benefit type in Table 7.4.

(1) In earlier discussion it was indicated that past levels of expenditure on urban locals may have been higher than is consistent with an economically efficient allocation of resources.

(2) A more detailed discussion of the approach was given in Chapter 6.

TABLE 7.2 - ALTERNATIVE TOTAL ROAD EXPENDITURE PROFILES BY CATEGORY: 1979-80 TO 1982-83

($ MILLION: 1976-77 PRICES)

Category of expenditure	Proportion of Warranted Program				
	100%	95%	90%	85%	80%
General administration[a]	785	746	706	667	628
Planning and Research[b]	98	93	88	83	78
Maintenance[c]	2792	2792	2792	2792	2792
Construction					
- urban local roads[d]	264	245	225	206	187
- MITERS[d]	276	256	236	216	196
- other roads	5592	5189	4779	4372	3965
Total Budget	9807	9321	8826	8336	7849

(a) 8 per cent of total budget.
(b) 1 per cent of total budget
(c) Projected maintenance as in warranted program.
(d) Urban local roads and MITERS are assumed to comprise the same proportion of total construction as in the warranted program.

TABLE 7.3 - ECONOMICALLY EFFICIENT ALLOCATION OF ROAD CONSTRUCTION[a]

(percent)

State/Territory and Category	Estimated Expenditure 1977-78 and 1978-79	Proportion of Warranted Program - 1979-80 to 1982-83				
		100%	95%	90%	85%	80%
National Highways						
N.S.W.	4.6	5.3	5.5	5.6	5.7	5.9
VIC.	2.0	2.2	2.4	2.5	2.7	2.9
QLD	2.3	3.0	3.3	3.6	3.9	4.3
S.A.	1.6	0.8	0.8	0.7	0.6	0.5
W.A.	1.3	1.3	1.3	1.3	1.2	1.2
TAS.	0.6	0.3	0.3	0.3	0.2	0.1
N.T.	0.7	0.8	0.7	0.7	0.6	0.6
A.C.T.	0.2	0.1	0.1	0.1	0.1	0.1
TOTAL[b]	13.3	13.9	14.5	14.8	15.2	15.6
Rural Arterials						
N.S.W.	7.1	15.4	15.5	15.5	15.8	16.0
VIC.	2.6	4.7	4.8	4.9	5.1	5.2
QLD	3.8	8.4	8.4	8.7	9.0	9.4
S.A.	1.1	3.3	3.2	3.1	3.1	3.0
W.A.	1.9	2.0	2.1	2.2	2.3	2.5
TAS.	0.8	0.7	0.7	0.7	0.7	0.7
N.T.	0	0.3	0.3	0.3	0.3	0.3
TOTAL[b]	17.3	34.7	35.0	35.6	36.4	37.2
Rural Locals						
N.S.W.	8.6	3.2	2.9	2.6	2.1	1.6
VIC.	4.9	1.2	0.9	0.5	0	0
QLD	5.1	7.2	6.9	6.7	6.4	6.1
S.A.	1.1	1.1	1.1	1.0	1.1	1.0
W.A.	2.4	1.1	1.0	1.0	0.9	0.8
TAS.	1.1	0	0	0	0	0
N.T.	0.1	0.4	0.4	0.4	0.3	0.3
TOTAL[b]	23.3	14.2	13.2	12.2	10.9	9.8
Urban Arterials						
N.S.W.	6.1	9.7	10.1	10.4	10.7	11.1
VIC.	7.2	8.8	8.4	8.3	8.1	7.9
QLD	2.6	2.8	2.6	2.8	3.0	3.3
S.A.	1.1	2.3	2.3	2.1	1.9	1.5
W.A.	2.1	4.0	4.2	4.2	4.2	4.3
TAS.	0.6	0.7	0.7	0.6	0.6	0.5
N.T.	0.1	0	0	0	0	0
A.C.T.	1.6	0.1	0.1	0.1	0.1	0.1
TOTAL[b]	21.5	28.5	28.5	28.6	28.7	28.7
TOTAL[b]	(75.4)	(91.2)	(91.2)	(91.2)	(91.2)	(91.2)

(a) Proportions of total construction expenditure including all road categories and MITERS.
(b) Totals may not add exactly due to rounding.

TABLE 7.4 - COSTS AND BENEFITS OF ALTERNATIVE ROAD CONSTRUCTION BUDGETS: 1979-80 TO 1982-83[a]

$ Millions

Item	Proportion of Warranted Program				
	100%	95%	90%	85%	80%
Construction expenditure					
- actual	5592	5189	4779	4372	3965
- discounted[b]	4592	4262	3925	3591	3256
Monetary benefits					
- savings in					
: vehicle operating costs	4856	4713	4549	4389	4172
: accident costs	1377	1344	1307	1272	1218
: occupant travel time					
. private	1127	1101	1069	982	996
. commercial	5134	5014	4873	4740	4539
: road maintenance	-97	-101	-102	-104	-104
Total direct benefits	12397	12071	11696	11279	10821
Indirect benefits[c]	2107	2029	1910	1852	1703
Total benefits	14504	14100	13636	13131	12564
Ratio of total discounted benefits to total discounted construction expenditure	3.16	3.31	3.47	3.66	3.86

(a) Excludes construction for urban locals and MITERS.
(b) Discounted to 1976-77 present value at 10 per cent.
(c) Includes reduction in dust, delays and losses in production, and benefits attributable to number of trips generated by improved roads.

The general effect of reducing the size of the construction budget (from the warranted level) is to increase the share of warranted allocation to rural arterials and national highways at the expense of rural local roads. This relationship is illustrated graphically in Figure 7.1.

The analysis presented in Table 7.3 also suggests, inter alia, that a reduction in rural local road funding when compared with recent funding patterns would increase economic efficiency (in the benefit and cost terms used here). On this basis the reduction required would be proportionately more (than the reduction in the other categories) the smaller the overall budget available. For example, the analysis shows that New South Wales, Victoria, Western Australia and Tasmania rural local roads would receive less construction funding than they have received in the past.

It is, of course, unlikely that economic efficiency considerations based largely on traffic flows are the major determinant of decisions leading to investment in local or access roads.

Therefore it may be considered that the economic analysis employed in this study is an inappropriate or inadequate means of measuring the merit of future local road expenditure levels. The evaluation approach used compared the net benefits associated with upgrading roads from their existing state. The standard of upgrading depends upon the traffic volume on a given section of road. The benefits included in the evaluation are as follows:

(a) vehicle operating cost savings;
(b) travel time savings;
(c) accident cost reduction;
(d) benefits due to reduction in period of road closure in terms of reduction in time delays, education cost, and milk production foregone;
(e) benefits in terms of increased comfort and avoided production losses due to reduction in road dust and road roughness;

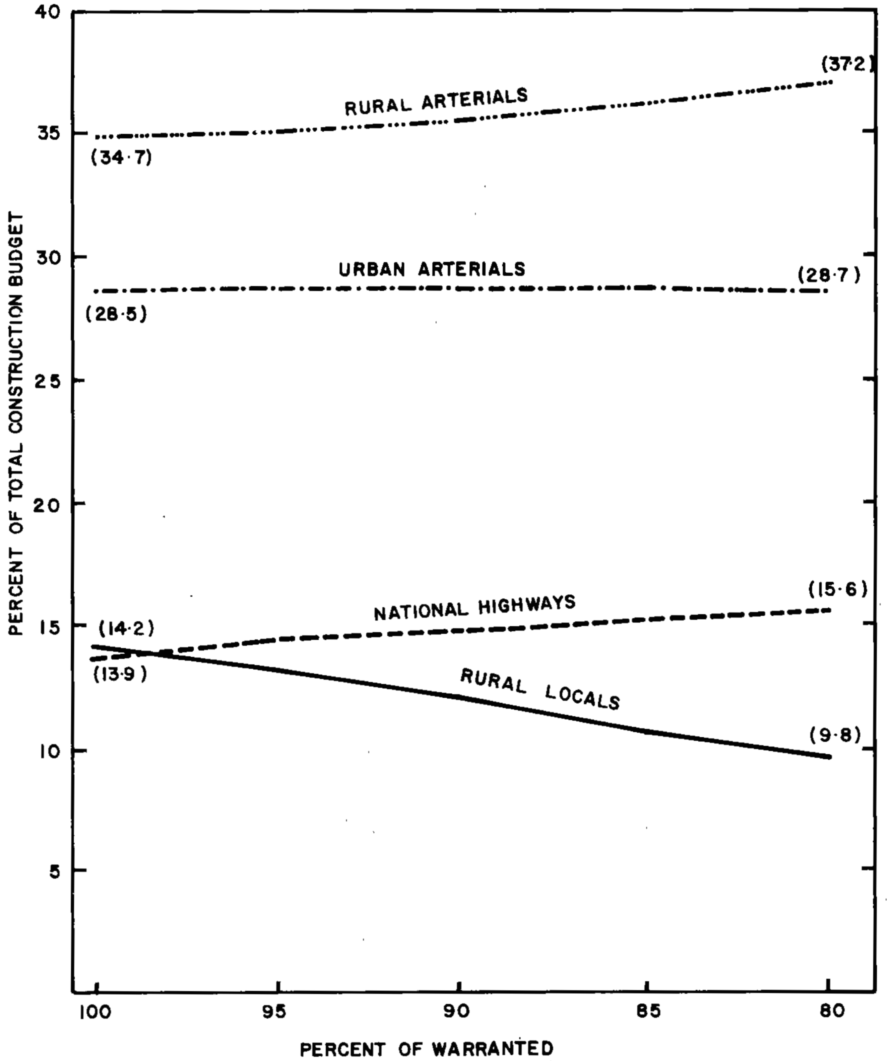

FIGURE 7·1

ECONOMICALLY EFFICIENT ALLOCATIONS OF WARRANTED PROGRAM 1979-80 TO 1982-83

(f) benefits to generated traffic; and

(g) reduced road maintenance cost.

It may be argued that this approach is inadequate because it does not quantify other benefits which impinge on the social well-being of the rural population[1]. For example, regional development objectives and social interaction may be furthered by improved accessibility at a local level. Further, road funds provide local employment which has significant flow-on benefits within local communities and regions. Finally, in the context of transferability of resources between road categories it is important to note that between 1974-75 and 1978-79 about 60 per cent of rural local road expenditure was funded by local authorities themselves.

Nevertheless the analysis does demonstrate that the economic return to investment in arterial roads increases relative to investment in local roads as the budget constraint is tightened.

Table 7.5 and Figure 7.2 present the results of a similar analysis which was carried out for the three arterial road categories excluding rural local roads. The results indicate that efficient allocations (in terms of relative shares) of a constrained arterial road budget between the three categories are not particularly sensitive to the level of that budget.

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(1) In addition, different parameter values (for example, for the value of travel time) may apply to base road usage.

TABLE 7.5 - ECONOMICALLY EFFICIENT ALLOCATION OF ROAD CONSTRUCTION BUDGETS[a]

(percent)

State/Territory and Category	Estimated Expenditure 1977-78 and 1978-79	Proportion of Warranted Program - 1979-80 to 1982-83				
		100%	95%	90%	85%	80%
National Highways						
N.S.W.	8.8	6.8	7.0	7.1	7.1	7.2
VIC.	3.8	2.8	3.1	3.2	3.4	3.7
QLD	4.4	3.8	4.2	4.5	4.9	5.4
S.A.	3.1	1.0	1.1	0.9	0.8	0.5
W.A.	2.5	1.6	1.7	1.6	1.5	1.4
TAS.	1.2	0.5	0.4	0.3	0.2	0.1
N.T.	1.3	1.0	1.0	0.9	0.8	0.7
A.C.T.	0.4	0.1	0.1	0.1	0.1	0.1
TOTAL	25.5	17.6	18.6	18.6	18.6	19.1
Rural Arterials						
N.S.W.	13.6	20.0	19.8	19.8	19.7	19.7
VIC.	5.0	6.1	6.1	6.2	6.3	6.5
QLD	7.3	10.9	10.8	11.0	11.3	11.6
S.A.	2.1	4.4	4.1	4.0	3.8	3.7
W.A.	3.6	2.6	2.7	2.8	2.9	3.1
TAS.	1.5	0.9	0.9	0.9	0.9	0.9
N.T.	0	0.3	0.4	0.4	0.4	0.4
TOTAL	33.1	45.2	44.8	45.1	45.3	45.9
Urban Arterials						
N.S.W.	11.7	12.4	13.0	13.2	13.4	13.7
VIC.	13.8	11.6	10.8	10.5	10.1	9.6
QLD	5.0	3.8	3.4	3.5	3.8	4.1
S.A.	2.1	3.0	3.1	2.7	2.3	1.7
W.A.	4.0	5.2	5.4	5.3	5.3	5.2
TAS.	1.2	0.9	0.8	0.8	0.7	0.6
N.T.	0.2	0	0	0	0	0
A.C.T.	3.1	0.1	0.1	0.1	0.1	0.1
TOTAL	41.1	37.0	36.6	36.1	35.7	35.0
TOTAL[a]	100	100	100	100	100	100

(a) Excludes rural and urban local roads and MITERS.

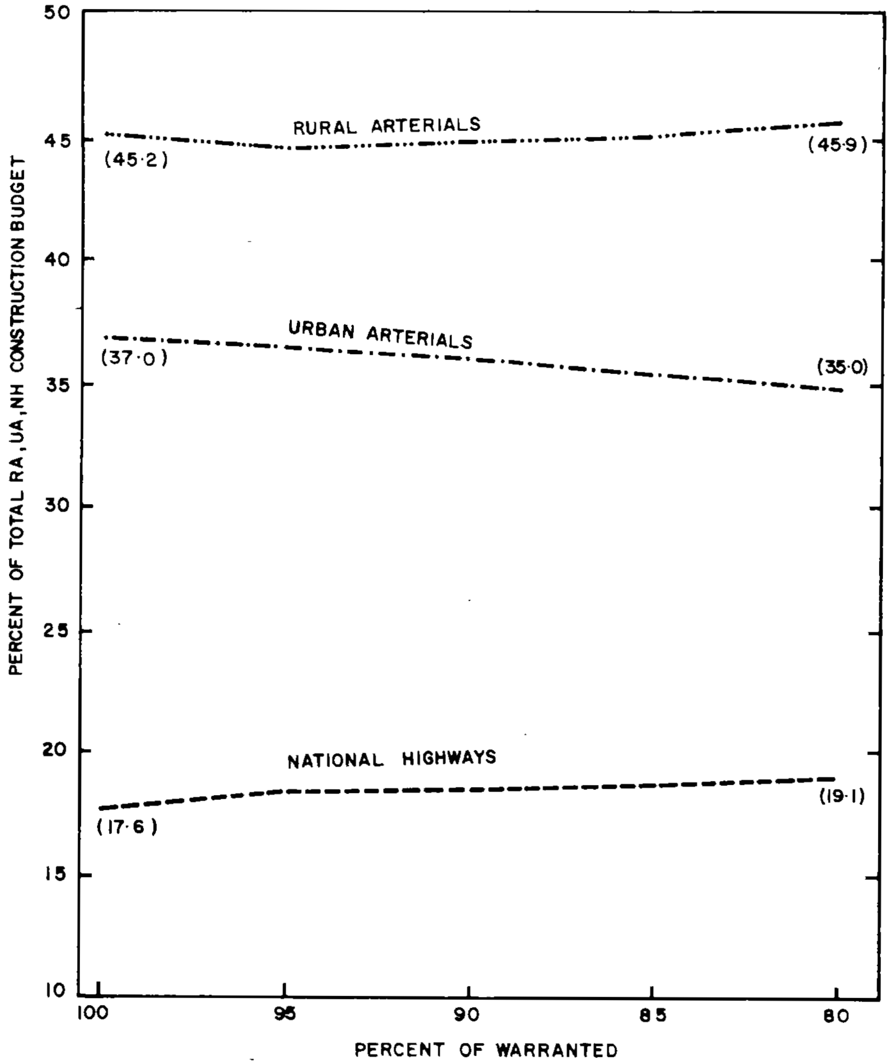

FIGURE 7·2
ECONOMICALLY EFFICIENT ALLOCATIONS OF WARRANTED RURAL ARTERIAL, URBAN ARTERIAL, NATIONAL HIGHWAY PROGRAM 1979-80 TO 1982-83

INTER-SECTORAL ECONOMIC IMPACT

In this section the implications of adopting alternative programs of road expenditure over the period 1979-80 to 1982-83 are assessed for their impact on:

- the output of industries supplying either directly or indirectly goods and services to the road construction industry; and
- the level of direct employment in the road construction industries and the industries supplying it.

Estimates of these impacts are developed by means of the Bureau's resource allocation model. This model is a combination of two separate models - an aggregate medium term forecasting model and a disaggregated demand model into which forecasts are incorporated.

The aggregate medium term forecasting model was developed by Haig and a detailed description is given in BTE Occasional Paper 14[1]. This model is based on the work of Clark, Kuznets and Fuchs[2] where the relationship between industry structure and real income per capita is assumed to be due to the demand and supply characteristics of industries which induce changes in industrial structure and real per capita income. The demand and supply factors are brought together through input-output relationships which link the product of industry sectors to final expenditure on the output of industries. The output from this model provides the forecasts which are used in the second model.

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(1) Haig B.D., A Model for Medium Term Economic Forecasting - Projections of Australian Income and Expenditure, Bureau of Transport Economics Occasional Paper 14, AGPS, Canberra, 1978.

(2) Clark, C., The Conditions of Economic Progress, 1st Edition, Macmillan and Company, London, 1940. Kunznets S., Quantitative Aspects of the Economic Growth Nations: II. Industrial Distribution of National Product and Labor F orce. Economic Development and Cultural Change V, 1957 Supplement. Fuchs V., The Growing Importance of the Service Industries, Occasional Paper 96, The National Bureau of Economic Research, New York, 1965.

The second model comprises an input-output analysis in which the Australian economy is disaggregated into fifty-eight industries. The forecast information of the first model provides the basis for final demand estimates for the input-output model which is used to determine the total requirements of each industry to meet the final demand forecasts. Forecasts of the various categories of final demand by the fifty-eight industry sectors are set out in Annex 4.

The output from these models, together with work done by the CBR(1), enabled the demand for labour to be forecast for the varying levels of final demand for the road construction industry. The results are briefly discussed later in this Chapter and set out in more detail in Annex 4.

Expenditure is defined according to the concepts and scope of the Australian national accounting input-output analyses of the ABS(2). The main differences between the Bureau's and Australian national accounting definitions of roads expenditure are that interest charges, transfer payments, administration costs of local governments, and road expenditures by authorities other than road authorities are excluded from the Australian national accounting estimates. In addition there are a number of relatively small items included in the scope of the Australian national accounting road expenditures (for example, expenditure on the Westgate Bridge) which are excluded from BTE estimates of road expenditure. On the basis of an analysis of the differences between the two estimates of road expenditure for 1975-76, a factor of 0.81 was used to convert the BTE estimates of road expenditures to Australian national accounting terms. A further adjustment (by a factor of 0.946) to the Australian national accounting expenditures was made to conform with the scope of the national accounting input-output expenditure. This adjustment was necessary because the Australian national accounting input-output road expenditure excludes capital

(1) Commonwealth Bureau of Roads, Resource Allocation Study, unpublished Staff Paper, Melbourne 1976.
(2) Australian Bureau of Statistics, Australian National Accounts: Input-Output Tables 1968-69, Commonwealth Government Printer, Canberra.

expenditure by road authorities on capital plant and equipment. This expenditure is part of the output of the producing plant and equipment industry and is a component of the final demand of this industry.

Road Construction Industry Requirements

The analysis provides an assessment of the direct and indirect requirements from supplying industries for each $100 of expenditure in the road construction industry. Direct requirements are defined as those commodities and services which are supplied by the producing industry directly to the road construction industry. Indirect requirements are those commodities and services which are supplied by industries to meet the requirements of industries supplying directly goods and services to the road construction industry.

The analysis has been conducted on the basis of average responses of industries to changes in activity levels rather than in terms of marginal changes. This approach is considered appropriate because the resource availability model is used to determine the medium to long-term effects of changes in demand for the output of various industries. However, the distinction between average and marginal changes does become significant in the context of the short-run.

The main industries supplying goods and services to the road construction industry are set out in Table 7.6. Full details of this Table are set out in Annex 4.

The quarry materials industry undertakes the extraction and processing of sand, gravel and crushed stone. It is the most important of the industries supplying to the road construction industry - $10.95 of quarry materials are directly required, and $11.52 directly and indirectly required, for each $100 of road construction. The quarry materials industry is characterised by a

TABLE 7.6 - DIRECT AND INDIRECT INDUSTRY REQUIREMENTS FOR EACH $100 OF EXPENDITURE BY THE ROAD CONSTRUCTION INDUSTRY - $

Industry	Direct	Indirect	Direct and Indirect
Quarry Materials	10.95	0.57	11.52
Petroleum Products (Aust Oil)	5.04	1.45	6.49
Petroleum Products (Imported Oil)	2.47	2.08	4.55
Ready-Mixed Concrete	1.68	0.04	1.72
Concrete Products	3.26	0.03	3.29
Metal Products	2.79	2.40	5.19
Road Transport	9.72	1.02	10.74

Source: CBR, *Resource Allocation Study*, *op.cit.*

large number of publically owned road making establishments - the output of which is used primarily in road works and can therefore be directly related to road construction activity.

For the purposes of this analysis the petroleum products industry has been divided into two (sub) industries - the petroleum products (Australian oils) industry which produces petroleum products derived from Australian crude oil, and the petroleum products (imported oils) industry which produces petroleum products derived from imported oils. The reason for this distinction is that Australian crude oils are not suitable for the production of bituminous products which are derived from the heavier imported oils.

The petroleum products (Australian oils) industry directly supplies petrol and diesel fuel for the road construction industry for the operation of construction equipment, etc. and indirectly fuel used by the road transport industry for the transport of goods for the road construction industry.

The petroleum products (imported oils) industry produces heavy oil derivatives such as bituminous products, as well as petrol and diesel fuel. The main user of bituminous products is the road construction industry. The direct requirements shown in Table 7.6 reflect the amount of bitumen used in road construction. The indirect requirements are petrol and diesel fuel which are distributed through the petroleum products (Australian oils) industry.

The output of the ready-mixed concrete industry is used in the construction of bridges, kerbing and a small number of roads; it is the general practice in Australia to build flexible pavements with bituminous surfaces.

The metal products industry produces steel for girder works, reinforcing rods, etc. The indirect requirements are due to steel used by supplying industries such as the concrete products industry in the production of reinforced blocks and pipes.

An important component of the costs of road construction is road transport, which arises from the need to transport goods used by the road construction industry to the construction site by road transport. The goods carried (such as quarry materials) are generally high volume/weight in relation to their value.

Road Construction Program Impacts on Industry Activity

There is interdependence either directly or indirectly between most industries in the economy. In assessing the impacts of various road programs on the supply of goods and services to the road construction industry it is necessary to analyse the demands of all industries in the economy.

Following the methodology set out above, final demands for the fifty-eight industries into which the Australian economy was divided (with the exception of the road construction industry and the other building and construction industry) are forecast for the years 1979-80 to 1982-83. The road construction industry's final demand is determined by the road program being analysed. Final demand for the other building and construction industry, which includes expenditure on building of offices, shops, schools hospitals, airports, dams, etc., is determined by the subtraction of the assumed road expenditure budget from the forecast of building and construction capital expenditure which was derived from the macro-forecasting model(1). It is assumed for this analysis the results obtained form the best estimates of what might occur over the period of investigation.

By applying the input-output model to the final demand data the total output for each of the industries is estimated for each of the years 1979-80 to 1982-83 for each of the alternative road programs set out in Table 7.1. Also from the model the direct and

(1) Note that the forecast level of demand for building and construction capital expenditure is fixed; consequently, the lower the share of road expenditure in the total, the higher the share of "other building and construction".

indirect requirements for each supplying industry for each year are estimated in terms of actual values in 1968-69 prices and as a percentage of total output of each of the industries for each of the years to 1982-83. Full details of the results of this analysis for the fifty-eight industries into which the Australian economy is divided is set out in Annex 4. A general observation of these results indicates that variations in road programs affect nearly every industry in the economy directly or indirectly.

The industries whose output is of most significance to the road construction industry is discussed in more detail below.

The Quarry Materials Industry

Details of the actual output both directly, and directly and indirectly used by the road construction industry for each of the road programs are set out in Table 7.7.

The output of the quarry materials industry is very much dependent on the road program since over 50 per cent of output of this industry is estimated to be used by the road construction industry. Because of the large proportion of road usage of the output of this industry the increase in total output of the quarry materials industry is similar to that of increases in the road construction programs.

The Petroleum Products (Australian Oil) Industry

Between 5 and 7 per cent of the total output of petroleum products produced by this industry is estimated to be used by the road construction industry. The results are the analysis are shown in Table 7.8.

The Petroleum Products (Imported Oil) Industry

The direct requirements of the total output of the petroleum products (imported oil) industry used by the road construction industry reflects the usage of bituminous products produced from the imported crude oils. The indirect requirements of the road construction industry is the usage of fuels derived from imported crude oil for the operation of road construction equipment. As a result, as shown in Table 7.9, the road construction industry will consume between 11 to 14 per cent of the total output of the industry.

The Ready-mixed Concrete Industry

The requirements of the road construction industry for the output of the ready-mixed concrete industry are projected to be between 9 and 13 per cent, as shown in Table 7.10, depending on the year and the road program. The importance of the output of this industry lies in the construction of bridges, kerbing and certain roads. In the event of restrictions on the supply of heavy crude oils from overseas it may be necessary to consider the greater use of concrete roads. This would result in a significant increase in the output of the ready mixed concrete industry.

Concrete Products Industry

As shown in Table 7.11, between 12 and 17 per cent of the total output of concrete products is estimated to be used by the road construction industry.

Employment in the Road Construction Industry

The direct labour costs of the road construction industry are high compared with most other industries - the only industries which exceed road construction in labour intensity are service type industries such as rail transport, health, education and welfare. Details of a selected group of industries are set out in Table 7.12. In the road construction industry 42 per cent of direct inputs are in the form of labour and an additional 20 per cent is indirect labour.

The projections of direct employment in the road construction industry for the various road programs are set out in Table 7.13. These projections have been derived from an updating of the method developed by the CBR(1). Indirect employment for the various road programs would approximate an additional 50 per cent of the direct employment.

On the basis of the 1954 to 1972 trend in labour productivity, an annual increase in total roads expenditure of from 2.3 to 2.8 per cent per annum would be associated with a constant labour force over the period of the analysis. Put another way, this means that a program of approximately 82 per cent of the warranted program would result in a roughly constant road industry labour force.

(1) Commonwealth Bureau of Roads, Resource Allocation Study, unpublished Staff Paper, Melbourne, 1976.

TABLE 7.7 - QUARRY MATERIALS INDUSTRY REQUIREMENT FOR VARIOUS ROAD PROGRAMS, 1979-80 TO 1982-83

($ MILLION, 1968-69 PRICES)

Road Program	1979-80	1980-81	1981-82	1982-83
100% of Warranted Program				
Quarry Materials Output	161.6	177.8	193.4	212.8
Road Construction				
Direct Requirements				
Actual - $M	77.8	90.4	105.0	121.9
Per cent of Quarry Materials Output	48.2	50.9	54.3	57.3
Direct and Indirect Requirements				
Actual - $M	81.9	95.1	110.5	128.3
Per cent of Quarry Materials Output	50.7	53.5	57.1	60.3
95% of Warranted Program				
Quarry Materials Output	161.6	175.2	187.5	202.5
Road Construction				
Direct Requirements				
Actual - $M	77.8	87.8	98.8	111.3
Per cent of Quarry Materials Output	48.2	50.1	52.7	55.0
Direct and Indirect Requirements				
Actual - $M	81.9	92.4	104.0	117.1
Per cent of Quarry Materials Output	50.7	52.7	55.5	57.9
90% of Warranted Program				
Quarry Materials Output	161.6	172.5	181.3	192.2
Road Construction				
Direct Requirements				
Actual - $M	77.8	84.9	92.5	100.7
Per cent of Quarry Materials Output	48.2	49.2	51.0	52.4
Direct and Indirect Requirements				
Actual - $M	81.9	89.4	97.3	106.0
Per cent of Quarry Materials Output	50.7	51.8	53.7	55.1
85% of Warranted Program				
Quarry Materials Output	161.6	169.5	175.0	182.1
Road Construction				
Direct Requirements				
Actual - $M	77.8	81.9	85.9	90.3
Per cent of Quarry Materials Output	48.2	48.3	49.1	49.6
Direct and Indirect Requirements				
Actual - $M	81.9	86.2	90.4	95.0
Per cent of Quarry Materials Output	50.7	50.8	51.7	52.2
80% of Warranted Program				
Quarry Materials Output	161.6	166.4	168.8	172.5
Road Construction				
Direct Requirements				
Actual - $M	77.8	78.7	79.6	80.3
Per cent of Quarry Materials Output	48.2	47.3	47.1	46.6
Direct and Indirect Requirements				
Actual - $M	81.9	82.8	83.7	84.5
Per cent of Quarry Materials Output	50.7	49.8	49.6	49.0

Source: BTE Estimates.

TABLE 7.8 - PETROLEUM PRODUCTS (AUST OIL) INDUSTRY REQUIREMENTS FOR VARIOUS ROAD PROGRAMS, 1979-80 TO 1982-83

($ MILLION, 1968-69 PRICES)

Road Program	1979-80	1980-81	1981-82	1982-83
100% of Warranted Program				
Petroleum Products (Aust Oil) Output	884.6	930.0	975.4	1011.0
Road Construction				
Direct Requirements				
Actual - $M	35.8	41.6	48.3	56.1
Per cent of Petroleum Products (Aust Oil) Output	4.0	4.5	5.0	5.6
Direct and Indirect Requirements				
Actual - $M	46.2	53.6	62.3	72.3
Per cent of Petroleum Products (Aust Oil) Output	5.2	5.8	6.4	7.2
95% of Warranted Program				
Petroleum Products (Aust Oil) Output	884.6	928.8	972.6	1006.1
Road Construction				
Direct Requirements				
Actual - $M	35.8	40.4	45.5	51.2
Per cent of Petroleu Products (Aust Oil) Output	4.0	4.3	4.7	5.1
Direct and Indirect Requirements				
Actual - $M	46.2	52.0	58.6	66.0
Per cent of Petroleum Products (Aust Oil Output	5.2	5.6	6.0	6.6
90% of Warranted Program				
Petroleum Products (Aust Oil) Output	884.6	927.5	969.7	1001.3
Road Construction				
Direct Requirements				
Actual - $M	35.8	39.1	42.6	46.3
Per cent of Petroleum Products (Aust Oil) Output	4.0	4.2	4.4	4.6
Direct and Indirect Requirements				
Actual - $M	46.2	50.4	54.9	59.7
Per cent of Petroleum Products (Aust Oil) Output	5.2	5.4	5.7	6.0
85% of Warranted Program				
Petroleum Products (Aust Oil) Output	884.6	926.1	966.7	996.5
Road Construction				
Direct Requirements				
Actual - $M	35.8	37.7	39.5	41.6
Per cent of Petroleum Products (Aust Oil) Output	4.0	4.1	4.1	4.2
Direct and Indirect Requirements				
Actual - $M	46.2	48.6	51.0	53.6
Per cent of Petroleum Products (Aust Oil) Output	5.2	5.2	5.3	5.4
80% of Warranted Program				
Petroleum Products (Aust Oil) Output	884.6	924.7	963.8	992.0
Road Construction				
Direct Requirements				
Actual - $M	35.8	36.2	36.6	37.0
Per cent of Petroleum Products (Aust Oil) Output	4.0	3.9	3.8	3.7
Direct and Indirect Requirements				
Actual - $M	46.2	46.7	47.2	47.7
Per cent of Petroleum Products (Aust Oil) Output	5.2	5.0	4.9	4.8

Source: BTE Estimates.

TABLE 7.9 - PETROLEUM PRODUCTS (IMPORTED OIL) INDUSTRY REQUIREMENTS FOR VARIOUS ROAD PROGRAMS, 1979-80 TO 1982-83

($ MILLION, 1968-69 PRICES)

Road Program	1979-80	1980-81	1981-82	1982-83
100% of Warranted Program				
Petroleum Products (Imp Oil) Output	301.7	317.4	336.9	352.1
Road Construction				
Direct Requirements				
Actual - $M	17.6	20.4	23.7	27.5
Per cent of Petroleum Products (Imp Oil) Output	5.8	6.4	7.0	7.8
Direct and Indirect Requirements				
Actual - $M	32.4	37.6	43.7	50.7
Per cent of Petroleum Products (Imp Oil) Output	10.7	11.8	13.0	14.4
95% of Warranted Program				
Petroleum Products (Imp Oil) Output	301.7	318.1	334.6	348.2
Road Construction				
Direct Requirements				
Actual - $M	17.6	19.8	22.3	25.1
Per cent of Petroleum Products (Imp Oil) Output	5.8	6.2	6.7	7.2
Direct and Indirect Requirements				
Actual - $M	32.4	36.5	41.1	46.3
Per cent of Petroleum Products (Imp Oil) Output	10.7	11.5	12.3	13.3
90% of Warranted Program				
Petroleum Products (Imp Oil) Output	301.7	317.0	332.3	344.3
Road Construction				
Direct Requirements				
Actual - $M	17.6	19.2	20.9	22.7
Per cent of Petroleum Products (Imp Oil) Output	5.8	6.1	6.3	6.6
Direct and Indirect Requirements				
Actual - $M	32.4	35.3	38.5	41.9
Per cent of Petroleum Products (Imp Oil) Output	10.7	11.1	11.6	12.2
85% of Warranted Program				
Petroleum Products (Imp Oil) Output	301.7	315.9	329.8	340.4
Road Construction				
Direct Requirements				
Actual - $M	17.6	18.5	19.4	20.4
Per cent of Petroleum Products (Imp Oil) Output	5.8	5.9	5.9	6.0
Direct and Indirect Requirements				
Actual - $M	32.4	34.1	35.8	37.6
Per cent of Petroleum Products (Imp Oil) Output	10.7	10.8	10.8	11.0
80% of Warranted Program				
Petroleum Products (Imp Oil) Output	301.7	314.7	327.5	336.7
Road Construction				
Direct Requirements				
Actual - $M	17.6	17.8	18.0	18.1
Per cent of Petroleum Products (Imp Oil) Output	5.8	5.6	5.5	5.4
Direct and Indirect Requirements				
Actual - $M	32.4	32.7	33.1	33.4
Per cent of Petroleum Products (Imp Oil) Output	10.7	10.4	10.1	9.9

Source: BTE Estimates.

TABLE 7.10 - READY MIXED CONCRETE INDUSTRY REQUIREMENTS FOR VARIOUS ROAD PROGRAMS, 1979-80 TO 1982-83

($ MILLION, 1968-69 PRICES)

Road Program	1979-80	1980-81	1981-82	1982-83
100% of Warranted Program				
Ready Mixed Concrete Output	137.4	144.3	143.6	146.4
Road Construction				
Direct Requirements				
Actual - $M	11.9	13.8	16.1	18.7
Per cent of Ready Mixed Concrete Output	8.7	9.6	11.2	12.8
Direct and Indirect Requirements				
Actual - $M	12.2	14.2	16.5	14.1
Per cent of Ready Mixed Concrete Output	8.9	9.8	11.5	13.1
95% of Warranted Program				
Ready Mixed Concrete Output	137.4	144.6	144.2	147.5
Road Construction				
Direct Requirements				
Actual - $M	11.9	13.4	15.1	17.1
Per cent of Ready Mixed Concrete Output	8.7	9.3	10.5	11.6
Direct and Indirect Requirements				
Actual - $M	12.2	13.8	15.5	17.5
Per cent of Ready Mixed Concrete Output	8.9	9.5	10.8	11.8
90% of Warranted Program				
Ready Mixed Concrete Output	137.4	144.9	144.9	148.6
Road Construction				
Direct Requirements				
Actual - $M	11.9	13.0	14.2	15.4
Per cent of Ready Mixed Concrete Output	8.7	9.0	9.8	10.4
Direct and Indirect Requirements				
Actual - $M	12.2	13.3	14.5	15.8
Per cent of Ready Mixed Concrete Output	8.9	9.2	10.0	10.6
85% of Warranted Program				
Ready Mixed Concrete Output	137.4	145.2	145.6	149.7
Road Construction				
Direct Requirements				
Actual - $M	11.9	12.5	13.2	13.8
Per cent of Ready Mixed Concrete Output	8.7	8.6	9.0	9.2
Direct and Indirect Requirements				
Actual - $M	12.2	12.9	13.5	14.2
Per cent of Ready Mixed Concrete Output	8.9	8.9	9.3	9.5
80% of Warranted Program				
Ready Mixed Concrete Output	137.4	145.5	146.2	150.8
Road Construction				
Direct Requirements				
Actual - $M	11.9	12.1	12.2	12.3
Per cent of Ready Mixed Concrete Output	8.7	8.3	8.3	8.2
Direct and Indirect Requirements				
Actual - $M	12.2	12.4	12.5	12.6
Per cent of Ready Mixed Concrete Output	8.9	8.5	8.5	8.4

Source: BTE Estimates.

TABLE 7.11 - CONCRETE PRODUCTS INDUSTRY REQUIREMENTS FOR VARIOUS ROAD PROGRAMS, 1979-80 TO 1982-83

($ MILLION, 1968-69 PRICES)

Road Program	1979-80	1980-81	1981-82	1982-83
100% of Warranted Program				
Concrete Products Output	193.3	203.6	206.2	212.9
Road Construction				
Direct Requirements				
Actual - $M	23.2	26.9	31.3	36.3
Per cent of Concrete Products Output	12.0	13.2	15.2	17.1
Direct and Indirect Requirements				
Actual - $M	23.4	27.2	31.6	36.7
Per cent of Concrete Products Output	12.1	13.4	15.3	17.2
95% of Warranted Program				
Concrete Products Output	193.3	203.6	206.0	212.7
Road Construction				
Direct Requirements				
Actual - $M	23.2	26.1	29.4	33.1
Per cent of Concrete Products Output	12.0	12.8	14.3	15.6
Direct and Indirect Requirements				
Actual - $M	23.4	26.4	29.7	33.5
Per cent of Concrete Products Output	12.1	13.0	14.4	15.7
90% of Warranted Program				
Concrete Products Output	193.3	203.5	205.9	212.4
Road Construction				
Direct Requirements				
Actual - $M	23.2	25.3	27.5	30.0
Per cent of Concrete Products Output	12.0	12.4	13.4	14.1
Direct and Indirect Requirements				
Actual - $M	23.4	25.6	27.8	30.3
Per cent of Concrete Products Output	12.1	12.6	13.5	14.3
85% of Warranted Program				
Concrete Products Output	193.3	203.4	205.7	212.2
Road Construction				
Direct Requirements				
Actual - $M	23.2	24.4	25.6	26.9
Per cent of Concrete Products Output	12.0	12.0	12.4	12.7
Direct and Indirect Requirements				
Actual - $M	23.4	24.6	25.9	27.2
Per cent of Concrete Products Output	12.1	12.1	12.6	12.8
80% of Warranted Program				
Concrete Products Output	193.3	203.4	205.6	212.0
Road Construction				
Direct Requirements				
Actual - $M	23.2	23.4	23.7	23.9
Per cent of Concrete Products Output	12.0	11.5	11.5	11.3
Direct and Indirect Requirements				
Actual - $M	23.4	23.7	23.9	24.2
Per cent of Concrete Products Output	12.1	11.7	11.6	11.4

Source: BTE Estimates.

TABLE 7.12 - LABOUR COSTS OF SELECTED INDUSTRIES: PERCENTAGE OF FACTOR COST

Industry	Direct	Direct and Indirect
Coal	39.8	51.9
Quarry Materials	25.3	38.0
Food Production	14.7	37.8
Ready mixed Concrete	7.4	42.1
Concrete Products	29.9	52.7
Metal Products	23.3	45.0
Motor Vehicles and Parts	21.7	34.3
Construction Equipment	17.2	33.1
Dwellings	25.4	54.2
Road Construction	42.4	62.2
Rail Construction	35.6	63.1
Other Construction	29.5	55.6
Road Transport	29.2	41.7
Rail Transport	44.2	70.6
Health	52.4	63.9
Education	69.9	80.5
Welfare	71.2	80.6

TABLE 7.13 - DIRECT EMPLOYMENT REQUIREMENTS FOR ROAD CONSTRUCTION INDUSTRY PROGRAMS: THOUSANDS[(a)]

Program	1979-80	1980-81	1981-82	1982-83
100% of Warranted	73	81	90	99
95% of Warranted	73	79	85	92
90% of Warranted	73	77	81	85
85% of Warranted	73	75	76	78
80% of Warranted	73	72	72	72

(a) Rounded to nearest '000, based on employment/expenditure trends observed between 1954 to 1972.

CHAPTER 8 - SUMMARY OF COMMENTS PROVIDED TO THE BUREAU

INTRODUCTION

The Bureau invited comments on questions of road funding from:

- State Ministries of Transport;
- The State Road Authorities; and
- Associations of Local Government Authorities.

The Bureau sought written comments under a number of headings although not precluding comment of a more general kind.

The headings under which comment was invited, while varying slightly depending on the group, encompassed the following.

(a) How do the existing arrangements for funding of transport activities, including roads, affect the implementation of transport development strategy for your State?

(b) Are there any changes in those arrangements that you would like to see made, particularly for roads?

(c) Specifically do you consider that there should be any variation to existing road grant categories and for what reasons?

(d) What are the main features of the road development and maintenance strategy being planned or implemented in your State?

(e) How is this strategy being affected by present funding levels and/or legislative arrangements?

(f) In which grant categories have variations in levels of total funding from all sources and variations in the level of Commonwealth grants had the most impact, and what are those impacts?

(g) What are the effects in your State or Territory of the standards adopted for national highways?

(h) Are there any ways whereby changes in road funding arrangements might have significant impacts on the pattern of, and costs attributable to, accidents?

In addition comments were received from the Automobile Association of Australia, the Australian Road Federation, the Australasian Road Transport Federation, the National Roads and Motorists Association of New South Wales (NRMA) and the Brisbane City Council.

The responses from those organisations which provided comments are published verbatim as Annex 6 to this report. A summary of these responses is provided in this Chapter, in the order:

(a) State Ministries;
(b) State Road Authorities;
(c) Associations of Local Government Authorities; and
(d) Other organisations.

STATE MINISTRIES OF TRANSPORT

New South Wales Ministry of Transport and Highways (incorporating Department of Main Roads)

Introduction

New South Wales' warranted road works exceed past levels of Commonwealth and State road funds - as a result New South Wales has increased its own expenditures. At the same time Commonwealth assistance in real terms has fallen in recent years. In addition the State Government has embarked on a major program to improve and modernise its rail network. The Ministry sought a reconsideration of certain problems related to Commonwealth land transport assistance, and more funds to reduce the backlog of warranted road works.

New South Wales Transport Development Strategy:

(a) Overall Approach

- program should yield benefits in the short term - with emphasis on flexibility and expansion by incremental units
- emphasis on solving existing problems and maximising use of low cost improvements
- expenditure emphasis on projects which will achieve the best balance of improvements for the transport system
- road planning and expenditures related to existing and forecast demand
- urban public transport program a continuation of past modernisation and improvement achievements.

(b) Urban Roads

- emphasis on removal of congestion via freeway and major arterial road construction

(c) Public Transport

- involves overall rail upgrading, bus and ferry acquisitions and other capital works with emphasis on the maintenance of existing services

- reduce heavy truck movements by encouraging bulk freight to use rail

- co-operation with private bus and taxi industries

(d) National Highways

- while supporting the national highway concept consideration needs to be given to a reduction in construction standards in difficult topography

- complementary Commonwealth assistance for mainland rail upgrading between capital cities is required

(e) Rural Arterials

- many were built to outdated standards, current funds tend to go in maintenance of this standard

(f) Recreational and Tourist Roads

- additional demands have been created for improvements to forestry roads and roads leading to recreational centres.

Funds for New South Wales Roads

In real terms Commonwealth grants to New South Wales between 1974-75 and 1977-78 have fallen (and in real terms urban arterial grants fell 57 per cent over that period). State revenues from motor vehicle registration and road maintenances taxes have also fallen in real terms over recent years.

As a result of the trends in Commonwealth and State road financing the State's road development program has been restricted severely and the backlog of urgent needs has mounted.

New South Wales complained about the Commonwealth's decisions concerning the partial indexation of road grants, the falling 'return' of road grants to fuel tax collections, the failure to increase funding of energy conservation research, and the reduction of roads assistance to three year rather than five year Acts.

Allocations of Commonwealth Assistance

Falls in the real level of Commonwealth roads assistance has shifted the burden of roads financing to the State and local government. Roads and urban public transport assistance is tied to categories and this lack of State discretion in determining spending priorities contrasts sharply with the concept of a total transport budget (and the use of State expertise).

National and rural local road allocative emphasis has been primarily at the expense of urban arterial roads, despite high State priority for the latter works. Some progress on these matters could be achieved by reducing the number of assistance categories. Finally a substantial increase in assistance for rural roads is required.

State Road Funding Sources

Specific State road tax revenues are falling, and charges on motorists have reached a point where further substantial increases would be unreasonable. There has been an increase in State loan funds directed to roads but this has been at the expense of other urgent public works. It was concluded that a substantial increase in Commonwealth funding is required, especially as State road fund sources do not have the required flexibility needed to finance a reasonable roads expenditure program.

Commonwealth Funding Arrangements

The number of road categories should be reduced and some changes made to the urban/rural classification system. Arterial road funding needs to be increased, and national highway construction standards should be revised downwards in some cases (New South Wales' national road priorities are contained in Annex 6). Increased funding is needed by certain major works e.g. roads associated with Kingsford-Smith Airport.

Suggested Changes:

- consideration of a total transport budget concept;
- substantial increase in Commonwealth road funds to all categories;
- additional assistance for major road works for national significance, based on proportion of fuel tax raisings;
- grants to be indexed to rises in road construction costs;
- introduction of five year rolling program;
- increased funding of energy conservation research financed from levy on Australian produced oil;
- abandon national commerce road category;
- extend MITERS assistance to include operational aspect of road safety programs;
- reduce design standard of national highways from 130 km/h to 110 km/h;
- no additions to national highways network in New South Wales;
- continue planning and research funding on present lines with increased assistance.

Victorian Ministry of Transport

The Victorian Minister for Transport's submission included the views of the Victorian Country Roads Board.

Basic Funding Situation

In its overall transport strategy Victoria has placed major emphasis on the upgrading of urban public transport. The Minister was critical of the amount and variability of assistance provided under the States Grants (Urban Public Transport) Act 1974. In particular the administration of that Act was at variance with the problems associated with urban public transport vehicle replacement programs where, by necessity, contractual arrangements covered more than one year while Commonwealth funds were only provided (if at all) annually.

In relation to roads the Minister viewed current levels of Commonwealth assistance as inadequate, particularly when compared to fuel tax raisings.

Roads

The Country Roads Board concluded that while the demand on the road system is increasing, general road conditions were deteriorating. Peak travel times were increasing in major urban areas and many rural roads and rural bridges are wearing out faster than they are being replaced. A substantial increase in the real value of total funds was needed to prevent further deterioration of road conditions.

Road Development Strategy

(a) Urban roads - maintain existing system with increased emphasis on traffic management techniques. Develop selected arterials (including freeways), set aside land for future development and provide grade separation at level crossings.

(b) National roads - develop according to Commonwealth guidelines with emphasis on 4 lane roads between Melbourne and Ballarat and Melbourne and the N.S.W. border. A list of national road priorities is provided in Annex 6.

(c) Rural roads - maintain existing system plus development of specific major routes (see Annex 6).

Present Funding Levels

Most of the roads funds are expended on the maintenance and rehabilitation of the existing road system. The Board criticised the Commonwealth's assistance categories; the financial strategy towards national roads was having a detrimental effect on other road improvements, while the distinction between urban and rural roads has disadvantaged outer urban areas and provincial cities as they have to compete for funds against large urban projects. Also the urban local/arterial road split has created administrative problems.

Road Categories

The Board supports a system of two categories - "national roads" and "other roads" and was especially critical of the national commerce road category (which it wants abolished) and the exclusion of arterial road maintenance.

When discussing recent category funding the Board was critical of the Commonwealth's rundown (in percentage terms) of urban arterial road funds and the increase given to urban local roads. Further criticism was directed at Commonwealth policy in relation to national roads and rural local roads.

Other Points

There is no clear evidence that MITERS funding has had any substantial effect on the costs of accidents; the rate of improvement depends more on overall funding.

Conclusion of the Overall Submission

For urban public transport the Commonwealth's funding must be more predictable than in the past. This also applies to roads. In addition the Minister saw a need for a substantial increase in Commonwealth roads assistance, a scaling down of Victoria's quota requirement, provision for a five year rolling program, a reduction in the number of road categories to two (national roads and other roads), and the elimination of the requirements to submit road programs for Commonwealth approval.

Queensland Department of Transport

The Department of Transport provided a brief letter in response to the Bureau's request. It did not comment on road development but raised matters of inter-modal transport. The Department foresaw a future problem of infra-structure duplication (especially between rail and road) if consideration is not given to the relative roles of different modes over long distances.

South Australian Director-General of Transport

This submission addressed how land transport planning is affected by current Commonwealth financial assistance arrangements. It was argued that:

- current assistance arrangements encourage a capital intensive approach (especially for urban public transport) which maintains and sometimes extends the existing transport networks. Little encouragement has been given to ways and means of replacing existing systems with alternatives better suited to present and future patterns of demand;

- to encourage innovating in land transport, financial assistance should be made available for non-capital expenditures;

- separate assistance arrangements for roads and urban public transport tend to inhibit innovation and flexibility as there is no ability to re-allocate funds either into or out of modes.

The Director-General maintained that the formulation and execution of overall transport development strategies would be helped by a single Commonwealth Act with funding categories minimised - the ideal being "urban transport" and "rural transport". However a third category might be "national roads and rail" to be funded by the Commonwealth, with the States used as construction agencies.

Western Australian Director-General of Transport

The Director-General did not provide detailed comments (preferring to leave specific issues to be covered by the Department of Main Roads). Instead, two major points regarding the allocation of road funds in urban areas were raised.

(a) Economic Evaluation of Urban Road Investment Proposals: It was pointed out that although BTE carries out economic evaluations in order to assess road investment needs, actual funding does not necessarily conform to these needs. Of major concern was the question of efficient allocation of resources and the reason why the Commonwealth insists on economic evaluation of urban public transport projects but does not require similar evaluation for major urban road projects.

(b) Allocation of Road Funds in Urban Areas: Local authority road allocations tend to be based somewhat on local government measures of population and road mileage. Three problems not adequately taken into account in such a base are:

- rising traffic densities in central business district type regions of falling population;
- funding inadequacies in local authorities areas of rapidly growing population; and
- the relative adequacy, or otherwise, of the existing road stock within local authority networks compared to the needs of other authorities.

Tasmanian Transport Commission

The Tasmanian Transport Commissioner provided a brief letter of comment, leaving detailed comment to the Department of Main Roads. The Commissioner made the following points.

- Existing arrangements, whereby transport activities are sectionalised, made co-ordination difficult.
- It was suggested that all land transport assistance be covered by a common set of provisions.
- Within this framework, either MITERS should be extended, or separate provisions made for "transport systems management".
- Allowance should be made for MITERS expenditure to be directed to potential accident areas.

It was pointed out that policies in the United States and United Kingdom are based on national transport policies relating to land transport, including transport management features.

Department of Transport and Works Northern Territory of Australia

The Department is currently examining the implications of Commonwealth/State funding for roads for the newly created Northern Territory Government. Some problems are foreseen if traditional Commonwealth/State funding arrangements are adopted without due allowance being given to the Territory's road needs for remote communities, tourism development, and pastoral properties. Aside from meeting these needs the major feature of the Department's road development strategy is to upgrade national roads to modified national road standards.

STATE ROAD AUTHORITIES

New South Wales

Views included in New South Wales Ministry paper.

Victorian Country Roads Board

Included as a component of Victorian Ministry paper.

Queensland Main Roads Department

Basic points made by the Queensland Main Roads Department (MRD) were that current Commonwealth roads assistance is inadequate to meet the needs of the road network (with the backlog of works approaching an unmanageable magnitude), and that the three year Acts under which assistance has been provided are unsuitable as regards forward planning and programming. MRD favour a six year Act, updated every three years. The MRD then commented on three issues - road development strategy, funding arrangements, and accidents.

Road Development Strategy

Commonwealth controls over road administration have mitigated against the development of an effective road strategy - MRD support a system of broad policy responsibility at the Commonwealth level leaving detailed administrative responsibility at the State level. MRD concluded the main problems with present Commonwealth legislation arrangements were that funding levels and administrative guidelines were set outside the level of government directly responsible for roads development strategies - especially in the case of national roads.

Funding Arrangements

There is a need for a functional classification to describe roads - MRD see the Commonwealth roads assistance categories as a legal classification. The past system of classifying roads as either "urban" or "rural" was satisfactory. The more complex the system, the greater the effort expended on administration and the greater the distortions caused by shifts in emphasis of Commonwealth funding.

Accidents

Studies attempting to relate accident reductions to specific expenditures have not had spectacular success. Providing greater flexibility to the local engineer by removing Federal controls on his decisions can give more adequate safety benefits than those achieved at present.

In summary, MRD stated that:

- current Commonwealth funding is inadequate;
- current assistance is distributed among categories in a distorting fashion which State fund shifts cannot eliminate - a reduction in the number of categories is needed; and

- roads policy should make the maximum use of existing State expertise - present Commonwealth legislative arrangements are too restrictive.

South Australian Highways Department

This detailed paper addressed issues related to road development strategy, funding arrangements for roads, road funding and accident costs, as well as some other issues identified by the Department. In its introduction the Highways Department stressed the need for a balanced (all modes considered) assessment of transport needs and related funding. It commented that it is regrettable that actual road funding levels bear little relation to needed funds and that in fact real levels of funds had declined over recent years. It was suggested that the State be allowed to participate more fully with the Commonwealth Government on this matter to the extent of possibly introducing a fuel surcharge tax collected for the State by the Commonwealth.

Road Development Strategy

Under the restricted financial conditions the present strategy is a policy of retention and minor improvement rather than expansion and increased standards.

Funding Arrangements for Roads

It was argued that the categorisation of Commonwealth road grants has necessitated the introduction of cumbersome administrative procedures, and had in some cases affected the orderly and balanced development of the State's road network. This has occurred in cases where Commonwealth funds provided have been below expectations and where allocations have significantly varied from previous years. It was suggested by the Highways Department that the degree of categorisation be substantially reduced to either "national roads" and "other roads" or "national roads", "urban roads" and "rural roads", with the Commonwealth accepting full financial responsibility for national roads (with national road grants being additional to other road category grants).

National road construction standards were criticised as they take little account of variations in terrain and traffic, especially on long road stretches. The national commerce category was found to be unsatisfactory as it is not clearly defined. All arterial roads to some extent facilitate trade and commerce - under these circumstances it was submitted that the category will cease to be meaningful unless there is to be some Commonwealth input into identifying future projects.

Road Funding and Accident Costs

It is doubtful whether the road funding arrangements have had a significant impact on accident prevention. Safety improvements tend to rely more on engineering judgements and overall funding levels rather than programs such as MITERS. It is suggested that MITERS administration costs could be avoided by dropping the category (and divert the funds elsewhere) or relaxing the project approval procedure - especially the $50 000 project limit.

Other Issues

(a) A balanced transport system. The Highways Department recognise the need for a co-ordinated approach in developing transport investment plans but stressed that the major role of roads should not be underestimated. Attention should be given to the needs of inter-suburban road travel and road improvements necessitated by road based urban public transport.

(b) Level of road funding and distribution to categories. In arriving at its warranted and feasible roads program (CBR 1973 report) the CBR assumed no change in road maintenance expenditure despite the warranted and feasible program representing a 28 per cent reduction on the warranted program. However, such a reduction necessitates additional expenditures to maintain deficient roads. The submission quoted the results of the CBR's evaluation and compared recommended grants to those actually provided. It was concluded that the backlog of warranted road expenditure is assuming immense proportions, and that the need for increased real levels of road funding is urgent.

(c) Other points. The Highways Department favour a rolling program (six years with three year extensions) of grants so that grant levels are always known up to three years in advance. It was suggested that the current method of indexing of grants is inappropriate and that a road cost index be developed for this purpose. It was pointed out that falling real levels of grants had adversely affected roads activity and employment, and had increased roads maintenance expenditures. An alternative method of allocating administrative costs was suggested which avoids the arbitrary allocations which occur at present. Finally it was argued that the South Australian share of current road funds is insufficient (as based on comparative measures of population, area, motor vehicles, and vehicle kilometres travelled). It was felt that South Australian urban areas were especially underfunded under the current arrangements.

Western Australian Main Roads Department

The Western Australian Main Roads Department (MRD) addressed four basic issues - road development strategy, funding arrangements for roads, accident costs, and Commonwealth administration of its roads assistance to the State.

Road Development Strategy

Western Australia's strategy for development of its road system (particularly in the Pilbara region) is being hampered by a shortage of Commonwealth road funds. This situation has created a need to stage some projects over an excessively long period and to defer others. MRD cited evidence of a drift in Commonwealth road grants to the State - in 1968-69 Western Australia received some 18 per cent of Federal road funds but presently only some 13 per cent. In addition the real value of grants to Western Australia for roads has fallen between 1975-76 and 1977-78 whereas over the same period State contributions have increased significantly.

In support of more funds MRD argue that BTE's road evaluation model does not take into account the unique contribution made by the State and especially the Pilbara region, to Australia's export earnings. In addition State mining operations have added significantly to Federal tax collections. MRD argue that more funds should be returned to the Pilbara region in order to aid further development, improve living and working conditions, and favourably influence the industrial relations climate.

Funding Arrangements for Roads

The MRD judged the present eight road category system of classification to be inadequate. It said that the Commonwealth allocation of funds to these categories is often made in an arbitrary way, without regard to State views, by Commonwealth officers remote from the local scene. MRD would like to see funds allocated to two categories only - "national roads" and "other roads".

MRD were critical of reduced Commonwealth funding of arterial roads - this has resulted in a need to shift State funds into these roads but a large backlog of works exists.

Criticism was made of the national road construction standards on lightly trafficked roads. Future national road projects are given in the verbatim report in Annex 6.

Road Funding and Accident Costs

MRD conclude that the MITERS program has improved local trouble spots but to achieve a demonstratively greater safety record would require greater Commonwealth arterial road funding.

Administration

MRD concluded that the Commonwealth's system of road expenditure approvals had not achieved better road expenditure practices than that under the earlier Commonwealth Aid Roads Acts. It was maintained that the State should not need prior Commonwealth approval in order to spend Commonwealth road grants - the expertise rests with the State and the State should be free to make its own expenditure decisions.

Tasmanian Department of Main Roads

This paper provided comments on Tasmanian Department of Main Roads (DMR) road development strategies and current road funding arrangements.

Road Development Strategy

Reviews and studies have been initiated or completed with a view to identify urban arterial, rural arterial and national road development strategies. These investigations indicated that the present level of funding would be adequate for planned national road developments, but would result in inadequate levels of funds for planned arterial road construction. Indications were that current funding levels for local roads and MITERS would be generally sufficient in the future if cost-indexed.

Current Funding Arrangements

The DMR found the present system of funding categories satisfactory. In specific comments on category funding it was stated that for:

(a) arterial roads - the reduction in Commonwealth grants has had a crippling effect on improvements despite an increase in funds from State sources. The overall impact has been a serious retardation of necessary works.

(b) national roads - Commonwealth funds have been sufficient for capital works; however, some construction costs have been relatively high due to the adoption of national highway construction standards which are higher than would have been applied to rural arterial roads with similar traffic volumes.

(c) Launceston connections with national roads - DMR consider that Launceston should be included in the definition of the national road link between Burnie and Hobart, and that the road from Bell Bay to Launceston also be included in the national road configuration.

(d) national commerce roads - the East Tamar Highway (linking Launceston and Bell Bay) is the only declared road in this category. DMR would like to see this road reclassified as a national road (see above) and would consider the declaration of other national commerce roads if more funds were made available under this category. (See verbatim text Annex 6 for a list of potential commerce roads.)

ASSOCIATIONS OF LOCAL GOVERNMENT AUTHORITIES

<u>Local Government Association of N.S.W and Shires Association of N.S.W.</u>

It was the Associations' view that the ability of local government to continue the construction and maintenance of its own road network was being seriously eroded because of inadequate funding. They stated that 85 per cent of the New South Wales road network is the fiscal responsibility of local government, and that in 1977-78 these roads were financed on the following basis:

- local government own sources	43%
- State government	22%
- Commonwealth government	19%
- council loan funds	16%.

One source of increased financial pressure on local government is the Commonwealth's arterial road financing policy - the cut in funding has led to a reluctance for the State to declare new arterial roads leaving local government responsible for what, in effect, have become major arterials.

Tax sharing funds have an implied use (avoidance of rate increases) and this affects local government expenditure patterns. The Associations contended that local government does not have the same revenue-raising capacity as the other levels of government (despite tax sharing) and concluded that increased funding for roads from the other levels was required.

Rural Local Roads

It was pointed out that in real terms Commonwealth grants for local roads in 1978-79 were barely equivalent to 1973 grants (in intervening years real grants were less than those provided in 1973). The Associations argued that increased funding of these roads was required to prevent a deterioration of the network, and that such a policy would ease unemployment and stimulate the rural economy.

Urban Local Roads

While appreciating the introduction of Commonwealth grants to these roads the Associations argued that funding levels were little more than "token" and totally inadequate to overcome urban local road deficiencies. As use of the 17 000 km network is not confined to local rate-paying communities (due to through traffic and inadequate urban arterial networks) the Associations argued for a shifting of more of this financial burdey away from rate-payers to the community as a whole.

Fuel Tax Collections and Future Funding

In New South Wales the Commonwealth collects three times more in fuel taxes than it provides in the form of road grants. The Associations view the case of relating road grants to fuel tax collections as outweighing the case against such a comparison.

On examining local authority funding the Associations found that rural authority financial capacity had declined relative to urban authorities, while urban councils in high growth and inner city areas faced either static or declining revenue-raising capacities.

Other Issues

- road needs surveys should be carried out every three years.

- more advanced knowledge of future road grants is required - preferably up to three years in advance.

- some changes in arterial road classification were suggested (see Annex 6) to relieve their financial burden on local authorities.

Municipal Association of Victoria

The object of the Association was to put its case for local government road funding assistance - the main aims were to achieve an increase in financial assistance for roads and for the flow of funds to become predictable.

Effect of Changes in Road Grants Since 1975

Generally Grants Commission allocations and the tax sharing arrangements have allowed councils to avert large rates increases. Loan raisings for road purposes have taken on increased significance for urban councils. Charges of local authority enterprises have remained largely unaffected. Council expenditures on roads have generally not kept pace with inflation - partly resulting from a desire to keep rates, charges and loans at a minimum and partly as a result of increases in expenditures in other areas of council responsibility.

Future Financing of Local Government Road Expenditure

Rural council financial resources are generally inadequate to meet road expenditure needs and in both rural and urban areas councils will have to contribute an increasing proportion of funds in order to maintain existing roads. It was concluded that increased assistance is needed from the other levels of government.

Grants Categories

In general it was felt that Federal and Victorian Country Roads Board (CBR) road classifications should be common. There was some council support for the CRB concept of two categories, "national roads" and "other roads", or a three tier system where roads were classified according to responsibility - national, state, municipal. On balance the MAV concluded that Commonwealth legislation should provide for not less than four road funding categories.

Overview

Indications were that there was some kind of dichotomy between rural and urban areas as to the effect changes in the levels of government grants have had:

- increased revenue sharing and 'personal' service type grants have assisted urban areas more than rural; while

- diminishing road grants have also affected rural areas more than urban although both areas have had to either defer road projects or increase loan financing.

The special needs of councils in inner urban areas and tourism areas (both affected by large and uneven traffic flows originating outside their boundaries) need to be catered for. Similarly the closure of some country rail services has resulted in a considerably and unplanned increase in the usage of alternative road routes.

Summation

The Association is promoting a new cost sharing formula for roads (the MAVPLAN):

Commonwealth	50%
State	35%
Local	15%

This sharing suggestion resulted from the Association's consideration of ability to pay and financial resources of each level of government. In addition rolling five year programs with guaranteed annual funding increases are required. It was suggested that all roads classified as arterial roads by the BTE and NAASRA be automatically declared as arterial roads for the purposes of Commonwealth assistance as many such roads are currently given local road status due to the method of administration the States Grants (Roads) Act 1977.

Local Government Association of Queensland (Inc.)

In their introduction the Association drew attention to the fact that for many local authorities, particularly rural local authorities, the greatest proportion of their expenditure is on roads.

In addition there still exists concern in local government authorities over inadequate financial assistance to local government from other levels of government. It was pointed out that local authorities in Queensland are responsible for the major roads communication network for the State (146 608 km out of a total network of 185 548 km). Attention was also drawn to the relatively long distances of unsealed roads for which local authorities are responsible.

Changes in Grants to Local Government Since 1975

The Association pointed out that whereas Commonwealth payments for roads to local authorities increased between 1975-76 and 1977-78 total payments (including roads) over the same period fell by 17.5 per cent. At the same time local authorities had had to allocate a greater proportion of their expenditure to community services, with a corresponding depletion of funds for roads.

In order to meet these expenditure demands local government had increased rate revenues at rates greater than the general level of inflation. By contrast, the Association pointed out, the proportion of fuel taxes to Commonwealth roads grants has fallen from 55 per cent to 42 per cent between 1974-75 and 1977-78.

In discussing local government loan raising and debt payments the Association stated that total borrowings by Queensland local authorities had not kept pace with inflation - and therefore there had been a reduction in the real level of funds available for capital works. At the same time local authorities have had to allocate more of their borrowings to community services of a general nature, and have also faced increased payouts for debt servicing.

The association requested that the Commonwealth consider giving local government some relief from its loan commitments (as it did to a limited extent with the States in recent years).

Tables were provided to show that local authorities have increased their revenues from local authority enterprises at rates greater than the general rate of inflation, and to show that the proportion of expenditures on welfare, social and cultural activities had increased while that for roads has fallen (see Annex 6).

Future Financing of Local Government Road Expenditure

In their analysis the Association gave evidence that there has been increasing calls on local authority finance to provide wider ranges of community services and that the authorities had increased their own financial raisings to meet these demands. It concluded that if local authorities are to continue roads expenditure at a reasonable level then the Commonwealth Government would need to provide additional finance to local government.

Road Categories

The Association supported a reduction in the number of categories to reduce administration costs. It was submitted that the categories be reduced to "national roads" under Commonwealth responsibility, "declared roads" under State responsibility and "roads wholly controlled by local authorities".

It was further submitted that there should be no need to submit programs to the Commonwealth for approval.

Local Government Association of Western Australia (Inc.)

Local government in Western Australia has had to make adjustments to its roads program in recent years as a result of Commonwealth road grants for Western Australia failing to allow adequately for inflation and because of the falling share of road funds allocated to the State. In addition recent changes to State legislation have led to significant increases in the matching requirements for local government authorities.

The Association stated that forward planning was hampered by uncertainities in the level of future road funds. It was suggested that this situation be overcome by setting road grants at a fixed percentage of fuel tax revenues or on a basis reflecting a user pay concept, so that road funds would have an inbuilt growth factor. It was also suggested that local governments receive their annual funds at the beginning of each year in one lump sum rather than as periodic payments throughout the year.

In conclusion the Association reiterated their desire to see funds tied to some growth index, supported the continuation of specific purpose road grants, and supported the retention of categories in that these protect local governments' share of Commonwealth funds.

Municipal Association of Tasmania

In their paper the Association discussed current roads legislation and its effect on expenditure on urban local roads, MITERS, and rural local roads.

Urban Councils

It was only recently that urban councils became involved in the design and/or construction of urban arterial and local roads and MITERS projects. (Under an arrangement with the Tasmanian Department of Main Roads (DMR) some urban arterial projects can be funded on a dollar for dollar basis with the State.) The Association strongly supports the continued recognition of local government in the road planning process.

It was argued that the definition of urban local roads is somewhat restrictive, and could perhaps be extended to include some sub-arterial roads under council control and to include Burnie and Devonport in the definition of urban areas.

It was suggested that some MITERS funds be spent on maintenance of roads and construction of urban local roads as such expenditures would also aid road safety.

Rural Councils

Road expenditures constitute an important part of council services expenditures, especially in the purely rural areas. It was found that in general road rating had kept pace with inflation.

Concern was expressed over the leakage of Commonwealth rural road grants for use on Hydro-Electricity Commission and Forestry Commission roads and to the DMR for rural road purposes. The Association felt that rural local roads under council control deserved a higher priority than currently accorded.

Some criticism was directed at the grant distribution process as it affected local government. It was concluded that it should be the aim of any grant distribution formula to achieve a relatively predictable level of funding. Suggestions were made for changes in the way in which Commonwealth and State road funds are directed to local government (see verbatim text in Annex 6).

Appendices

The Association's submission included seven appendices. These were:

(a) Policy for State Government Financial Assistance to Councils for Construction of Urban Arterial Roads (DMR statement dated June 1978).

(b) Further discussion on the use of Commonwealth grants for urban local roads.

(c) Listing of local authorities and their individual roads and ordinary services expenditures.

(d) Further detailed statistics of council roads expenditures between 1971-72 and 1976-77.

(e) Further detailed statistics of council roads expenditures between 1971-72 and 1976-77.

(f) List of rural local roads classified by the State.

(g) Council loan fund raisings for road purposes.

A convenient summary of the Association's recommendations on urban local roads, MITERS, and rural local roads was provided in the beginning of their submission (see verbatim report in Annex 6).

The Local Government Association of the Northern Territory

At this stage local authorities in the Northern Territory are not funded in the same way as those in the States. In general there are no specific road arrangements outside general assistance arrangements.

Australian Council of Local Government Association

The ACLGA submitted a detailed study[1] of roads and road funding needs. Their report involved an extensive data collection exercise from individual local government authorities and included discussion of a large range of issues. These are set out briefly below but the reader should examine the verbatim report in the Appendix for a fuller appreciation of the work undertaken by the ACLGA.

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(1) Australian Council of Local Government Associations, Roads and Road Funding, ACLGA Issue Discussion Paper No. 1, January, 1979.

ACLGA Data Survey

It was concluded by the ACLGA that there was insufficient existing information on local government finances and responsibilities as they relate to roads at the time BTE requested its inputs to this report. However, the ACLGA's attempts at gathering uniform statistical data was very severely restricted by the time and resources available. Their survey questionnaire collected data in three distinctive fields - road lengths, financial data, and more general resource data related to road construction and maintenance.

Eight hundred and sixty-two councils were included in the original survey of which 319 returns were used (Victoria was excluded due to late returns and will be added later) to obtain the results in their study.

Road Responsibilities

A brief history of the development of road responsibilities, including a discussion of constitutional constraints was given. The development of the importance of Commonwealth Section 96 grants to the States was outlined. There was some discussion of the current budgetary problems facing the Commonwealth Government and criticism was levelled at the policy of controlling the budget deficit partly by increasing fuel tax revenues. In addition the ACLGA criticised the formulation of current roads grants as this policy had more to do with anti-inflationary policies than the community's road needs.

National Road Needs

Evidence was given of the increasing demand for motor transport within Australia and the economic importance of the roads networks and road transport industry to the Australian economy. It was also pointed out that the road network is now an important part of the social infra-structure of Australian society.

In discussing elements of a future national roads policy, the ACLGA identified four real concerns - a need for transport coordination to optimise the use of transport resources, issues related to land utilisation and of regional and/or urban planning, a need for classification of the total road system applicable to all three spheres of government to assist with the identification of the type and level of road services and to facilitate co-ordination of policy, planning, research and expenditure, and an urgent need for an inquiry to be established to examine a national scheme for funding the backlog of road maintenance at all levels.

Financial Matters

The ACLGA provided a brief interpretation of the Commonwealth's Federalism policy with its emphasis on tax sharing arrangements. It then identified the major sources of roads funds for each level of government, including a discussion on the flexibility of each funding source. Two funding issues were identified - user pay and the ability to pay.

It was pointed out that the proportion of Commonwealth road grants to fuel tax raisings and total taxes on motorists had fallen over recent years, and also that the "return" was lowest for the two most populous States. Although not supporting an increase in funds because of this, the ACLGA was concerned that a close scrutiny be kept on Australia's road network to ensure that it does not waste away from a genuine deprivation of financial resources.

Survey Results

The ACLGA pointed out a number of problems encountered in conducting and analysing their financial survey and went on to discuss the different types of situations encountered by different council groupings.

It was judged to be impractical to attempt to summarise these results for this report. In a general conclusion the ACLGA found that:

(a) in real terms local authorities had been maintaining their rating effort since 1971-72;

(b) over the same period there appears to have been a drift away from loan funding to a greater dependence on current expenditure;

(c) local government has been maintaining its road funding effort;

(d) the introduction of untied Commonwealth grants and the subsequent increases were timely and proved important in cushioning the effects of inflation between 1975 and 1977; and

(e) based on past performance local government will continue to place a high priority on roads expenditure.

OTHER ORGANISATIONS

Australian Automobile Association

The AAA stressed their position that the Commonwealth Government, despite massive taxes on motorists, has failed to provide adequate finance to the States for road construction and maintenance. The growth of car ownership and road usage, and the role of road transport led the AAA to conclude that for the foreseeable future land transport investment must continue to be dominated by road needs. Attention was drawn to losses being incurred by the nation due to recent declines (in real terms) in road funding. This has also added to the backlog of essential construction and maintenance works. The AAA further argued that greater rates of road expenditure are required to reduce Australian production costs, reduce accidents and their associated costs, conserve fuel, and reduce vehicle emissions.

The Inadequacies of Australia's Roads

Evidence was provided by way of overseas example that, despite our dependence on an extensive road network, Australia is not a leader in the provision of road transport facilities. Urban networks are inadequate, especially those catering for inter-suburban travel. Survey's of road conditions by AAA's constituent members have shown that much of the major road system is characterised by outdated standards. The Hume Highway was quoted as one example.

Road Funding in Australia

The AAA drew attention to its deep concern at historical trends in road financing. Constraints operating on local government and State Government financial sources were outlined. In regard to the Commonwealth the AAA argued that although the hypothecation of fuel taxes to road grants ceased in 1959 nevertheless there remained a strong historical link between the two. Attention was drawn to the serious drift in road funding at the Commonwealth level compared to fuel tax revenues; a situation which would only be acceptable if road funding was adequate.

A case showing that road funding is inadequate was then developed. This case was based on past work of the Commonwealth Bureau of Roads whose reports recommended road expenditure programs far greater than those financed. Whilst accepting the need for the Commonwealth Government's policy on public expenditure restraint the AAA argued this policy was inappropriate in the case of roads given the benefits from road improvements. It was further argued that increased roads expenditure would favourably influence inflation by reducing overall transport costs.

Australian Road Federation

In their reply the ARF provided comments on transport spending trends within the public sector (particularly road expenditure trends), road user taxing, unemployment arterial road development, national road development, and road maintenance. They concluded that additional Commonwealth road funding of $100 million per annum (and as a supplementary grant in 1978-79) was needed in order to reduce the roads needs backlog.

Public Sector Transport Spending

While acknowledging the need for public financial restraint the ARF argued that the reduced priority accorded to road funding by both the Commonwealth and State Governments since 1970 was inconsistent with road investment needs. The ARF pointed to the declining proportion of roads funds to total government outlays and of Gross Domestic Product over recent years, and that such levels of expenditure are insufficient to reduce the roads investment backlog of economically warranted works.

Financial Contributions of Road Users

The ARF expressed dissatisfaction over the amount of Commonwealth road grants in comparison to fuel tax revenues (expressed as proportion of automotive fuel tax, road grants in 1978-79 were estimated at 36 per cent) and stated that such a "share" should only exist if Australia's road needs were being adequately met.

Unemployment

In support of additional road funding the ARF referred to the labour intensiveness of the roads construction industry. They argued that significant reductions in unemployment would result if real roads expenditures were to be increased and that there would be beneficial flow-on effects within industries supplying the roads industry.

Urban and Rural Arterial Road Funding

It was pointed out that there are significant advantages from improving arterial roads and that these benefits should not be overlooked because of vocal oppositions from anti-freeway or resident action groups. The submission went on to argue that suggestions that under-investment-caused congestion would turn people back to public transport have been proved historically wrong. Such under-investment ignores both the predominant part played by urban arterials in the movement of goods and people, and resulting increases in fuel consumption, congestion pollution and through traffic in central business district areas if needed works are not carried out.

National Roads

While agreeing with the national road funding concept the ARF argue that insufficient funds are being provided in relation to need. It is claimed that the benefits from national roads for defence purposes and tourism development have also received insufficient emphasis.

Road Maintenance Funding

Roads maintenance expenditure must be maintained and such expenditures are cheap insurance for the maintenance of the road capital stock.

Australian Road Transport Federation

The ARTF response was in the form of a letter which outlined the adverse operating conditions currently faced by private bus operators resulting in their inability to replace buses optimally with a resultant ageing bus fleet.

The ARTF sought Commonwealth assistance by means of:

- direct grants towards the cost of new vehicles;
- special depreciation allowances;
- long term, low interest loans;
- remission of fuel tax;
- relief from sales tax on equipment, parts and maintenance; and
- reduced tariffs on new bus chassis.

It was pointed out by the ARTF that the private bus industry is responsible for 46 per cent of bus passenger transport in Australia and that public bus acquisitions are currently assisted by the Commonwealth whereas there is no such assistance available for private operators.

National Roads and Motorists Association of New South Wales (N.R.M.A.) and the Brisbane City Council

Papers were received from the National Roads and Motorists Association of NSW (NRMA) and the Brisbane City Council. Both are included in Annex 6. Although the views of each organisation were considered in the preparation of this report summaries are not included. It was felt that the major thrust of their comments were reflected in the Australian Automobile Association's and Australian Council of Local Government Association's comments. The Brisbane City Council paper is of further interest for its discussion of Brisbane bus operations.

CHAPTER 9 - CONCLUSION

INTRODUCTION

This report represents the fourth major study of roads in Australia. Earlier reports were produced by the Commonwealth Bureau of Roads in 1969, 1973 and 1975. In 1977 the Commonwealth Bureau of Roads and the Bureau of Transport Economics were amalgamated and in September 1978 the new Bureau was requested by the Minister for Transport to prepare this report. The report draws largely on investigatory and analytical work undertaken by the CBR together with more recent analyses carried out within the BTE.

RECENT TRENDS

Road Use

Chapters 2 and 3 of ths report examined recent trends in roads usage and the condition of the roads network. It was found that:

- between 1964 and 1977:
  - vehicle numbers had increased at an average rate of 5.0 per cent per annum;
  - total vehicles per 1000 persons had grown at 3.2 per cent per annum;
  - total vehicle-kilometres of travel had grown at an average rate of 6.7 per cent per annum; and
- between 1962 and 1976 the average annual rate of increase in road use was 7.5 per cent in terms of passenger-kilometres and 6.2 per cent in terms of tonne-kilometres.

Between 1969 and 1977 a marked and continuous decrease in the number of persons injured and killed per kilometre travelled was observed.

Future demand for road travel and usage was estimated by projecting population, and forecasting per capita vehicle ownership and annual vehicle travel. For the rest of this century population was predicted to grow at 1 per cent per annum, vehicle numbers at just over 3 per cent per annum and total vehicle-kilometres of travel at 4.4 per cent per annum.

Road Conditions

Changes in the road network as a result of expenditures on roads between 1974-75 and 1978-79 (estimated to be $8859 million in nominal terms or $10259 million in 1978-79 prices) were assessed for the national highway and rural arterial road systems. In 1977 these systems carried 29 per cent of all road traffic in Australia and over the period 1974-75 to 1978-79 they attracted about 29 per cent of roads construction expenditure.

Over the period 1974 to 1979 estimated travel on the national highways and rural arterial road systems increased from 25 363 to 32 482 million vehicle-kilometres; a rate of growth of 8.6 per cent per annum.

Over this same period 960 kilometres of the declared national highways system was sealed and a further 150 kilometres was upgraded to dual-carriageway standard. By 1977, 2990 kilometres of the 16 275 kilometre system remained to be sealed.

Although, overall, the proportion of the national highways system which was deficient in terms of the declared engineering design standards only fell from 94 per cent to 90 per cent, this is more a reflection of staging of construction towards the ultimate standards (and the ultimate standards themselves) rather than an accurate indication of the rate of progress in upgrading the quality of the road system.

From 1974 to 1977, 884 kilometres of the rural arterial system was sealed, and as at 1977, some 75 per cent of the combined national highway and rural arterial system of 111 793 kilometres had been sealed. Across States this proportion varied from 68 per cent in the case of New South Wales to 97 per cent in Victoria.

There was little change in deficiencies in terms of engineering standards, on the rural arterial system, over the three year period. However, this concealed considerable variation across States with the proportion of rural arterial road deficiencies increasing in New South Wales and South Australia and falling in Victoria, Queensland, Western Australia and Tasmania.

Although it is not possible to estimate changes in conditions on the urban arterial system from the available data, travel on these roads increased by about 8.4 per cent per annum over the three year period from 1974 to 1977. By 1977 such travel amounted to 52 595 million vehicle-kilometres per year or about 62 per cent of all travel on arterial roads and 48 per cent on all road travel in Australia. Urban arterial roads accounted for just over 20 per cent of total road construction expenditure in the period 1974-75 to 1978-79.

Because of data limitations, no assessment was possible of the effects of expenditure on the local road categories. However, it may be noted that, although rural and urban local roads carry only 23 per cent of total traffic, these categories accounted for about 47 per cent of total construction expenditure.

Expenditure on Roads

Total estimated expenditure on the Australian road system from all sources increased from $1363 million in 1974-75 to $2139 million in 1978-79, an average rate of 11.9 per cent per annum. Growth in expenditure in real terms was considerably lower at 2.7 per cent per annum (as compared to a virtually constant level of real expenditure for the preceding five years).

Within this overall real rate of growth, the allocation of resources to the national highway and rural arterial road systems increased at rates of 7.8 and 6.9 per cent per annum respectively, or about three times the average, whereas expenditure on local roads increased at slightly less than the average rate. The level of resources devoted to the urban arterial road system actually fell in the first two years of the period, recovering somewhat in the last three, but still only reaching a level some 15 per cent below the level of 1974-75.

Maintenance expenditure in real terms increased at a rate of 3.4 per cent per annum, some 26 per cent above the average rate.

Thus allocative trends within the roads sector have tended to direct resources to national highways and rural arterial roads as against urban arterial roads and both categories of local roads. These trends are shown in Figures 6.1 to 6.5.

From 1974-75 to 1978-79 there was a considerable shift in the relative contributions of the three levels of government to expenditure on roads. Over this period Commonwealth Government contributions fell in real terms by about 6 per cent. This was offset by an increase in State sourced road funding of 39 per cent in real terms. Local government sourced expenditure in real terms increased by 7.3 per cent which is nevertheless lower than the overall increase in expenditure for the sector of 12 per cent.

The effect of the reduction in real expenditure by the Commonwealth was concentrated on the urban arterial road systems and to a lesser extent rural local roads. A high growth rate of Commonwealth funding of national highways and urban local roads was maintained. State Governments reacted to offset this pattern, achieving very high rates of growth in funding rural and urban arterial and rural local roads and slackening their effort somewhat in the case of urban local roads.

In summary, the last five years have seen an accelerated State funding of road expenditures which has offset the decreasing Commonwealth allocation. This has been associated with a fairly rapid growth of expenditure on national highways and rural arterial roads and a little below average growth in the local road categories. However, real expenditure on the urban arterial systems failed to reach levels ruling in 1974-75.

In comparing the levels of resources allocated to, and within, the roads sector over the last five years with the warranted and recommended programs for the same period, it appears that, in real terms, realised total expenditure was some 15 per cent less than the amount assessed as warranted but 4 per cent greater than the recommended program.

Total construction expenditure, in real terms, fell short of that assessed as warranted by 28 per cent. The shortfall ranged from 4 per cent in the case of rural local roads to 66 per cent for urban arterial roads. Expenditure on urban local roads exceeded the warranted figure by 139 per cent. Maintenance expenditure, in real terms, exceeded the CBR estimate by 51 per cent. A similar pattern emerges in comparison with the recommended program, although in this case the realised level of total construction expenditure was only 5 per cent below the recommended level and expenditure on both local road categories exceeded it.

The general result of this analysis is to indicate that the actual allocation of resources to roads was somewhat greater than that recommended by the CBR and not greatly less than the warranted program. However, these resources were allocated significantly more to maintenance expenditure than foreseen by the Bureau. Within the construction program more resources were allocated to local roads than the CBR analysis suggested was economically warranted. These results are set out graphically in Figure 9.1, together with the warranted program developed in Chapter 5.

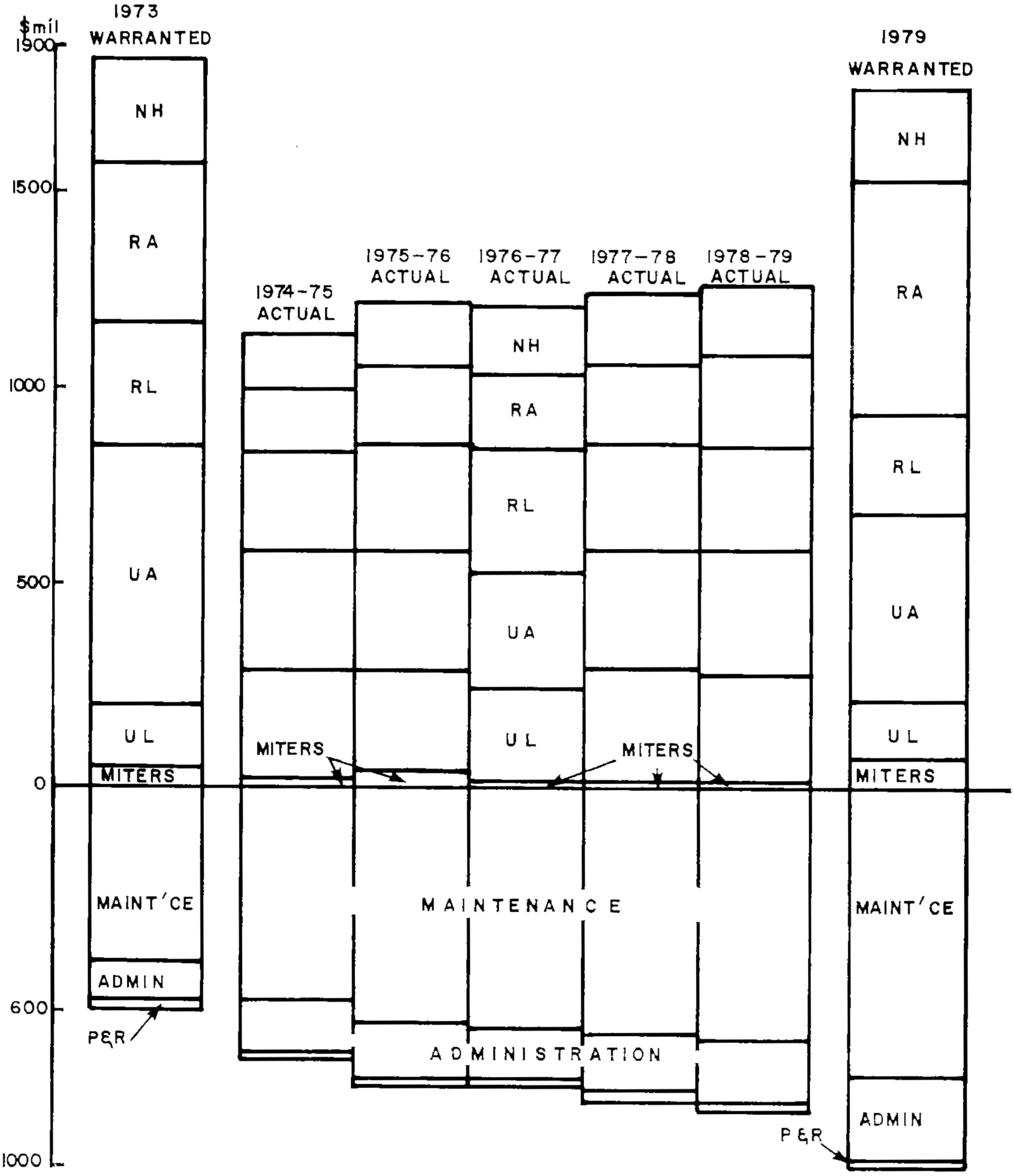

FIGURE 9·1

WARRANTED AND ACTUAL EXPENDITURE ON ROADS (a)

(a) Comparison by category of 1973 Warranted, 1974-75 to 1978-79 Actual, 1979 Warranted. 1978-79 Prices

Across the States and Territories, real expenditure in New South Wales, Western Australia, Tasmania and the A.C.T. exceeded the recommended program by 10 per cent, 9 per cent, 12 per cent and 168 per cent, respectively. Expenditure in Victoria and Queensland was almost exactly the recommended level while expenditure in South Australia fell short by 8 per cent.

The main sources of these variations were high levels of expenditure on local roads in New South Wales and Victoria; on national highways and urban local roads in South Australia; on rural arterial and local roads in Western Australia and on rural local roads in Tasmania. Rates of expenditure were considerably lower than warranted on rural arterial roads in Victoria and on rural local roads in Queensland and South Australia.

The fact that the warranted program as assessed was not achieved has implications for the efficient distribution of resources within the road sector between States and categories. An analysis based on redistribution of warrants constrained by the total levels of construction expenditure actually achieved for the national highways, arterial and rural local road categories suggested an over-allocation of resources to all States except Queensland. This effect was most pronounced in the case of Tasmania. Across categories, the analysis indicated that, given a constrained total budget and setting aside constraints on substitutability between categories (and sources of funds), too great a level of resources, in terms of pure economic efficiency, has been directed to rural local roads at the expense of national highways and rural and urban arterial roads.

In summary, the analyses of trends in expenditure on roads from 1974-75 to 1978-79 indicated that total road expenditure had grown in real terms despite a continuing decline in the real level of Commonwealth funding. Although the total level of resources allocated to roads exceeded the recommended program assessed by the CBR in 1973, this mainly resulted from higher than projected expenditure on maintenance. Real expenditure on national highways and rural arterial roads increased considerably, but there was evidence that, in terms of economic efficiency, insufficient resources were allocated to these categories and urban arterial roads in comparison to local roads, and to Queensland as a whole in comparison to the other States.

ROAD EXPENDITURE 1979-80 TO 1982-83

Engineering Needs and Warranted Expenditure

Total road expenditure needs to meet engineering standards (excluding planning and research and general administration) for the period 1977-78 to 1983-84 were assessed (in 1978-79 prices) at $27 995 million for construction and $5183 million for maintenance; a total of $33 178 million.

This represents an increase of some 9.5 per cent on the 1975 estimate for engineering needs covering the period 1974-75 to 1980-81.

Economically warranted road expenditure over the period 1977-78 to 1983-84 was estimated at $17 775 million (excluding general administration and planning and research; 1978-79 prices). This represents an increase of 18 per cent over the seven year warranted program for the period 1974-75 to 1980-81 as reported by the CBR in 1975.

A total level of expenditure on roads of $11 288 million (1978-79 prices) was estimated to be economically warranted over the four year period 1979-80 to 1982-83, an increase of 35 per cent over the estimated actual expenditure of $8338 million (1978-79 prices) achieved during the previous four year period. Attainment of such a program would require a 16.1 per cent per annum growth in roads expenditure in real terms over the four year period.

Table 9.1 sets out the results of the evaluations referred to above by category.

TABLE 9.1 - COMPARISON OF ENGINEERING NEEDS AND WARRANTED PROGRAMS
($ MILLION, 1978-79 PRICES)

Category of expenditure	Engineering Needs 1977-78/1983-84	Warranted program		Estimated expenditure four years 1975-76/1978-79
		1977-78/1983-84	1979-80/1982-83	
Construction				
National highways	2 036	1 704	980	789
Rural arterial roads	7 259	4 127	2 446	883
Rural local roads	10 518	1 882	1 001	1 296
Urban arterial roads	5 473	3 376	2 010	1 102
Urban local roads	1 936	1 015	304	1 297
MITERS	773	488	318	86
Maintenance	5 183	5 183	3 214	2 828
TOTAL	33 178 (a)	17 775 (a)	10 273 (a)	8 281 (b)

(a) Excludes planning and research and general administration.

(b) Includes general administration, excludes planning and research. Exclusion of general administration would reduce the total by some $650 million.

1979-80 to 1982-83: Alternative Roads Programs

The effects that various total road expenditure budgets would have on economically warranted expenditure at the category and State level, and the effects such variations would have on road user benefits (and costs) were examined in Chapter 7. The effect of the program size variations on industries supplying the roads industry were also examined. Five alternative programs, ranging from 100 per cent to 80 per cent of the warranted program, were considered. Table 9.2 sets out these alternatives together with the projections made from past levels of expenditure and the program developed by the capital-output ratio method.

From Table 9.2 it can be seen that the capital-output ratio estimate of 1979-80 to 1982-83 road expenditure needs results in a program totalling 94.3 per cent of the warranted program for the period. The projections of recent total funding levels and of constant price trends produce four year total expenditures of 85.7 per cent and 81.3 per cent of the warranted program, respectively.

The assessment of the economically efficient allocation of the five alternative levels of expenditure was limited to the four road categories for which the requisite data were available.

The general effect of reducing the total expenditure available to the roads program was to increase the proportionate warrant for national highways and rural arterial roads at the expense of rural local roads. The proportionate share of urban arterial roads remained approximately constant. These relationships are shown in Figure 7.1.

Thus, in terms of economic efficiency, the analysis showed that reduction of the total roads budget below the warranted program tends to increase the warrant of arterial roads at the expense of the rural local road category. However, it is important to bear in mind that there may be other important considerations in

TABLE 9.2 - ALTERNATIVE FUTURE ROAD PROGRAMS

($ MILLION, 1978-79 PRICES)

Program[a]	Average annual growth rate	1979-80	1980-81	1981-82	1982-83	Total
	%					
100 per cent of warranted	16.1	2 225	2 583	2 998	3 482	11 288
95 per cent of warranted	12.6	2 225	2 505	2 821	3 177	10 728
90 per cent of warranted	8.9	2 225	2 423	2 638	2 873	10 159
85 per cent of warranted	5.0	2 225	2 337	2 453	2 576	9 591
80 per cent of warranted	1.0	2 225	2 247	2 270	2 203	9 035
Capital-output program	11.6	2 125	2 722	2 841	2 952	10 640
Financial projection	5.7	2 225	2 348	2 480	2 624	9 677
Constant price projection	2.8	2 200	2 262	2 325	2 391	9 178

(a) Including maintenance, planning and research and general administration.

addition to economic efficiency, relating to decisions to invest in access or local roads. Thus, it may be desirable to analyse both urban and rural local road categories separately from arterial roads.

This conclusion is reinforced by the analyses carried out in Chapters 5 and 6 in respect of the development of the 1979-80 to 1982-83 warranted program and the comparison of recent expenditure to the 1974-75 to 1978-79 warranted program. These showed that expenditure in the two local roads categories often exceeds the economically warranted level. It is clear that, within the road sector, and given the current pattern of resource allocation, direction of resources to the arterial categories would appear to provide the highest economic return to the community as a whole.

For this reason the effects of constraining the arterial roads budget were examined. The results demonstrated fairly clearly that the relative warrants of arterial road categories are not particularly sensitive to the total level of expenditure available on these roads.

The effect of reducing the warranted program on costs and benefits is shown in Table 9.3.

Inter-sectoral Economic Impact

By combining the results of two modelling procedures - one relating to industry output forecasts in the medium term and the second an input-output matrix, the effects of alternative road budgets for the four year period 1979-80 to 1982-83 on selected key industries and the labour force were estimated. The results are reported in Chapter 7 and Annex 4 and summarised in Table 9.4.

The greatest effect of changes in the road budget was on the quarry materials industry since some 50 per cent of this industry's output is absorbed by the road construction industry. Similar

TABLE 9.3 - COSTS AND BENEFITS OF ALTERNATIVE ROAD CONSTRUCTION BUDGETS[a] 1979-80 TO 1982-83

($ MILLION, 1978-79 PRICES)

Item	Proportion of warranted program				
	100%	95%	90%	95%	80%
Construction expenditure[b]	5 285	4 906	4 518	4 133	3 748
% change	-	-7.2	-7.9	-8.5	-9.3
Total benefits[b]	16 695	16 229	15 695	15 114	14 461
% change	-	-2.8	-3.3	-3.7	-4.3
Average BCR[c]	3.16	3.31	3.47	3.66	3.86
% change	-	4.8	4.8	5.5	5.5
Incremental BCR[d]	-	1.23	1.38	1.51	1.70

(a) Excludes expenditure on construction for urban local roads and MITERS: excludes maintenance, planning and research and general administration.

(b) Discounted to 1979-80 value using a 10 per cent discount rate.

(c) Total benefits divided by total construction costs; BCR = benefit-cost ratio.

(d) The difference in benefits between program levels divided by the difference in construction costs between program levels.

percentages for the other industries are petroleum (Australia oil) industry 5 to 7 per cent, imported oil industry 11 to 14 per cent, ready-mixed concrete industry 9 to 13 per cent and concrete products industry 11 to 17 per cent.

Forty-two per cent of direct inputs to the roads construction industry are in the form of direct labour with a further 20 per cent in the form of indirect labour. On the basis of trends observed between 1954 and 1972, which may overstate future productivity gains, an annual real increase in total roads expenditure of from 2.3 to 2.8 per cent per annum would be associated with a constant labour force over the period of analysis. Put another way, and as a descriptive statement only, this means that a program of approximately 82 per cent of the warranted program would result in a constant road industry labour force.

TABLE 9.4 - ROAD CONSTRUCTION INDUSTRY REQUIREMENTS[(a)]: BY SUPPLYING INDUSTRY (PROPORTION OF TOTAL INDUSTRY OUTPUT: %)

Year	Supplying Industry									
	Quarry Materials		Petroleum Products (Australian oil)		Petroleum Products (Imported oil)		Ready Mixed Concrete		Concrete Products	
Warranted Program Level	80%	100%	80%	100%	80%	100%	80%	100%	80%	100%
1979-80	50.7	50.7	5.2	5.2	10.7	10.7	8.9	8.9	12.1	12.1
1980-81	49.8	53.5	5.0	5.8	10.8	11.8	8.5	9.8	11.7	13.4
1981-82	49.6	57.1	4.9	6.4	10.8	13.0	8.5	11.5	11.6	15.3
1982-83	49.0	60.3	4.8	7.2	11.0	14.4	8.4	13.1	11.4	17.2

(a) Direct and indirect requirements.
Source: BTE Estimates.

ANNEX 1

NATIONAL HIGHWAYS SYSTEM INVENTORY ANALYSIS

INTRODUCTION

The declared national highways system has been assessed in terms of conditions, as at June 1977, relative to national highway design standards. The 1977 Update Survey has been used for this assessment. The national highways system was considered to be deficient on those sections not to standard in seal or gravel width, structural condition, surface type and travel speed capability.

The deficiency analysis provides a guide as to the current state of the national highways system when compared with the design standards for this system. The analysis does not, by itself, indicate sections which are deficient to the extent that road works are either warranted or necessary to provide safe and efficient road conditions. For example, the final section of the Eyre Highway was recently sealed to a width of 6.8 metres. Although a width of seal for this section of 7.4 metres is specified in the design standards, this section of road is not in need of reconstruction, nor it is likely to be over the period 1977-84. That is, although considerate work has been undertaken to improve the standard of this segment of the national highways network, the segment remains deficient with respect to the design standards. This applies to other segments where expenditures have been recently made.

The minimum seal or gravel width required by the design standards is 7.4 metres per carriageway except for the segments Woomera (Pimba) to Alice Springs and Derby Turn-off to Wyndham Turn-off (Victoria Highway Junction) where reduced widths of 6.7 metres and 6.2 metres respectively are allowable. A single two-lane carriageway is specified for all but the Sydney-Melbourne link, the Canberra connections and for the link segments Sydney to

Scone, Warwick to Brisbane, Melbourne to Ballarat, Murray Bridge to Adelaide, Adelaide to Two Wells, Northam to Perth, Brisbane to Toowoomba, Adelaide River to Darwin, Perth to Muchea, Brisbane to Gympie and Latrobe to Burnie. For these a dual carriageway, with each carriageway of two lanes, is the required standard.

The structural condition of the roadway is considered satisfactory if the structure is sound until at least the end of the assessment period, that is, until June 1984. A surface type of bituminous seal or better and a safe travel speed capability of the legal maximum speed (100 kph) is required.

For the purposes of assessment and reporting, the national highways system has been broken into ten links. These links have been further divided into segments. The following link reports consist of Descriptive, Quantitative and Deficiency Analysis Tables together with brief written reports. These reports summarise the data in the tables in terms of segment traffic volumes (in Average Annual Daily Traffic (AADT) flows), deficiencies in width, structure and surface type and overall deficiencies relative to June 1977 conditions and indicate areas where major reconstruction has been undertaken between June 1974 and June 1977.

LINK REPORTS

Sydney-Melbourne Link

The Hume Highway is the declared national highway connecting Sydney and Melbourne. It is planned to construct the Hume Highway to the declared national highway standard of a four-lane divided carriageway.

(a) Sydney to Mittagong:
This section of road is subjected to high rural traffic volumes which are in excess of 4000 vehicles per day[1] (vpd) over the

(1) Vehicles per day statistics throughput relate to average annual daily traffic (AADT) volumes.

entire length with 18 per cent of the length carrying over 15 000 vpd. The existing highway is now dual carriageway and to width standard for 32 per cent of the length. The remainder is single carriageway. Three kilometres of the divided highway are assessed as being structurally deficient.

Significant new work has been completed on the South Western Freeway since 1974 which has resulted in a distance saving of three kilometres. This construction work has decreased the percentage of deficient roadway on this segment from 96 per cent in 1974 to 75 per cent.

(b) Mittagong to Federal Highway Junction:
Traffic volumes in excess of 4000 vpd occur over the entire length of this segment. The highway is currently divided and to width standard over 20 per cent of the segment, however almost all of this divided carriageway has been assessed as being structurally deficient.

No major construction work has been undertaken on this segment since the 1974 survey. The segment is deficient principally because the roadway is mostly single carriageway. There has been a large increase in the length of road which has become structurally deficient over the last three years. The segment is still 99 per cent deficient.

(c) Federal Highway Junction to Barton Highway Junction:
On 52 per cent of this section traffic is in excess of 4000 vpd. The road is totally deficient since it is only a single carriageway.

Some reconstruction has occurred on this segment which has reduced structural deficiency from 90 per cent in 1974 to 66 per cent. The work was not a duplication project and thus the segment remains totally deficient overall.

(d) Barton Highway Junction to Sturt Highway Junction:
Traffic is in excess of 4000 vpd over 76 per cent of the length of this segment. Only 9 per cent of the segment is divided and to width standard with the remainder being single carriageway.

Although a minor duplication project has been completed since 1974, the original carriageway, which constitutes one side of the current divided highway sections, has been assessed as being structurally deficient. Thus the segment is 100 per cent deficient which is an increase from 98 per cent in 1974.

(e) Sturt Highway Junction to Albury:
Traffic on this segment is generally in the range 2201-4000 vpd. This is the most lighly trafficked segment on the link. The highway is divided and to width standard over 14 per cent of the length, however again the majority of this divided section is structurally deficient.

On this segment there has been some major duplication work carried out since 1974. However this work has not reduced the overall deficiency by as much as might be expected because of structural deficiency occurring on the divided highway which existed in 1974. There has been a small achievement in reducing overall deficiency on this segment from 100 per cent to 97 per cent.

(f) Albury to Wangaratta:
This section of road is trafficked by more than 4000 vpd over its entire length with in excess of 15 000 vpd on 5 per cent of its length. Only 3 per cent is divided and to width standard with the remainder being single carriageway of poor structural standard.

There has been a minor duplication project on this segment which has reduced the overall deficiency slightly from 99 per cent to 97 per cent.

(g) Wangaratta to Benalla:
Traffic is in excess of 4000 vpd over the entire length with 4 per cent carrying more than 15 000 vpd. The single carriageway is totally width deficient and of poor structural condition.

No significant new work has been undertaken on this segment since 1974. As in 1974, this segment is totally deficient.

(h) Benalla to Euroa and Euroa to Seymour:
This section of road is trafficked by more than 4000 vpd over the whole length. The single carriageway is totally width deficient and of poor structural condition.

No significant new work has been undertaken on this section since 1974, and this section remains totally deficient.

(i) Seymour to Broadford:
On this segment traffic is in excess of 15 000 vpd on 10 per cent of its length and is over 4000 vpd on the remainder. The highway has been duplicated to width standard for 89 per cent of its length. However 72 per cent of the segment is structurally deficient as was the case in 1974.

No significant work has been undertaken on this segment in the past three years. The segment is 83 per cent deficient overall which is almost totally due to structural deficiency.

(j) Broadford to Melbourne:
Traffic is in excess of 15 000 vpd on 3 per cent of the length of this segment with over 4000 vpd on the remainder. The whole length is divided and to width standard, however since 1974 structural deficiency has increased from 22 per cent to 61 per cent indicating that a large portion of the divided highway has at least one carriageway which is old in terms of structural condition.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

SYDNEY-MELBOURNE LINK

Segment	Length (Km)	Surface Type: Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	General Terrain: Flat	Undulating	Hilly	Mountainous	Land Use: Town	Rural	No. of Structures: Bridge	Culvert	Other	Rail Crossing
Hume Highway																	
201A Sydney-Mittagong	85				100				62	38		12	88	24	10		1
201B Mittagong-Federal Highway	100				62	37	1	3	76	21		15	85	31	21		1
202A Federal Hwy.-Barton Highway	68				74	26			70	30		2	98	13	10		
203A Barton Hwy.-Sturt Highway	143				82	18		10	27	63		9	91	33	16		4
204A Sturt Hwy.-Albury	148				90	10		11	67	22		7	93	39	45		1
302D Albury-Wangaratta	71				98	2		80	20			7	93	19	6		2
302C Wangaratta-Benalla	40				96	4		84	16			16	84	13	2		1
302B Benalla-Euroa	42				100			100				7	93	17	5		
302A Euroa-Seymour	55				100			56	44			9	91	11	4		1
301B Seymour-Broadford	18				100				100				100	13			1
301A Broadford-Melbourne	56				68	32		38	62				100	7	1		
TOTAL	826				86	14	-*	26	50	24		8	92	220	120		12

* Less than 1%.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

SYDNEY-MELBOURNE LINK

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Hume Highway																							
201A Sydney-Mittagong	85						82	18	28					14	14	22	22			27	4	33	8
201B Mittagong-Federal Hwy.	100						100		37	2					3	19	39			2	2	43	14
202A Federal Hwy.-Barton Hwy.	68					48	52							21	62	5	12			21	12	55	12
203A Barton Hwy.-Sturt Highway	143					24	76		5				1	30	33	10	21			24	8	50	13
204A Sturt Hwy.-Albany	148					91	7	2	7	3				8	26	21	35			5	5	73	7
302D Albury-Wangaratta	71						95	5	2	5				2		89	2					91	2
302C Wangaratta-Benalla	40						96	4		4					88		8					92	4
302B Benalla-Euroa	42						100								77	19	4					96	4
302A Euroa-Seymour	55						100		3						3	94						91	6
301B Seymour-Broadford	18						90	10	82						18							18	
301A Broadford-Melbourne	56						97	3		100													
TOTAL	826					25	72	3	12	8			-*	10	26	25	19			10	4	58	8

* Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

SYDNEY-MELBOURNE LINK

Segment	1974					1977					Percentage Change in Deficiency
	Total Length (Km)	Length Structurally Deficient (Km)	Length Width Deficient (Km)	Overall Length Deficient (Km)	Percentage of Total Length Deficient	Total Length (Km)	Length Structurally Deficient (Km)	Length Width Deficient (Km)	Overall Length Deficient (Km)	Percentage of Total Length Deficient	
Hume Highway											
201A Sydney-Mittagong	88	23	80	85	96	85	20	58	61	75	- 21
201B Mittagong-Federal Highway	100	35	80	99	99	100	50	80	99	99	
202A Federal Hwy.-Barton Highway	68	61	68	68	100	68	45	68	68	100	
203A Barton Highway-Sturt Highway	143	90	137	140	98	143	102	135	143	100	+ 2
204A Sturt Highway-Albury	148	94	137	148	100	148	88	127	143	97	- 3
302D Albury-Wangaratta	71	58	70	70	99	71	58	69	69	97	- 2
302C Wangaratta-Benalla	40	33	40	40	100	40	34	40	40	100	
302B Benalla-Euroa	42	16	42	42	100	42	16	42	42	100	
302A Euroa-Seymour	55	20	55	55	100	55	19	55	55	100	
301B Seymour-Broadford	18	13	2	15	83	18	13	2	15	83	
301A Broadford-Melbourne	60	13	38	41	68	56	34		34	61	- 7
TOTAL	833	456	749	803	96%	826	479	676	769	93%	- 3%

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

CANBERRA CONNECTIONS

Segment	Length (Km)	Surface Type						General Terrain				Land Use		No. of Structures			
		Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	Flat	Undulating	Hilly	Mountainous	Town	Rural	Bridge	Culvert	Other	Rail Crossing
Federal Highway																	
214A Hume Highway-ACT Border	68				100				93	7			100	11	20		
901A ACT Border-Canberra	5				100				33	67			100		2		
TOTAL	73				100				89	11			100	11	22		
Barton Highway																	
215B Hume Highway-ACT Border	37				65	35			95	5		4	96	10	9		
902B ACT Border-Canberra	3				100				100				100	3			
TOTAL	40				68	32			96	4		4	96	13	9		

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

CANBERRA CONNECTIONS

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Federal Highway																							
214A Hume Highway-ACT Border	68						100			2			10	64	7	10	7			72	7	12	7
901A ACT Border-Canberra	5						100							67		33					67	33	
TOTAL	73						100			2			9	65	6	12	6			68	11	13	6
Barton Highway																							
215A Hume Highway-ACT Border	37					100								39	52		9		38	8	4	50	
902A ACT Border-Canberra	3						100									50	50					100	
TOTAL	40					92	8							36	48	4	12		35	7	4	54	

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

CANBERRA CONNECTIONS

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Federal Highway											
214A Hume Hwy-ACT Border	68	58	64	68	100	68	63	60	68	100	
901A ACT Border-Canberra	5		5	5	100	5		5	5	100	
Barton Highway											
215A Hume Hwy-ACT Border	37	29	35	37	100	37	23	35	37	100	
902A ACT Border-Canberra	3		3	3	100	3		3	3	100	
TOTAL	113	87	107	113	100%	113	86	103	113	100%	

The Hume Freeway now extends to Broadford and has shortened the 1974 distance by four kilometres.

Canberra Connections

The Federal and Barton Highways link Canberra with the Hume Highway (the Sydney-Melbourne link). The Canberra connections are planned to be upgraded to four-lane divided carriageways of full national highway standard.

(a) Federal Highway from Hume Highway to Canberra:
The Federal Highway carries traffic volumes in the range 4001-15 000 vpd. Only 11 per cent of the highway is of sufficient width, being mostly single carriageway, and 80 per cent is structurally deficient.

Since 1974, four kilometres of road has been upgraded to full standard; however, there has been an increase of five kilometres in the length of structurally deficient road over the same period and the highway is still 100 per cent deficient. This would indicate that the original carriageway of new duplicated section is structurally deficient.

(b) Barton Highway from Hume Highway to Canberra:
The Barton Highway carries traffic volumes in the range 2201-4000 vod over 90 per cent of its length with traffic being in excess of 4000 vpd on the remainder. Only five per cent of the highway is of sufficient width being mostly a single carriageway facility. Over 50 per cent of the highway is structurally deficient.

Reconstruction of pavement has been undertaken on six kilometres of highway since 1974 but this work was not to full standard. The Barton Highway is still 100 per cent deficient.

Sydney-Brisbane Link

A number of highways join together to provide the declared national highway connecting Sydney and Brisbane. From Sydney to Newcastle the declared route follows the Newcastle Expressway which merges with the Pacific Highway at Ourimbah. From Newcastle to Warwick the route follows the New England Highway and then the Cunningham Highway from Warwick to Ipswich. The recently commenced Southern Ipswich Bypass has not been included in the inventory.

Two national highway standards apply to this link. Between Sydney and Scone and between Warwick and Ipswich, the declared National Highway standard is for a four-lane divided highway. The remainder of the link is required to be a 7.4 metre wide single carriageway.

(a) Sydney to Ourimbah:
Traffic on this segment is in excess of 4000 vpd on the entire length and on 45 per cent is in excess of 15 000 vpd. The highway is divided and to width standard over 47 per cent of the segment and the entire length is structurally sound.

There has been an extension to the divided highway of five kilometres which has reduced the total length of the segment by two kilometres since 1974. This construction has reduced the overall deficiency from 60 per cent to 53 per cent.

(b) Ourimbah to Swansea:
On 66 per cent of this segment traffic is in excess of 15 000 vpd with the remainder carrying in excess of 4000 vpd. The segment is totally width deficient with most of the road being single carriageway only. The pavement is mostly structurally sound.

There has been no significant new work on this segment. The segment remains 100 per cent deficient.

(c) Hexham to Singleton:
On the entire length of this segment traffic is in excess of 4000 vpd and 18 per cent of the length carries greater than 15 000

vpd. Only 12 per cent of the highway is to width standard with the remainder being mostly single carriegway. One third of the segment is structurally deficient.

Since 1974 there has been some minor duplication projects covering two kilometres which have reduced overall deficiency by 3 per cent to 88 per cent.

(d) *Singleton to Scone:*
Traffic on this segment falls within the range, 4001-15 000 vpd. The highway is totally width deficient. It is single carriageway except for 12 kilometres which is divided but substandard in width. Some 25 per cent of the segment is structurally deficient.

No significant new work has been undertaken on this segment since 1974. The segment is still 100 per cent deficient.

(e) Scone to Glen Innes:
Traffic on 80 per cent of the segment is less than 4000 vpd. The single carriageway segment is 63 per cent deficient in width and 25 per cent is structurally deficient.

Major reconstruction has been undertaken on this segment in the last three years. This work has reduced width deficiency by fifty-four kilometres and overall deficiency by 81 kilometres. Thus twenty-seven kilometres of road which was deficient in structure only was reconstructed in this work. The overall deficiency has been substantially reduced from 89 per cent to 65 per cent during this period.

(f) Glen Innes to State Border:
On 80 per cent of this segment traffic is less than 2201 vpd. The single carriageway segment is 90 per cent deficient in width and over 50 per cent is structurally deficient.

Since 1974 there has been some reconstruction which has reduced structural deficiency by twelve kilometres and width deficiency by

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

SYDNEY-BRISBANE LINK

Segment	Length (Km)	Surface Type: Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	General Terrain: Flat	Undulating	Hilly	Mountainous	Land Use: Town	Rural	No. of Structures: Bridge	Culvert	Other	Rail Crossing
Newcastle Expressway and Road 26																	
211A Sydney-Ourimbah	58					100				100		3	97	13			
Pacific Highway																	
212A Ourimbah-Swansea (City of Newcastle)	42				8	92			85	15		12	88	11	8		
New England Highway																	
236A Hexham-Singleton	66				63	37		14	86			46	54	19	15		
237A Singleton-Scone	70				91	9			88	12		11	89	31	26		1
237B Scone-Glen Innes	340				99	1			64	33	3	10	90	90	47	6	2
237C Glen Innes-Qld. Border	110				100				92	7	1	4	96	36	1		
419A Qld. Border-Warwick	98				100				90	10		9	91	12	9		3
Cunningham Highway																	
408A Warwick-Ipswich	118				99	1		4	85	10	1	3	97	12	12		
TOTAL	902				85	15		2	73	24	1	11	89	224	118	6	6

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

SYDNEY-BRISBANE LINK

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Newcastle Expressway and Road 26																							
211A Sydney-Ourimbah	58						55	45	6	43				3	19	29					11	23	17
Pacific Highway																							
212A Ourimbah-Swansea (City of Newcastle)	42						34	66	8				4	4	38	12	34		4	19	19	38	12
New England Highway																							
236A Hexham-Singleton	66						88	12	7	7				2	32	20	32				24	47	15
237A Singleton-Scone	70						100		15	2				5	21	34	23			7	30	39	7
237B Scone-Glen Innes	340				38	40	21	1		1			1	30	20	12	36		3	38	17	37	4
237C Glen Innis-Qld. Border	110				81	15	4						7	29	36	15	13		25	31	31	10	3
419A Qld. Border-Warwick	98				87	13			2					39	46	5	8			13	70	13	2
Cunningham Highway																							
408A Warwick-Ipswich	118				15	75	10		3					67	13	13	4			33	32	29	3
TOTAL	902				36	28	29	7	3	4			1	29	26	15	22		4	25	28	30	6

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

SYDNEY-BRISBANE LINK

Segment	1974					1977					Percentage Change in Deficiency
	Total Length (Km)	Length Structurally Deficient (Km)	Length Width Deficient (Km)	Overall Length Deficient (Km)	Percentage of Total Length Deficient	Total Length (Km)	Length Structurally Deficient (Km)	Length Width Deficient (Km)	Overall Length Deficient (Km)	Percentage of Total Length Deficient	
Newcastle Expressway											
211A Sydney-Ouribmah	60		36	36	60	58		31	31	53	- 7
Pacific Highway											
212A Ourimbah-Swansea	42	5	42	42	100	42	12	42	42	100	
New England Highway											
236A Hexham-Singleton	66	21	60	60	91	66	23	58	58	88	- 3
237A Singleton-Scone	70	16	70	70	100	70	17	70	70	100	
237B Scone-Glen Innes	340	77	267	303	89	340	88	213	222	65	-24
237C Glen Innes-State Border	110	72	101	106	96	110	60	99	103	94	- 2
419A State Border-Warwick	98	61	87	89	91	98	94	86	98	100	+ 9
Cunningham Highway											
408A Warwick-Ipswich	118	103	118	118	100	118	91	118	118	100	
TOTAL	904	355	781	824	91%	902	385	717	742	82%	- 9%

two kilometres. This has caused an overall reduction in deficiency of three kilometres. This segment is now 94 per cent deficient overall compared to 96 per cent in 1974.

(g) State Border to Warwick:
Traffic on 87 per cent of the segment is less than 2201 vpd. Only 12 per cent of the single carriageway is up to width standard and almost all the pavement structure is deficient. All of the carriageway which is not width deficient is structurally deficient.

No significant work has been undertaken on this segment since 1974. However there has been a substantial increase in structural deficiency which has resulted in an increase in overall deficiency from 91 per cent to 100 per cent at present.

(h) Warwick to Ipswich:
This segment carries traffic volumes below 4000 vpd over 90 per cent of its length; some 15 per cent of the total length carries less than 2201 vpd. The entire length is deficient with regard to width, including some four kilometres of divided carriageway. Most of the roadway is structurally deficient.

Some reconstruction has been undertaken. This has reduced by about eight kilometres the amount of road below standard with regard to structure but has not reduced width deficiency. This segment is still 100 per cent deficient overall.

Melbourne-Adelaide Link

Three highways form the declared national highway route connecting Melbourne and Adelaide. From Melbourne the Western Highway extends to the State border where it joins the Dukes Highway which becomes the Princes Highway at Tailem Bend. The Princes Highway continues on to Adelaide.

Two national highway design standards apply to this link. Between Melbourne and Ballarat and between Murray Bridge and Adelaide the standard is for a four-lane dual carriageway facility. The standard for the remainder is a two-lane single carriageway of 7.4 metre width.

(a) Melbourne to Bacchus Marsh:
On this segment traffic volumes are in the range 4001-15 000 vpd. Divided highway of standard width extends for 77 per cent of this segment and the road is structurally sound for 67 per cent of its length. However, ten kilometres of the divided highway which is up to width standard is structurally deficient.

No significant new work has been undertaken since 1974 and a further eight kilometres has become structurally deficient. Overall deficiency has remained static at 51 per cent of the segment.

(b) Bacchus Marsh to Ballarat:
This segment carries traffic volumes in the range 4001-15 000 vpd. There is divided highway of standard width for 56 per cent of the segment. The remainder is single carriageway except for five kilometres of below standard divided highway.

Since 1974, a minor construction project has reduced the overall deficient length by two kilometres. Structural deficiency has occurred on three kilometres of highway in this period. The segment is 44 per cent deficient overall compared to 48 per cent in 1974.

(c) Ballarat to Horsham:
Some 67 per cent of the length of this segment carries traffic in the range, 4001-15 000 vpd with the remainder carrying lower volumes. The single carriageway is of standard width for only 27 per cent of its length and over 25 per cent is structurally deficient. Ten kilometres of road which is of adequate width is in this structurally deficient section.

There has been minor reconstruction which has reduced overall deficiency by two kilometres. Overall deficiency is now 79 per cent compared to 80 per cent in 1974.

(d) Horsham to State Border:
This segment carries traffic in the range 2201-4000 over 80 per cent of its length with the remainder carrying less traffic. Nearly 83 per cent of this single carriageway road is of sufficient width and only 18 per cent is structurally deficient. However 16 kilometres of highway which is up to width standard is in this structurally deficient length.

Since 1974, seven kilometres of this road, which was structurally deficient only, has been reconstructed and thus the overall deficiency has been reduced from 34 per cent to 29 per cent.

(e) State Border to Bordertown:
On 92 per cent of the length of this segment traffic volumes are in the range 1101-2200 vpd.

No significant work has been undertaken on this segment since 1974. The segment is still 100 per cent deficient in width and structure.

(f) Bordertown to Tintinara:
Traffic on this segment is in the range 1101-2200 vpd.

No significant work has been undertaken on this segment since 1974. The segment is still 100 per cent deficient in width and structure.

(g) Tintinara to Tailem Bend:
On 82 per cent of the length of this segment, traffic volumes are in the range 1101-2200 vpd. Ninety-nine per cent of this segment is deficient in both structure and width. The remaining 1 per cent is deficient in either structure or width and the segment is 100 per cent deficient overall.

There has been no significant work undertaken on this segment since 1974.

(h) Tailem Bend to Murray Bridge:
This segment carries traffic in the range 2201-4000 vpd over 88 per cent of its length. Under 8 per cent of this single carriage-way is sufficient in width but most of it is in good structural condition.

Only minor work has been undertaken on this segment in the last three years resulting in a reduction of width deficient highway by one kilometre. Overall deficiency is now 92 per cent compared to 96 per cent in 1974.

(i) Murray Bridge to Crafers:
On this segment, traffic volumes are in the range 4001-15 000 vpd over 91 per cent of the length. The highway is divided and up to width standard for 28 per cent of the segment. Nearly 68 per cent is structurally deficient.

Since 1974 an eight kilometre section of road constructed to full standard was opened to traffic. This section replaced an old road and reduced overall deficiency of this segment from 86 per cent to 74 per cent. A further section of twenty-one kilometres of freeway was nearing completion in June 1977. When opened in December 1977, the overall deficiency was reduced to 42 per cent.

(j) Crafers to Adelaide:
This segment carries traffic volumes in excess of 4000 vpd over its entire length with 50 per cent of the segment carrying more than 15 000 vpd. The segment is divided for 92 per cent of its length but only 36 per cent is actually of sufficient width. None of the segment is structurally deficient. The overall deficiency has remained at 73 per cent.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

MELBOURNE-ADELAIDE LINK

Segment	Length (Km)	Surface Type						General Terrain				Land Use		No. of Structures			
		Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	Flat	Undulating	Hilly	Mountainous	Town	Rural	Bridge	Culvert	Other	Rail Crossing
Western Highway																	
304A Melbourne-Bacchus Marsh	35				57	43		68		32		5	95	9			
304B Bacchus Marsh-Ballarat	52				97	3			13	87		13	87	11	6		2
304C Ballarat-Horsham	184				100			47	53			9	91	33	7		3
304B Horsham-State Border	137				100			100				6	94	5			1
Dukes Highway																	
502C State Border-Bordertown	18				100			33	67				100		1		
502B Bordertown-Tintinara	82				16	84		65	35			10	90	2			1
502A Tintinara-Tailem Road	98				100			18	82			3	97				1
Princes Highway																	
501C Tailem Bend-Murray Bridge	26				100			50	50			19	81	1			
501B Murray Bridge-Crafers	65				29	71		1	47	60		11	89	15	3		4
501A Crafers-Adelaide	11					100			39	100			100	1			
TOTAL	708				79	21		48	37	15		8	92	77	17		12

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

MELBOURNE-ADELAIDE LINK

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Western Highway																							
304A Melbourne-Bacchus Marsh	35						100		45	32							23						23
304B Bacchus Marsh-Ballarat	52						100		18	50					29		3			6	9	14	3
304C Ballarat-Horsham	184					35	65		1						87	9	3				69	28	2
304D Horsham-State Border	137				18	82			1						65	33	1			3	11	85	
Dukes Highway																							
502C State Border-Bordertown	18				92	8									100				100				
502B Bordertown-Tintinara	82				100										98		2		100				
502A Tintinara-Tailem Bend	98				82	18								2	85		13		98		2		
Princes Highway																							
501C Tailem Bend-Murray Bridge	26					88	12							6	88		6		19		69	12	
501B Murray Bridge-Crafers	65					9	91			28				61	7	4					65	3	4
501A Crafers-Adelaide	11						50	50	25	67							8						8
TOTAL	708	n			29	32	38	1	4	9				6	69	9	5		29		30	25	2

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

MELBOURNE-ADELAIDE LINK

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Western Highway											
304A Melbourne-Bacchus Marsh	35	5	8	18	51	35	13	8	18	51	
304B Bacchus Marsh-Ballarat	52		25	25	48	52	3	23	23	44	- 4
304C Ballarat-Horsham	184	53	135	147	80	184	52	135	145	79	- 1
304D Horsham-State Border	137	23	24	47	34	137	23	24	40	29	- 5
Dukes Highway											
502C State Border-Bordertown	18	18	18	18	100	18	18	18	18	100	
502B Bordertown-Tintinara	82	82	82	82	100	82	82	82	82	100	
502A Tintinara-Tailem Bend	98	97	97	97	99	98	97	97	98	100	+ 1
Princes Highway											
501C Tailem Bend-Murray Bridge	26	5	24	25	96	26	5	24	24	92	- 4
501B Murray Bridge-Crafers	65	37	56	56	86	65	44	48	48	74	-12
501A Crafers-Adelaide	11		8	8	73	11		8	8	73	
TOTAL	708	320	477	523	74%	708	337	466	504	71%	- 3%

Brisbane-Cairns Link

The Bruce Highway is the declared national highway connecting Brisbane and Cairns. The national highway standards require a divided highway between Brisbane and Gympie and a single carriageway of 7.4 metre width for the remainder of the link.

(a) Brisbane to Nambour:
This segment carries traffic volumes in excess of 4000 vpd over the entire length with 10 per cent of the length carrying greater than 15 000 vpd. Only 11 per cent of the highway is divided and to width standard. The roadway is generally in poor structural condition. Since 1974, six kilometres of divided highway previously to standard have become structurally deficient.

The divided highway has been extended three kilometres. Structural condition of the road has deteriorated resulting in an increase in overall deficiency over the past three years from 92 per cent to 95 per cent.

(b) Nambour to Gympie:
Over 66 per cent of this segment carries traffic in the range of 2201-4000 vpd with the remainder carrying up to 15 000 vpd. Almost all the road is single carriageway and therefore deficient. Some 50 per cent is also structurally deficient.

Reconstruction of the road in the vicinity of Yandina has reduced the segment length by two kilometres. However the project was not a duplication and hence the entire segment is still deficient overall.

(c) Gympie to Gin Gin:
Traffic volumes are below 4000 vpd over 86 per cent of the length of this segment. Some 88 per cent of this single carriageway road is deficient in width; over 33 per cent is structurally deficient.

Reconstruction of the road between Gunalda and Tiaro has reduced the segment length by two kilometres and the length of deficient road by sixteen kilometres. In addition more than thirty kilometres has been reconstructed but not to width standard. The overall deficiency has been reduced from 94 per cent to 85 per cent.

(d) Gin Gin to Rockhampton:
On 88 per cent of this segment traffic volumes are below 2200 vpd. This roadway is of sufficient width for only 12 per cent of the segment and 75 per cent is structurally deficient.

Construction of the highway to full standard has been undertaken on twenty-three kilometres, however ten kilometres of road previously up to standard has become structurally deficient. Overall deficiency has been reduced from 97 per cent to 91 per cent.

(e) Rockhampton to Marlborough:
Traffic is below 2200 vpd over 81 per cent of the segment length. Some 95 per cent of the roadway is below standard in width whilst 97 per cent is structurally deficient.

Only minor upgrading of the roadway has been undertaken to reduce overall deficiency by 2 per cent to 98 per cent.

(f) Marlborough to Sarina:
This is the most lightly trafficked segment on the link carrying less than 300 vpd over 88 per cent of its length. For this segment there is an alternative route in better condition. On this segment 93 per cent of its length is still deficient in width. The road structure is in poor condition.

Since 1974, forty-two kilometres have been reconstructed, shortening the route by two kilometres. However, only fifteen kilometres were constructed to full standard. This segment is 94 per cent deficient overall compared to 99 per cent in 1974.

(g) Sarina to Townsville:

Traffic volumes are less than 4000 vpd over 82 per cent of this segment. Only 11 per cent of the highway is of sufficient width and the remainder is almost all structurally deficient. In addition, twenty-two kilometres of the road which is of sufficient width is structurally deficient.

More than forty kilometres has been reconstructed but only thirteen kilometres to full standard. This has resulted in a reduction in overall deficiency from 98 per cent to 95 per cent.

(h) Townsville to Ingham:

This segment carries traffic volumes less than 4000 vpd over 85 per cent of its length. Less than 9 per cent of the single carriageway is up to width standard. Half the segment is structurally deficient.

Since 1974, forty-two kilometres have been reconstructed but only eight kilometres were constructed to full standard. This segment is now 92 per cent deficient compared with 99 per cent in 1974.

(i) Ingham to Innisfail:

The majority of this segment (96 per cent) carries volumes under 4000 vpd. Some 15 per cent of the segment length is sufficiently wide whilst 33 per cent is structurally sound.

Major reconstruction has occurred on fifty-five kilometres of road to rectify deficient structure. Only thirteen kilometres of this was constructed to full standard. Overall deficiency has been reduced by 8 per cent to 91 per cent.

(j) Innisfail to Cairns:

On this segment, 78 per cent of the length carries volumes less than 4000 vpd. The roadway is of sufficient width for 15 per cent of its length but most of the segment is in poor structural condition.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

BRISBANE-CAIRNS LINK*

Segment	Length (Km)	Surface Type						General Terrain				Land Use		No. of Structures			
		Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	Flat	Undulating	Hilly	Mountainous	Town	Rural	Bridge	Culvert	Other	Rail Crossing
Bruce Highway																	
402A Brisbane-Nambour	98				84	16		17	83			16	84	18	23		1
402B Nambour-Gympie	66				90	10			93	7		12	88	21	6		
402C Gympie-Gin Gin	204				100			36	55	9		9	91	50	10		11
402D Gin Gin-Rockhampton	266				99		1	24	76			2	98	44	8		3
403A Rockhampton-Marlborough	100				100			6	94			3	97	15	10		
420A Marlborough-Sarina	214		16	27	56		1	42	58			2	98	17	8	8	4
403C Sarina-Townsville	422				97	1	2	55	44	1		6	94	99	19		32
406A Townsville-Ingham	106				100			77	20	3		5	95	32	7		
406B Ingham-Innisfail	151				99	1		68	26	4	2	5	95	49	19		30
406C Innisfail-Cairns	89				100			89	10	1		15	85	27	20		21
TOTAL	1716		2	3	92	2	1	43	54	2	-**	6	94	372	140	8	103

* With the coast route between Marlborough and Sarina as the declared National Highway.

** Less than 1%.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

BRISBANE-CAIRNS LINK*

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road: Seal/Gravel Width		Undivided Road: Formation Width							Undivided Road: Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Bruce Highway																							
402A Brisbane-Nambour	98						90	10	26					8	13	45	8				21	23	
402B Nambour-Gympie	66					64	36							32	29	34	5		3	25	30	40	2
402C Gympie-Gin Gin	204			10	24	52	14					20	13	38	13	15	1	8	19	36	18	18	1
402B Gin Gin-Rockhampton	266			5	83	12			1			15	28	36	6	11	3		31	31	25	12	
403A Rockhampton-Marlborough	100			31	50	19			2				16	50	26	6		6	8	23	55	6	
420A Marlborough-Sarina	214	41	47	12							4	43	18	27	1	7		29	18	30		7	
403C Sarina-Townsville	422			12	29	41	17	1	2	1			40	45	5	6	1	1	40	30	13	13	
406A Townsville-Ingham	106					85	15					2	33	39	18	8		2	32	36	20	10	
406B Ingham-Innisfail	151				76	20	4		1	1			46	36	5	10	1	9	40	28	7	14	
406C Innisfail-Cairns	89				20	58	20	2	2	3		2	9	41	39	2	2	2	2	16	64	11	
TOTAL	1716	5	6	8	33	32	15	1	2	-**	-**	10	26	37	11	12	2	6	25	28	20	15	-**

* With the coast route between Marlborough and Sarina as the declared National Highway.

** Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

BRISBANE-CAIRNS LINK*

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Bruce Highway											
402A Brisbane-Nambour	101	27	93	93	92	98	69	87	93	95	+ 3
402B Nambour-Gympie	68	35	68	68	100	66	34	64	66	100	
402C Gympie-Gin Gin	206	135	190	193	94	204	79	169	174	85	- 9
402D Gin Gin-Rockhampton	266	230	256	258	97	266	203	233	243	91	- 6
403A Rockhampton-Marlborough	101	101	101	101	100	100	95	93	98	98	- 2
402A Marlborough-Sarina	216	215	215	215	99	214	172	199	201	94	- 5
403C Sarina-Townsville	422	386	390	414	98	422	345	377	399	95	- 3
406A Townsville-Ingham	106	95	100	105	99	106	53	97	97	92	- 7
406B Ingham-Innisfail	151	145	137	150	99	151	90	129	137	91	- 8
406C Innisfail-Cairns	89	58	81	84	94	89	70	75	84	94	
TOTAL	1726	1427	1631	1681	97%	1716	1210	1523	1592	93%	- 4%

* With the coast route between Marlborough and Sarina as the declared National Highway.

There has been six kilometres of reconstruction to full standard. However, six kilometres previously to standard has become structurally deficient. Thus the overall deficiency has remained at 94 per cent.

Brisbane-Darwin Link

The Brisbane-Darwin link intersects with the Adelaide-Darwin Link (Sturt Highway) at Tennant Creek. Between Brisbane and Tennant Creek the declared national highway route uses four different highways. From Ipswich to Morven the highway follows the Warrego Highway. At Morven the Landsborough Highway becomes the declared route until 115 kilometres east of Cloncurry where it is the Flinders Highway till it meets the Barkly Highway at Cloncurry. The Barkly Highway continues on to Tennant Creek.

Two national highway standards apply to this link. Between Ipswich and Toowoomba the divided highway standard applies. For the remainder of the link the highway need only be a single carriageway facility of 7.4 metre width.

(a) Ipswich to Gatton:
This segment carries traffic in the range 4000-15 000 vpd. Some 25 per cent of this segment is divided and of sufficient width. A further three kilometres (5 per cent) is also divided but is too narrow to meet the standard. In addition, 75 per cent of the highway is structurally deficient including three kilometres of the divided highway which is up to width standard.

Since 1974, fourteen kilometres of divided highway has been constructed but only eleven kilometres is up to full standard. In this period there has been a substantial increase in structural deficiency. However, overall deficiency has been reduced from 97 per cent to 79 per cent.

(b) Gatton to Toowoomba:
Traffic on this segment is in the range 4001-15 000 vpd. The

highway is a divided carriageway facility of sufficient width for 22 per cent of its length. The remainder is single carriageway. Some 67 per cent of the segment is structurally deficient, including all the divided carriageway section.

In the last three years, there has been reconstruction of failed pavement on ten kilometres of highway but none of this work overcame width deficiency. The segment remains 100 per cent deficient overall.

(c) Toowoomba to Miles:
Traffic on this segment is less than 15 000 vpd with 52 per cent of the segment carrying in the range of 301-1100 vpd. One quarter of this two-lane road is up to width standard but less than 25 per cent is to structural standards. Thus there is seven kilometres of highway of sufficient width but which is structurally deficient.

Since 1974 there has been major reconstruction of highway on 13 kilometres of the segment which has been constructed to full standard. This has reduced overall deficiency by 7 per cent to 79 per cent.

(d) Miles to Morven:
On 90 per cent of this segment, traffic is less than 1100 vpd. Only 1 per cent of this single carriageway road is of sufficient width and over 70 per cent is structurally deficient. This structurally deficient section of highway includes the three kilometres (1 per cent) of road which is of standard width.

Since 1974, approximately fifty kilometres of road has been reconstructed but not all to geometric design standards. Due to aging of the structure, the overall deficiency has increased from 99 per cent to 100 per cent.

(e) Morven to Tambo:
Traffic on this segment is less than 1100 vpd and on 44 per cent

of the segment is less than 300 vpd. The two-lane road is all width deficient and over 50 per cent is structurally deficient. There is still seventy-two kilometres of unsealed road on this segment.

The unsealed section of highway between Clara Creek and Augathella has been reconstructed in the last three years shortening the 1974 route by three kilometres. However, this section is still unsealed. Overall deficiency remains at 100 per cent.

(f) Tambo to Blackall:
On this segment, traffic is in the range 141-300 vpd. The single carriageway road is almost totally width deficient and 90 per cent structurally deficient.

No significant work has been undertaken since 1974 and structural deficiency has increased from 5 per cent to 90 per cent in this period. The segment is 100 per cent deficient overall.

(g) Blackall to Barcaldine:
Traffic on this segment is in the range 301-1100 vpd. Almost the whole segment is width deficient and about 75 per cent is now structurally deficient.

No significant work has been undertaken on this segment in the last three years and structural deficiency has increased from nil to 72 per cent. The segment is still 100 per cent deficient overall.

(h) Barcaldine to Longreach:
On 76 per cent of the length of this segment traffic is less than 140 vpd. None of this segment is up to the required width standard and most of it is structurally deficient.

Since 1974 structural deficiency has increased from nil to 90 per cent as no significant work has been undertaken on this segment in that period. Overall deficiency is 100 per cent.

(i) Longreach to Winton:
Traffic on this segment is in the range 141-300 vpd. Over 70 per cent of the highway is deficient in width and almost 80 per cent is structurally deficient.

In 1974, seventy-six kilometres was unsealed but this is now sealed. Between Darr and Chorregon fifty-two kilometres has been reconstructed to full standard. In the last three years structural deficiency has increased from nil to 45 per cent, however the overall deficiency has been reduced from 100 per cent in 1974 to 71 per cent.

(j) Winton to Cloncurry:
On 93 per cent of the length of this segment traffic is less than 140 vpd. This is the most lightly trafficked segment on the link. The two-lane road is unsealed for 266 kilometres (77 per cent) of its length and most of the remainder is width deficient. About 15 per cent of the highway is structurally deficient.

Since 1974, nineteen kilometres of the previously unsealed section has been sealed but no other significant work has been undertaken. Overall deficiency remains at 99 per cent.

(k) Cloncurry to Mt Isa:
Traffic on this segment is in the range 301-1100 vpd. The sealed two-lane road is totally deficient in width and structure and no work has been undertaken in the last three years to overcome this deficiency.

(l) Mt Isa to State Border:
There is less than 300 vpd on this segment. Less than 2 per cent of this sealed two-lane road is of sufficient width and over 87 per cent is structurally deficient.

In the last three years, seventeen kilometres of structurally deficient road has been reconstructed but not all to the required width. Overall deficiency has been reduced by 2 per cent to 98 per cent.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

BRISBANE-DARWIN LINK*

Segment	Length (Km)	Surface Type: Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	General Terrain: Flat	Undulating	Hilly	Mountainous	Land Use: Town	Rural	No. of Structures: Bridge	Culvert	Other	Rail Crossing
Warrego Highway																	
410A Ipswich-Gatton	63				85	15		23	46	31		8	92	8	4		
410B Gatton-Toowoomba	31				100			15	65	5	15	5	95	4	3		
410C Toowoomba-Miles	207				100			84	16			6	94	6	6		7
410D Miles-Morven	319				100			26	71	3		5	95	21	24		9
Landsbroough Highway																	
414A Morven-Tambo	211		31	1	68			34	66			1	99	5	2	3	
414B Tambo-Blackall	101				100			100				3	97	1			
414C Blackall-Barcaldine	106				100			100				3	97	2	4		1
415A Barcaldine-Longreach	106				100			100				3	97			1	
415B Longreach-Winton	179				99		1	100				1	99	3	11	1	
415C Winton-Cloncurry	346	7	70		23			87	13			1	99	9	3	16	2
Barkly Highway																	
416A Cloncurry-Mt. Isa	119				100				52	48		1	99	2	2		
416B Mt. Isa-State Border	202				100			93	7			4	96	7	5	1	
804B State Border-Tableland Hwy. Junc.	258				100			91	9				100	3	2	10	
804A Tableland Hwy.-Tennant Creek	190				100			92	8				100			5	
TOTAL	2438	1	13	-**	86	-**	-**	71	25	4	-**	3	97	71	66	37	19

* Section from Brisbane to Tennant Creek - for Tennant Creek to Darwin section see Adelaide-Darwin link.

** Less than 1%.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

BRISBANE-DARWIN LINK*

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Warrego Highway																							
410A Ipswich-Gatton	63						100		25	5				23	15	27	5				23	44	3
410B Gatton-Toowoomba	31						100		20					75		5				5		75	
410C Toowoomba-Miles	207			52	9	32	7		1				31	44	13	10	1		30	29	15	23	2
410D Miles-Morven	319		28	62	10				1				78	18	1		2		78	18	1	2	
Landsborough Highway																							
414A Morven-Tambo	211	42	2	56					2				63	15	20			51	5	1	10		
414B Tambo-Blackall	101		100						2				43	53	2			48	38		10	2	
414C Blackall-Barcaldine	106			100								2	44	41	11	2		44	24	17	12	3	
415A Barcaldine-Longreach	106	76			24								87	9	2	2			89	11			
415B Longreach-Winton	179		100						1			1	50	48				12	33	23	2	29	
415C Winton-Cloncurry	346	93		7							1	2	3	87				5	11	6		1	
Barkly Highway																							
416A Cloncurry-Mt. Isa	119			100						1			79	20					99				
416B Mt. Isa-State Border	202		100						1				92			7		92		2		5	
804B State Border-Tableland Hwy. Junc.	258		100									11	78	1	10			90			10		
804B Tableland Hwy. Junc.-Tennant Creek	190		100									2	64	26	8			92			8		
TOTAL	2438	20	42	28	3	3	4		2	-**	-**	2	55	32	6	2	-**	34	28	9	6	7	-**

* Section from Brisbane to Tennant Creek - for Tennant Creek to Darwin section see Adelaide-Darwin link.
** Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

BRISBANE-DARWIN LINK*

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Warrego Highway											
410A Ipswich-Gatton	63	51	61	61	97	63	45	47	50	79	- 18
410B Gatton-Toowoomba	31	31	24	31	100	31	21	24	31	100	
410C Toowoomba-Miles	207	150	169	177	86	207	163	156	163	79	- 7
410D Miles-Morven	319	277	317	317	99	319	229	316	319	100	+ 1
Landsborough Highway											
414A Morven-Tambo	214	98	214	214	100	211	109	211	211	100	- 1
414B Tambo-Blackall	101	5	101	101	100	101	90	100	100	99	
414C Blackall-Barcaldine	106		105	106	100	106	76	105	106	100	
415A Barcaldine-Longreach	106		106	106	100	106	95	106	106	100	
415B Longreach-Winton	179		179	179	100	179	81	127	127	71	- 29
415C Winton-Cloncurry	346	27	343	343	99	346	45	343	343	99	
Barkly Highway											
416A Cloncurry-Mt. Isa	119	119	119	119	100	119	119	119	119	100	
416B Mt. Isa-State Border	202	194	198	202	100	202	177	198	199	98	- 2
804B State Border-Tableland Hwy. Junc.	258	88	258	258	100	258	103	258	258	100	
804A Tableland Hwy. Junc.-Tennant Creek	190	70	190	190	100	190	105	190	190	100	
	2441	1110	2384	2404	98%	2438	1458	2300	2322	95%	- 3

* Section from Brisbane to Tennant Creek - for Tennant Creek to Darwin section see Adelaide-Darwin link.

(m) State Border to Tableland Highway Junction:
Traffic on this segment is less than 300 vpd. The segment is totally width deficient and 40 per cent is structurally deficient.

No significant work has been undertaken on this segment since 1974 and there has been an increase in structural deficiency. Overall deficiency is still 100 per cent.

(n) Tableland Highway Junction to Tennant Creek:
There is less than 300 vpd on this segment. All of the sealed two-lane road is width deficient and over 50 per cent is structurally deficient.

There has been an increase in structural deficiency over the last three years from 37 per cent of the segment to 55 per cent as no significant work has been completed in this period. The segment is still 100 per cent deficient.

<u>Adelaide-Perth Link</u>

A number of highways join together to provide the declared national highway connecting Adelaide and Perth. From Adelaide the declared route follows the Adelaide-Port Augusta Highway to Port Augusta. From there the Eyre Highway continues on to Norseman to join the Coolgardie-Esperance Highway. The route follows this highway to Coolgardie where it connects with the Great Eastern Highway for Perth.

Two national highway standards apply to this link. Between Adelaide and Two Wells and between Northam and Perth, the declared national highway standard is for a four-lane divided highway. The remainder of the link is required to be a 7.4 metre single carriageway.

(a) Adelaide to Two Wells:
Traffic on this segment is in excess of 4000 vpd over the entire

length. The existing highway is divided and to width standard for 46 per cent of its length, the remainder being single carriageway of low structural condition.

Duplication projects covering six kilometres have been completed since 1974. These have reduced the length of width deficient road. This segment is now 52 per cent deficient compared to 72 per cent in 1974.

(b) Two Wells to Crystal Brook:
On 39 per cent of this segment traffic is in the range of 2201-4000 vpd and in the range 1101-2200 vpd on the remainder. Some 97 per cent of the roadway meets the required width standard. Structural condition is also good.

Reconstruction projects totalling sixteen kilometres have been carried out since 1974.

This segment is now 4 per cent deficient compared to 13 per cent in 1974.

(c) Crystal Brook to Port Augusta:
Only on 14 per cent of this segment is traffic in excess of 2200 vpd, with the remainder carrying traffic in the range 1101-2200 vpd. This single carriageway road is below width standard over 74 per cent of its length and is generally in poor structural condition.

Reconstruction projects covering twenty-nine kilometres have been completed in the last three years. This work has reduced overall deficiency on this segment from 100 per cent in 1974 to 74 per cent.

(d) Port Augusta to Kimba:
Traffic is in the range 301-1100 vpd on 84 per cent of its length and in excess of this range on the remainder. Only 17 per cent of this single carriageway meets the width standard. About 42 per cent is also structurally deficient.

Completion of a deviation at the Port Augusta end of this segment has reduced structural and width deficiencies. This segment is now 84 per cent deficient compared to 90 per cent in 1974.

(e) Kimba to Ceduna:
Traffic is in the range 301-1100 vpd on this segment. The total length of this single carriageway road is width deficient but the pavement is in good structural condition.

No significant work has been undertaken on this segment since 1974. Overall deficiency is still 100 per cent.

(f) Ceduna to Boomerang Roadhouse:
This segment carries traffic in the range 301-1100 vpd. The highway is a single carriageway which is totally width deficient but 100 per cent sufficient in structural condition.

In the past three years a major realignment has been completed. This realignment has provided a sealed surface which is slightly shorter than the previously unsealed route. However, the sealed surface was not constructed to the required national highway width standard. Thus the segment is still 100 per cent deficient overall.

(g) Boomerang Roadhouse to the State Border:
Traffic on this segment is in the range 141-300 vpd. This is the most lightly trafficked segment on the link. The single carriageway highway is totally deficient in width standard but 100 per cent sufficient in structural condition.

In the past three years a major realignment of the highway has been completed. This realignment has shortened the segment by thirteen kilometres and has provided a sealed highway for this segment which was previously unsealed. However the sealed surface was not constructed to the required national highway width standard. Thus the segment is still 100 per cent deficient overall.

(h) State Border to Norseman:
This segment carries traffic in the range 301-1100 vpd. The highways is a single carriageway and all of it is width deficient. Some 25 per cent of it is now structurally deficient.

No significant work has been undertaken on this segment since 1974. In this period there has been a substantial increase in the length of pavement which is structurally deficient. The segment is 100 per cent deficient overall.

(i) Norseman to Coolgardie:
Traffic on this segment is in the range 301-1100 vpd. The single carriageway highway is 86 per cent to width standard but 75 per cent of the segment is structurally deficient.

Since 1974 there has been some minor reconstruction which has reduced the amount of highway deficient in width by four kilometres and eliminated twelve kilometres of road previously deficient in surface type. However, structural deficiency has increased dramatically from 19 per cent to 73 per cent of the segment length. Overall deficiency on the segment has increased from 42 per cent in 1974 to 81 per cent.

(j) Coolgardie to Southern Cross:
Traffic on this segment is less than 2200 vpd with 82 per cent of the highway carrying between 301-1100 vpd. Almost all the single carriageway highway is width deficient but most of the segment is in good structural condition.

There has been reconstruction work undertaken since 1974 which has reduced the extent of structural deficiency but, being sub-standard in width, has not altered the amount of width deficient road. The segment is 99 per cent deficient.

(k) Southern Cross to Kellerberrin:
Traffic on this segment is spread evenly across the range 301-2200

vpd. Only 12 per cent of the single carriageway highway is up to width standard and over 50 per cent of the segment is structurally deficient.

Since 1974, some of the highway which was of the required width but structurally deficient has been reconstructed. In addition a further seven kilometres of road has been brought up to standard. This has resulted in a decrease in overall deficiency from 97 per cent to 90 per cent.

(l) Kellerberrin to Northam:
Traffic is in the range 1101-2200 vpd on 77 per cent of the segment and in the range 301-1100 vpd on the remainder. The single carriageway highway is 87 per cent width deficient and 65 per cent structurally deficient.

There has been eight kilometres of reconstruction on the segment in the last three years which has reduced width deficiency accordingly. However structural deficiency has increased enough to offset the reconstruction program as some of the section which was previously to standard is now structurally deficient. The segment is still 95 per cent deficient overall.

(m) Northam to Perth:
On this segment traffic is between 2201 and 15 000 vpd over its entire length with 26 per cent carrying in excess of 4000 vpd. The national highway standard for this segment is a four-lane dual carriageway facility. Only 13 per cent of the segment meets this standard and 71 per cent is structurally deficient.

Reconstruction since 1974 has upgraded seven kilometres to standard. However in this period structural deficiency has occurred in five kilometres of road which was previously to standard. Overall the deficiency has been reduced 1 per cent to 99 per cent in the three years.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

ADELAIDE-PERTH LINK

Segment	Length (Km)	Surface Type						General Terrain				Land Use		No. of Structures			
		Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	Flat	Undulating	Hilly	Mountainous	Town	Rural	Bridge	Culvert	Other	Rail Crossing
Adelaide-Pt. Augusta Highway																	
510A Adelaide-Two Wells	24					100		100				13	87	4	2		
510B Two Wells-Crystal Brook	159				96	4		84	12	4		3	97	5			5
510C Crystal Brook-Pt. Augusta	111				97	3		59	41			3	97	8	8	3	2
Eyre Highway																	
511A Pt. Augusta-Kimba	155				99	1		1	99			1	99	3	1	1	1
511B Kimba-Ceduna	313				100			3	97			2	98				4
511C Ceduna-Boomerang Roadhouse	153				100			14	86			1	99				1
511D Boomerang R.H.-State Border	330				100			66	29	5			100				
602A State Border-Norseman	724				96	4		74	25	1			100				1
Coolgardie-Esperance Highway																	
601E Norseman-Coolgardie	166				95	5		55	45				100				3
Great Eastern Highway																	
601D Coolgardie-Southern Cross	188				100			31	69			1	99				
601C Southern Cross-Kellerberrin	166				100			83	17			2	98	10			2
601B Kellerberrin-Northam	106				100			42	58			5	95	12			4
601A Northam-Perth	70				91	9			74	26		5	95	9			1
TOTAL	2665				97	3	-*	50	48	2		1	99	52	11	5	24

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

ADELAIDE-PERTH LINK

Segment	Length (Kilometres)	Annual Average Daily Traffic: 0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	Divided Road, Seal/Gravel Width: 0 - 14.8m	>14.8m	Undivided Road, Formation Width: 0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	Undivided Road, Seal or Gravel Width: 0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Adelaide-Pt. Augusta Highway																							
510A Adelaide-Two Wells	29						85	15		50				29	21					50			
510B Two Wells-Crystal Brook	159				61	39									1	98	1			1		79	20
510C Crystal Brook-Pt. Augusta	111				86	7	7			1					57	14	28			23	48	27	1
Eyre Highway																							
511A Pt. Augusta-Kimba	155			84		16			1						83	16				83		16	
511B Kimba-Ceduna	313			99		1									100					100			
511C Ceduna-Boomerang Roadhouse	153			100											3	97				48	52		
511D Boomerang R.H.-State Border	330		100													100					100		
602A State Border-Norseman	724			100										100						100			
Coolgardie-Esperance Highway																							
601E Norseman-Coolgardie	166		33	67										46	54					1	12	87	
Great Eastern Highway																							
601D Coolgardie-Southern Cross	188			82	18									98	1		1	1			98	1	
601C Southern Cross-Kellerberrin	166			47	53									90	10					14	74	11	1
601B Kellerberrin-Northam	106			32	67		1						5	85	10					60	23	16	1
601A Northam-Perth	70					74	26		9					68	5	3	15				62	23	
TOTAL	2670		14	64	14	6	2	-*	-*	1			-*	48	24	25	2	-*		51	32	14	2

* Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

ADELAIDE-PERTH LINK

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Adelaide-Pt. Augusta Hwy.											
510A Adelaide-Two Wells	29	11	21	21	72	29	11	15	15	52	- 20
510B Two Wells-Crystal Brook	159	18	16	21	13	159	2	1	2	1	- 12
510C Crystal Brook-Pt. Augusta	111	97	109	111	100	111	82	91	91	82	- 18
Eyre Highway											
511A Pt. Augusta-Kimba	155	74	135	139	90	155	66	129	130	84	- 6
511B Kimba-Ceduna	313	26	312	313	100	313	27	312	313	100	
511C Ceduna-Boomerang R.H.	153	23	152	153*	100	153		152	153	100	
511D Boomerang R.H.-State Border	343	30	338	343	100	330		330	330	100	
602A State Border-Norseman	724	31	723	724	100	724	169	723	724	100	
Coolgardie-Esperance Highway											
601E Norseman-Coolgardie	166	31	27	70**	42	166	121	23	134	81	+ 39
Great Eastern Highway											
601D Coolgardie-Southern Cross	188	26	186	188	100	188	5	186	187	99	- 1
601C Southern Cross-Kellerberrin	166	66	153	161	97	166	95	146	150	90	- 7
601B Kellerberrin-Northam	106	52	100	101	95	106	69	92	100	95	
601A Northam-Perth	70	45	68	70	100	70	48	61	68	99	- 1
TOTAL	2683	530	2340	2415	90%	2670	695	2261	2397	90%	

* Includes 45 Km deficient in surface type.

** Includes some 12 Km deficient in surface type but not otherwise deficient.

Adelaide-Darwin Link

From Adelaide to Port Augusta this link follows the declared route detailed in the Adelaide-Perth Link. From Port Augusta the declared route follows the Stuart Highway to Darwin.

For most of the link the design standards require a single carriageway 7.4 metre in width. However, between Woomera (Pimba) and Alice Springs a lower standard applies which requires that the sealed surface be only 6.7 metres wide. The divided highway standard of two 7.4 metres carriageways applies between Adelaide River and Darwin.

(a) Port Augusta to Woomera (Pimba):
Traffic on this segment is in the range 301-1100 vpd. The segment is almost totally width deficient but structural condition is good.

No significant work has been undertaken on this segment since 1974. The segment is 100 per cent deficient overall.

(b) Woomera (Pimba) to Mt Eba:
On this segment traffic is less than 140 vpd. The reduced width standard applies to this segment which forms part of the lowest trafficked section on the link. The entire segment is unsealed and is therefore surface deficient. Only 3 per cent of the single carriageway highway is of sufficient width, and since it is all unsealed it is 100 per cent structurally deficient.

(c) Mt Eba to State Border:
Traffic is less than 140 vpd on 97 per cent of the length of the segment. The whole segment is width deficient, unsealed and therefore structurally deficient.

(d) State Border to Alice Springs:
On this segment traffic is less than 140 vpd. Nearly 32 per cent of the length of the segment is of sufficient width and most is in good structural condition.

Major reconstruction of over 140 kilometres of highway has been carried out since 1974. Of this length 94 kilometres was constructed to full standard and the remainder corrected failed pavement. This work has reduced overall deficiency from 100 per cent to 68 per cent.

(e) Alice Springs to Tennant Creek:
On this segment traffic is less than 1100 vpd with 33 per cent of the segment carrying traffic in the range 141-300 vpd. Only 3 per cent of the highway is of sufficient width. About 25 per cent of the segment is structurally deficient.

No significant work has been undertaken on this segment in the last three years. There has been a slight increase in structural deficiency over this period. Overall deficiency is still 97 per cent.

(f) Tennant Creek to Newcastle Waters:
Traffic volumes on this segment are in the range 141-300 vpd. Only 4 per cent of the single carriageway highway is up to width standard and over 33 per cent is structurally deficient.

As no significant work has been undertaken on this segment since 1974, the overall deficiency is still 96 per cent.

(g) Newcastle Waters to Katherine:
Traffic is less than 1100 vpd with 33 per cent of the segment carrying volumes in the range 141-300 vpd. Almost 96 per cent of the highway is deficient in width whilst 33 per cent is structurally deficient. Some overlap occurs and five kilometres of road which is of satisfactory width is below standard in terms of structure.

Only three kilometres of highway has been reconstructed since 1974. Overall deficiency has been reduced by 1 per cent to 96 per cent.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

ADELAIDE-DARWIN LINK*

Segment	Length (Km)	Surface Type						General Terrain				Land Use		No. of Structures			
		Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	Flat	Undulating	Hilly	Mountainous	Town	Rural	Bridge	Culvert	Other	Rail Crossing
Stuart Highway																	
512A Pt. Augusta-Pimba	179	23	5		72			75	25				100	4	4	7	3
513A Pimba-Mt. Eba	258	58	40	2				84	16				100			18	5
514A Mt. Eba-State Border	644	60	40					65	34	1		2	98			126	
803B State Border-Alice Springs	295		6		94			61	39				100	9	3	28	1
803A Alice Springs-Tennant Creek	512				100			92	3	5			100	2	14	96	
802B Tennant Creek-Newcastle Waters	291				100			78	7	15		1	99	6	2	80	
802A Newcastle Waters-Katherine	398				100			100				1	99	5	2	36	4
801B Katherine-Adelaide River	227				100			15	39	46			100	6	5	84	7
801A Adelaide River-Darwin	116				94	6		56	44			7	93	14	1	22	5
TOTAL	2920	20	13	-**	67	-**		74	20	6		1	99	46	31	497	25

* Section from Pt. Augusta to Darwin - for Adelaide to Pt. Augusta section see Adelaide-Perth link.
** Less than 1%.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

ADELAIDE-DARWIN LINK*

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Stuart Highway																							
512A Pt. Augusta-Pimba	179			100										15	62				2	55	15		
513A Pimba-Mt. Eba	258	100												41	1							2	
514A Mt. Eba-State Border	644	97	1	2								2	3	19	7	9							
803B State Border-Alice Springs	295	100											6	63	31				5	58	31		
803A Alice Springs-Tennant Creek	512		33	66		1							55	12	32	1		47	22		28	3	
802B Tennant Creek-Newcastle Waters	291		100									40	41	19				40	35		21	4	
802A Newcastle Waters-Katherine	398		35	65									32	24	40	4		49	7		40	4	
801B Katherine-Adelaide River	227			100									66		1	33		4	63		33		
801A Adelaide River-Darwin	116			46	17	12	19	6	4	3			8	16		69				25		68	
TOTAL	2920	40	21	36	1	1	1	-**	-**	-**		4	25	23	20	8		19	14	10	19	5	

* Section from Pt. Augusta to Darwin - for Adélaide to Pt. Augusta section see Adelaide-Perth link.
** Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

ADELAIDE-DARWIN LINK*

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Stuart Highway											
512A Pt. Augusta-Pimba	179	13	177	177	99	179	13	177	179	100	+ 1
513A Pimba-Mt. Eba	258	258	251	258**	100	258	258	251	258	100	+ 1
514A Mt. Eba-State Border	644	644	644	644**	100	644	644	644	644	100	
803B State Border-Alice Springs	295	164	295	295	100	295	18	201	201	68	- 32
803A Alice Springs-Tennant Creek	512	95	497	497	97	512	121	497	497	97	
802B Tennant Creek-Newcastle	291	106	279	280	96	291	106	279	280	96	
802A Newcastle Waters-Katherine	398	121	383	388	97	398	130	380	385	96	- 1
801B Katherine-Adelaide River	227	172	180	201	89	227	142	151	151	67	- 22
801A Adelaide River-Darwin	116	79	116	116	100	116	24	116	116	100	
TOTAL	2920	1652	2822	2856	98%	2920	1456	2696	2711	93%	- 5%

* Section from Pt. Augusta to Darwin - for Adelaide to Pt. Augusta section see Adelaide-Perth link.

** In addition, entire length of segment is surface deficient.

(h) Katherine to Adelaide River:
Traffic volumes on this segment are in the range 301-1100 vpd. Only 33 per cent of this segment is of sufficient width and satisfactory structural condition.

Since 1974, fifty kilometres of this segment have been improved. This work consisted of resealing a twenty-one kilometre section of surface deficient road and reconstructing twenty-nine kilometres to full national highway standard. The overall deficiency on this segment has been reduced from 89 per cent to 67 per cent during this period.

(i) Adelaide River to Darwin:
On this segment traffic is in excess of 4000 vpd on 25 per cent of its length. Although over eight kilometres of the segment is divided, only four kilometres is of sufficient width and this particular section is speed restricted to forty kph. The segment is in good structural condition for most of its length.

In the last three years fifty-five kilometres of highway have been reconstructed to overcome structural deficiency. However this reconstruction has not duplicated the highway on any section and the overall deficiency is still 100 per cent.

Perth-Darwin Link

The Great Northern Highway connects with the Victoria Highway to link Perth with Katherine. From Katherine the declared national highway for the Perth-Darwin link follows the Stuart Highway to Darwin. The national highway standards specify a divided highway between Perth and Muchea and a single carriageway for the remainder of the link. The minimum width of seal required is 7.4 metres per carriageway except on the Great Northern Highway between the Derby turn-off and the Victoria Highway Junction where only 6.2 metres wide seal is required.

(a) Perth to Muchea:
Some 73 per cent of this segment carries traffic between 4001 and 15 000 vpd. The remainder has volumes from 2201 to 4000 vpd. None of the highway is divided and is therefore deficient. The structure is becoming more deficient; since 1974 an additional sixteen kilometres have become below standard structurally.

No significant construction work has been undertaken. The segment is still 100 per cent deficient overall.

(b) Muchea to Walebing:
This segment carries traffic volumes below 1100 vpd over 70 per cent of its length. Only a small amount (4 per cent) is to width standard. The structure has deteriorated substantially over the past three years.

Some reconstruction has reduced width deficiency by four kilometres. However, this reconstructed section will become structurally deficient by 1984. The segment is still 99 per cent deficient.

(c) Walebing to Dalwallinu:
Traffic volumes on this segment are below 1100 vpd with some 20 per cent of the segment length carrying less than 300 vpd. The highway is almost entirely (99 per cent) deficient in width. Structural deficiency has increased significantly over the past three years.

There has been no major construction undertaken. The entire length of this segment is still deficient.

(d) Dalwallinu to Mount Magnet:
This segment is lightly trafficked with volumes between 142-300 vpd over the entire length. Almost all the segment (99 per cent) is deficient in width. Structural deficiency has increased substantially.

No significant construction has been carried out since 1974. Overall deficiency remains at 99 per cent of the length.

(e) Mount Magnet to Meekatharra:
The entire length of this segment carries light volumes in the range 141-300 vpd. Width deficiency is high at 99 per cent of the length. Whilst structural deficiency is still low at around 20 per cent, there has been a substantial increase (from eight to forty-two kilometres) in the length of roadway structural deficiency.

There has been no reconstruction in this segment over the past three years. The road is still 100 per cent deficient overall.

(f) Meekatharra to Newman:
Traffic volumes are very low (less than 140 vpd) over 60 per cent of the length with the remainder carrying less than 1100 vpd. Some 25 per cent of this segment is up to width standard. Most of the roadway sufficient in width is structurally deficient.

Extensive reconstruction over the past three years has reduced by eighty kilometres the length of roadway deficient in width and structure but this reconstructed section is deficient in surface type. In addition, some roadway previously up to standard is now structurally deficient. This has led to an increase in overall deficiency. This segment is now 96 per cent deficient compared with 94 per cent in 1975.

(g) Newman to Port Hedland:
This segment is the most lightly trafficked section on the link. Traffic volumes are below 140 vpd over the entire length. All of the roadway is deficient in width and structure.

No construction has been undertaken over the past three years. The segment remains 100 per cent deficient overall.

(h) Port Hedland to Broome:
Only 13 per cent of this segment carries volumes in excess of 300 vpd. The roadway is 86 per cent deficient in width with an additional 3 per cent being only structurally deficient.

Since 1974, major reconstruction has reduced the length of roadway deficient in structure and/or surface type by 333 kilometres. However, only seventy-three kilometres of this new roadway is to width standard. Some seventeen kilometres is still surface deficient. Overall deficiency has been reduced from 100 per cent in 1974 to 89 per cent.

(i) Broome to Derby turn-off:
All of this segment carries traffic volumes in the range 141-300 vpd. Some five kilometres (3 per cent) of roadway is not sufficient in width. All the roadway in this segment is structurally sound.

Reconstruction in the past three years has eliminated some five kilometres previously deficient in structure and width. Overall deficiency has been reduced by 3 per cent to 97 per cent of segment length.

(j) Derby turn-off to Halls Creek:
Traffic volumes on this segment are very low with 99 per cent of the length carrying less than 140 vpd. Some 61 per cent of the length is deficient in width. In addition 95 kilometres (18 per cent) are deficient in structure and/or surface.

Since 1974, reconstruction and realignment has reduced the segment length by twenty-one kilometres and the length of roadway deficient in width by 139 kilometres. However, much of this new roadway is deficient in surface type whilst roadway previously up to standard overall is now structurally deficient. As such, overall deficiency has only been reduced from 87 per cent to 79 per cent.

(k) Halls Creek to Victoria Highway Junction:
Traffic volumes below 140 vpd are carried on 90 per cent of the

length of this segment, with a further 7 per cent carrying volumes in the range 141-300 vpd. This segment is deficient in width over 73 per cent of its length. An additional sixty-five kilometres (21 per cent) are surface deficient and five kilometres (2 per cent) are deficient in structure only.

Major reconstruction over the past three years has reduced width deficiency by 77 kilometres. However, much of this new work is still surface deficient. Overall deficiency has been cut by 4 per cent to 95 per cent of the length of this segment.

(l) Victoria Highway Junction to State Border:
All of this segment carries less than 1100 vpd with 79 per cent of the length carrying volumes in the range 301-1100 vpd. All of this segment is deficient in width.

Reconstruction of thirteen kilometres has eliminated all structural deficiency. However, this new roadway has been constructed to below width standard. All the segment is still width deficient and, hence, deficient overall.

(m) State Border to Timber Creek:
This segment carries low traffic volumes with 100 per cent carrying less than 140 vpd. The entire segment is deficient in width. However, only some three kilometres is structurally deficient.

No major reconstruction has been undertaken in the last three years. All of the segment is still deficient overall.

(n) Timber Creek to Katherine:
All of this segment has traffic volumes below 300 vpd with 58 per cent of the length carrying less than 140 vpd. Some 93 per cent of this segment is deficient in width. In addition, two kilometres (less than 1 per cent) is deficient in structure only.

Some reconstruction over the past three years has reduced by eighteen kilometres the length of roadway deficient in width.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

PERTH-DARWIN LINK*

Segment	Length (Km)	Surface Type: Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	General Terrain: Flat	Undulating	Hilly	Mountainous	Land Use: Town	Rural	No. of Structures: Bridge	Culvert	Other	Rail Crossing
Great Northern Highway																	
603A Perth-Muchea	31				74	26		100		6		6	94	4			1
604A Muchea-Walebing	114				99	1		15	81	4		1	99	7			
604B Walebing-Dalwallinu	85				100			34	66			2	98				1
604C Dalwallinu-Mt. Magnet	317				100			91	9				100				1
604D Mt. Magnet-Meekatharra	196				100			100					99				3
604E Meekatharra-Newman	415	10	40	25	25			92	8				100		1	6	
605A Newman-Pt. Hedland	444	8	76	14	2			64	32	4			100	1		40	
606A Pt. Hedland-Broome	547		49	39	12			100					100			2	1
606B Broome-Derby T/O	145				100			100					100	4			
607A Derby T/O-Halls Creek	514		30	22	48			82	18				100	4	2	8	
607B Halls Creek-Victoria Highway Junction	314		29	2	69			34	59	7			100	10	1	2	
Victoria Highway																	
609A Junction-State Border	89				100			75	24	1			100	8			
805B State Border-Timber Creek	161				100			10	90				100	18	41	135	
805A Timber Creek-Katherine	291				100			68	27	5			100	15	17	47	
TOTAL	3663	2	28	14	56	-**		74	24	2		1	99	71	62	240	7

* *Section from Perth to Katherine - for Katherine to Darwin see Adelaide-Darwin link.*

** Less than 1%.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

PERTH-DARWIN LINK*

Segment	Length (Kilometres)	Annual Average Daily Traffic: 0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	Divided Road, Seal/Gravel Width: 0 - 14.8m	>14.8m	Undivided Road, Formation Width: 0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	Undivided Road, Seal or Gravel Width: 0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Great Northern Highway																							
603A Perth-Muchea	31					27	73							91	9						41	59	
604A Muchea-Walebing	114			97		3								97	3					85	11	4	
604B Walebing-Dalwallinu	85		73	27									9	83	1		1			33	65	1	1
604C Dalwallinu-Mt. Magnet	317	59	41										59	41				86	4	1	8	1	
604D Mt. Magnet-Meekatharra	196	100											6	93			1	93	1	5			1
604E Meekatharra-Newman	415	99		1							10			77	13			7		23		19	1
605A Newman-Pt. Hedland	444	100									8		1	84	7			1		15			
606A Pt. Hedland-Broome	547	96	4										2	86	12			19	18	3		10	1
606B Broome-Derby T/O	145	100											21	79					96	1		3	
607A DerbyT/O-Halls Creek	514	99	1										51	49					33	37		1	
607B Halls Ck.-Victoria Highway Junction	314	97		3									28	72				40	5	25	1		
Victoria Highway																							
609A Junction-State Border	89	8	41	51									48	52					48	52			
805B State Border-Timber Creek	161	100											100					97		1	2		
805A Timber Creek-Katherine	291	58	42									16	63	21				88	4	1		7	
TOTAL	3663	83	11	5		-**	1				2	1	27	66	4		-**	31	13	18	3	5	-**

* Section from Perth to Katherine - for Katherine to Darwin section see Adelaide-Darwin link.
** Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

PERTH-DARWIN LINK*

Segment	1974					1977					Percentage Change in Deficiency
	Total Length (Km)	Length Structurally Deficient (Km)	Length Width Deficient (Km)	Overall Length Deficient (Km)	Percentage of Total Length Deficient	Total Length (Km)	Length Structurally Deficient (Km)	Length Width Deficient (Km)	Overall Length Deficient (Km)	Percentage of Total Length Deficient	
Great Northern Highway											
603A Perth-Mucea	31	2	31	31	100	31	18	31	31	100	
604A Muchea-Malebing	114	42	113	113	99	114	81	109	113	99	
604B Walebing-Dalwallinu	85	26	84	85	100	85	64	84	85	100	
604C Dalwallinu-Mt. Magnet	317	29	314	314	99	317	89	314	314	99	
604D Mt. Magnet-Meekatharra	196	8	195	196	100	196	42	195	196	100	
604E Meekatharra-Newman	415	114	391	391	94	415	101	311	399	96	+ 2
605A Newman-Pt. Hedland	444	444	444	444	100	444	444	444	444	100	+ 1
606A Pt. Hedland-Broome	547	547	547	547	100	547	214	469	486	89	
606B Broome-Derby T/O	145	6	145	145	100	145		140	140	97	- 3
607A Derby T/O-Halls Creek	535	79	451	465	87	514	114	312	407	79	- 8
607B Halls Creek-Victoria Highway Junc.	314	5	306	312	99	314	5	229	299**	95	- 4
Victoria Highway											
609A Victoria Highway-State Border	89	13	89	89	100	89		89	89	100	
805B State Border-Timber Creek	161	3	161	161	100	161	3	161	161	100	
805A Timber Creek-Katherine	291	137	290	290	99	291	143	272	274	94	- 5
TOTAL	3684	1455	3561	3583	97%	3663	1318	3160	3438	94%	- 3%

* Section from Perth to Katherine - for Katherine to Darwin see Adelaide-Darwin link.

** Includes some 65 Km surface deficient only.

However, some two kilometres previously up to standard is now structurally deficient. Thus, overall deficiency has been reduced by 5 per cent to 94 per cent.

Hobart-Burnie Link

The declared National Highway route is the Midland Highway between Hobart and Launceston and then the Bass Highway to Burnie via Latrobe. The national highway standards specify a divided highway between Latrobe and Burnie and a single carriageway 7.4 metre wide for the remainder of the link.

(a) Hobart to Launceston:
This segment carries traffic volumes in the range 1101-15 000 vpd with 36 per cent of the length carrying 1101-2200 vpd and 55 per cent carrying 2201-4000 vpd. Some 25 per cent of the segment length is width deficient. However, all of the segment is structurally up to standard.

Reconstruction has eliminated twenty-two kilometres of width deficient roadway as well as six kilometres of roadway deficient structurally. Thus, overall deficiency has been reduced from 44 per cent in 1974 to 25 per cent.

(b) Launceston to Latrobe:
Traffic volumes in this segment are between 2201-15 000 vpd with 63 per cent of the segment carrying in excess of 4000 vpd. Only 19 per cent of this segment is width deficient with some 6 per cent of this width deficient roadway also being structurally deficient.

Subsequent to June 1977, a bypass route linking the Bass and Midland Highways at Launceston has been declared as part of the national highways system. Inventory relating to this route has been included in the analysis and, thus, this segment has increased in length by some five kilometres. This newly declared highway is deficient in width and structure. (It is the only part of the segment structurally deficient.) Reconstruction of some thirteen kilometres of highway has reduced width and overall deficiency. This segment is now 19 per cent deficient overall compared with 29 per cent deficiency in 1974.

(c) Latrobe to Burnie:
All of this segment carries volumes in excess of 2201 vpd. Some 80 per cent carries between 4001-15 000 vpd and 15 per cent of the length carries 2201-4000 vpd. Most (84 per cent) of this segment is single carriageway and, as such, is deficient. All of the roadway is to standard in terms of structure.

Some reconstruction and/or duplication has reduced width and overall deficiency by 11 per cent. This segment is now 84 per cent deficient overall.

NATIONAL HIGHWAYS INVENTORY SUMMARY

(DESCRIPTIVE)

1977

(percentages)

HOBART-BURNIE LINK

Segment	Length (Km)	Surface Type						General Terrain				Land Use		No. of Structures			
		Natural	Formed	Gravel	Bitumen Seal	Bitumen Concrete	Concrete	Flat	Undulating	Hilly	Mountainous	Town	Rural	Bridge	Culvert	Other	Rail Crossing
Midland Highway																	
701A Hobart-Launceston	173				55	45		51	41	8		7	93	21	12		4
Bass Highway																	
702A Launceston-Latrobe	89				37	63		47	53			12	88	9	3		2
702B Latrobe-Burnie	62				77	23		44	47	9		32	68	22	9		3
TOTAL	324				56	44		49	45	6		14	86	52	24		9

NATIONAL HIGHWAYS INVENTORY SUMMARY

(QUANTITATIVE)

1977

(percentages)

HOBART-BURNIE LINK

Segment	Length (Kilometres)	Annual Average Daily Traffic							Divided Road Seal/Gravel Width		Undivided Road Formation Width							Undivided Road Seal or Gravel Width					
		0 - 140	141 - 300	301 - 1100	1101 - 2200	2201 - 4000	4001 - 15k	>15k	0 - 14.8m	>14.8m	0 - 5.4m	5.5m - 7.3m	7.4m - 8.5m	8.6m - 10.4m	10.5m - 12.2m	12.3m - 13.2m	>13.2m	0 - 5.1m	5.2m - 6.0m	6.1m - 6.7m	6.8m - 7.3m	7.4m - 10.8m	>10.8m
Midland Highway																							
701A Hobart-Launceston	173				36	55	9					18	16	5	35	24	2	6	31			63	
Bass Highway																							
702A Launceston-Latrobe	89					37	63					14		45		41		14				86	
702B Latrobe-Burnie	62					18	80	2	16			20	2	18	7	35	4	21	2	11		50	
TOTAL	324				20	43	37	-*	3			18	9	17	21	30	2	11	18	3		65	

* Less than 1%.

NATIONAL HIGHWAYS DEFICIENCY ANALYSIS

(according to National Highway Design Standards)

HOBART-BURNIE LINK

Segment	1974 Total Length (Km)	1974 Length Structurally Deficient (Km)	1974 Length Width Deficient (Km)	1974 Overall Length Deficient (Km)	1974 Percentage of Total Length Deficient	1977 Total Length (Km)	1977 Length Structurally Deficient (Km)	1977 Length Width Deficient (Km)	1977 Overall Length Deficient (Km)	1977 Percentage of Total Length Deficient	Percentage Change in Deficiency
Midland Highway											
710A Hobart-Launceston	173	6	76	76	44	173	0	44	44	25	- 19
Bass Highway											
702A Launceston-Latrobe	84	0	24	24	29	89	5	17	17	19	- 10
702B Latrobe-Burnie	62	0	59	59	95	62	0	52	52	84	- 11
TOTAL	319	6	159	159	50%	324	5	113	113	35%	- 15%

ANNEX 2

PROJECTION OF ROAD INVESTMENT NEEDS USING THE CAPITAL - OUTPUT RATIO APPROACH

INTRODUCTION

Any productive process or activity can be characterised by a production function which defines the relationship between the output and input of any such process. Such relationships provide the theoretical bases for other and usually simpler mathematical relationships which are often used as partial measures of performance such as labour or capital productivity.

In this Annex an approach to the assessment of future road needs in terms of projection of the capital stock of roads is outlined.

The approach depends on the basic assumptions that:

- travel, as represented by vehicle kilometres, is a reasonable measure of the output of the road system;
- design standards, quality of road service etc., embodied in the road capital stock are stable over time or changing in a consistent fashion; and
- that the cross relationships between other inputs to the road system and road capital are invariant with output and over time, or are changing in a consistent fashion over time.

This Annex is therefore based on the hypothesis that projections of road expenditure needs can be derived by independently projecting the demand for road services (as measured by vehicle-kilometres) and capital-output ratios to determine net and gross expenditure required to achieve the capital stock forecasts.

CAPITAL STOCK MEASURES

The road capital stock at any point in time is developed using the perpetual inventory method. This consists of developing a historic capital expenditure series, adjusting this for price changes, asset retirements and changes in the productive capacity of roads over time and accumulating the resulting values.

The estimated total capital expenditure on roads for the period 1921-76 is given in Table A2.1. This expenditure series is converted to constant price valuation of expenditure using a price index that reflects changes in the replacement costs of roads over time(1): this index is also shown in Table A2.1.

Adjustment for asset retirements over time is based upon an assumed average life for all classes of roads and structures of twenty-five years. The sensitivity of the capital stock estimates to changes in this average life is examined using longer and shorter lives.

Changes in the productive capacity of roads is accounted for using an approach developed by Jack Faucett Associates in the United States(2). In that study, losses in productive capacity over an asset's life were represented by what was called an 'efficiency depreciation function'. This function is the lower segment of the rectangular hyperbola:

$$D(a) = \frac{S - A}{S - xA} \quad \text{when A is greater than O but less than S}$$

and $= 0$ when A is greater than S

---

(1) Use of series means that the capital stock estimates will reflect the replacement cost of assets that are in the asset stock in any point in time.

(2) Jack Faucett Associates, Inc., <u>Capital Stock Measures for Transportation</u>, prepared for the U.S. Department of Transportation, December, 1974, Volume 1, Table 3.4.

TABLE A2.1 - ESTIMATED CAPITAL STOCKS FOR ROADS

Year Ended 30 June	Gross Capital Investment(1) ($ million (current prices)	Road Price Index(2) 1971-72 = 100	Gross Capital Investment $m 1971-72 Prices	Estimated Capital Stocks $m 1971-72 Prices (x = 0.9)
1921	14	24.8	56	
1922	17	24.0	71	
1923	17	22.9	74	
1924	20	23.0	87	
1925	24	23.0	104	
1926	27	23.8	113	
1927	32	23.8	134	
1928	33	23.0	138	
1929	32	24.0	133	
1930	30	22.5	133	
1931	23	22.2	104	
1932	19	20.2	94	
1933	21	18.9	111	
1934	23	18.7	123	
1935	26	18.8	138	
1936	28	19.1	147	
1937	28	19.6	143	
1938	30	20.8	144	
1939	30	21.3	141	
1940	40	21.6	185	
1941	38	22.4	170	
1942	23	24.1	95	
1943	15	26.3	57	
1944	17	27.6	62	
1945	16	25.4	63	
1946	24	27.6	87	
1947	34	28.7	118	
1948	38	33.1	115	
1949	42	36.1	116	
1950	49	39.4	124	
1951	62	44.4	140	
1952	83	53.2	156	
1953	86	60.1	143	
1954	92	60.7	152	
1955	111	62.9	176	

TABLE A2.1 (continued)

Year Ended 30 June	Gross Capital Investment(1) ($ million (current prices)	Road Price Index(2) 1971-72 = 100	Gross Capital Investment $m 1971-72 Prices	Estimated Capital Stocks $m 1971-72 Prices (x = 0.9)
1956	128	64.2	209	2 742
1957	144	67.8	212	2 836
1958	158	68.9	229	2 939
1959	170	70.3	242	3 048
1960	206	72.8	283	3 193
1961	231	78.3	295	3 348
1962	247	80.2	308	3 516
1963	263	80.8	325	3 702
1964	299	83.0	360	3 923
1965	316	82.6	383	4 164
1966	335	80.6	416	4 455
1967	371	82.7	449	4 801
1968	394	83.2	474	5 176
1969	419	86.8	483	5 550
1970	446	90.6	492	5 921
1971	474	95.1	498	6 281
1972	525	100.0	525	6 654
1973	576	106.6	540	7 035
1974	640	123.4	519	7 386
1975	823	147.5	558	7 763
1976	990	163.9	524	8 093

(1)(a) 1921-1941 series from M. Keating, The Australian Workforce 1910-11 to 1960-61, Australian National University, p. 231.
(b) 1942-1948 series estimated by BTE from published data on central State road authority expenditure, local government expenditure and capital works financed from loan funds.
(c) 1949-1976 series from ABS, Australian National Accounts, 'Gross Fixed Capital Expenditure, All Public Authorities: By Purpose; Road Transport', various issues.
(d) Maintenance expenditure is assumed to account for about 25 per cent of total road expenditures (refer Commonwealth Bureau of Roads, Report on Roads in Australia, 1973, Melbourne, November, 1973, p. 223) and series are adjusted accordingly.

(2)(a) 1921-1941 component of the index from M. Keating, op.cit., p. 231.
(b) 1941-1964 component of the index relates to the N.S.W. Department of Main Roads' Index of Cost Rises.
(c) 1964-1976 component of the index from R.H. Burke, A Road Construction Price Index, Bureau of Transport Economics, Forthcoming.

where D(a) is per cent of asset surviving, A is age of asset in years, S is the service life of the asset and x is a parameter whose value must be determined. Values of x close to one allow the function to represent the 'one-hoss-shay' type of loss in productive capacity whereas values close to zero approximate uniform losses in productive capacity over time.

The value of the parameter measure in the efficiency depreciation function is taken to be 0.9 which is the value employed in the U.S. study. A value of 0.7 is used to examine the sensitivity of capital stock estimates to changes in this parameter.

The resultant capital stock estimates for roads for the years 1956 through 1976 are shown in Table A2.1.

CAPITAL-OUTPUT RATIO PROJECTIONS

Capital-output ratio forecasts are derived by extrapolating the observed trend in historic capital-output ratios. The historic ratios are obtained by combining the capital stock measures derived above with a relevant output measure. The output measure used for roads is vehicle-kilometres which is very highly correlated with the capital stock estimates obtained above. Estimates of this output measure are shown in Table A2.2 together with projections of this measure(1). The resultant capital output ratios are also shown in Table A2.2, together with projections using an exponential trend extrapolation. The resultant capital stock projections for the period 1976-77 to 1983-84 are also given in that Table.

PROJECTION OF ROAD INVESTMENT NEEDS

Given future capital stock requirements as projected above, the perpetual inventory method can be used to determine the investment

(1) These projections were derived by the BTE for this report.

TABLE A2.2 - CAPITAL OUTPUT RATIO FORECASTS

Year Ended 30 June	Output (m. veh. km)	Capital Stock ($m, 1971-72 prices)	Capital Output Ratio
1956	28 572	2 742	.0960
1957	30 245	2 836	.0938
1958	32 128	2 939	.0915
1959	34 102	3 048	.0894
1960	36 841	3 193	.0867
1961	38 193	3 348	.0877
1962	40 769	3 516	.0862
1963	41 475	3 702	.0893
1964	46 268	3 923	.0848
1965	50 759	4 164	.0820
1966	54 303	4 455	.0820
1967	57 693	4 801	.0832
1968	61 715	5 176	.0839
1969	67 564	5 550	.0821
1970	73 294	5 921	.0808
1971	77 657	6 281	.0803
1972	82 859	6 654	.0803
1973	86 095	7 035	.0817
1974	91 403	7 386	.0808
1975	95 100	7 763	.0816
1976	99 071	8 093	.0817
1977	110 438	8 614	.0780
1978	113 517	8 786	.0774
1979	115 161	8 856	.0769
1980	118 746	9 060	.0763
1981	124 661	9 436	.0757
1982	130 897	9 830	.0751
1983	137 410	10 237	.0745
1984	143 300	10 604	.0740

needed to achieve these stocks. The method used to determine this investment is to forecast replacement investment required to maintain capital stocks at 1976 levels. This investment is shown in Table A2.3.

TABLE A2.3 - REPLACEMENT INVESTMENT REQUIRED TO MAINTAIN 1975-76 CAPITAL STOCKS
($ MILLION, 1971-72 PRICES)

Year Ended 30 June	Capital Stocks given no New Investment after 1976	Replacement Investment Required to Maintain 1976 Capital Stock Levels
1976	8 093	-
1977	7 887	206
1978	7 674	213
1979	7 446	228
1980	7 200	246
1981	6 937	263
1982	6 662	275
1983	6 372	290
1984	6 065	307

New Investment required to achieve the capital stock requirements shown in Table A2.2 are derived by subtraction as shown below:

Year Ended 30 June	Capital Stock ($m, 1971-72 prices)	New Capital Investment Needed ($m, 1971-72 prices)
1976	8 093	-
1977	8 614	521
1978	8 786	172
1979	8 856	70
1980	9 060	204
1981	9 436	376
1982	9 830	394
1983	10 237	407
1984	10 604	367

TABLE A2.4 - CAPITAL INVESTMENT NEEDED TO ACHIEVE PROJECTED CAPITAL STOCKS IN 1981 AND 1986

($m)

Year Ended 30 June	Investment (1971-72 prices) Replacement	Net	Gross	Investment[a] (1976-77 prices) Replacement	Net	Gross
1977	206	521	727	432	1093	1525
1978	213	172	385	447	361	808
1979	228	70	298	478	147	625
1980	246	204	450	516	428	944
1981	263	376	639	552	789	1341
1982	275	394	669	577	827	1404
1983	290	407	697	608	854	1462
1984	307	367	674	644	770	1414

(a) The road price index number for 1976-77 to extend the series given in Table A2.2 is 209.8.

New investment in the years following 1976 will also be subject to losses in productive capacity and replacement investment will be required to maintain capital stocks at the required level. This investment is small however and is not included. The annual investment required for these purposes is less than 3 per cent of replacement investment required to maintain 1976 capital stock levels.

The total capital investment needed to achieve the capital stock levels projected for 1977 to 1984 is shown in Table A2.4.

These estimates do not allow for maintenance of roads or for planning and research, and these are separately identified to arrive at total road expenditure requirements obtained by this projection method.

SENSITIVITY ANALYSES

Figures A2.1 and A2.2 demonstrate the sensivitiy of the needs projected by the capital-output ratio method to:

(a) assumed service life of road assets (roads and structures); and

(b) the parameter x in the efficiency depreciation function which ranges between zero and one;

- with a value close to zero indicating uniform losses in productive capacity over the life of the asset; and

- a value close to one, indicating one time loss in productive capacity at the end of the service life of the asset.

The sensitivity analyses in Figures A2.1 and A2.2, reveal wide

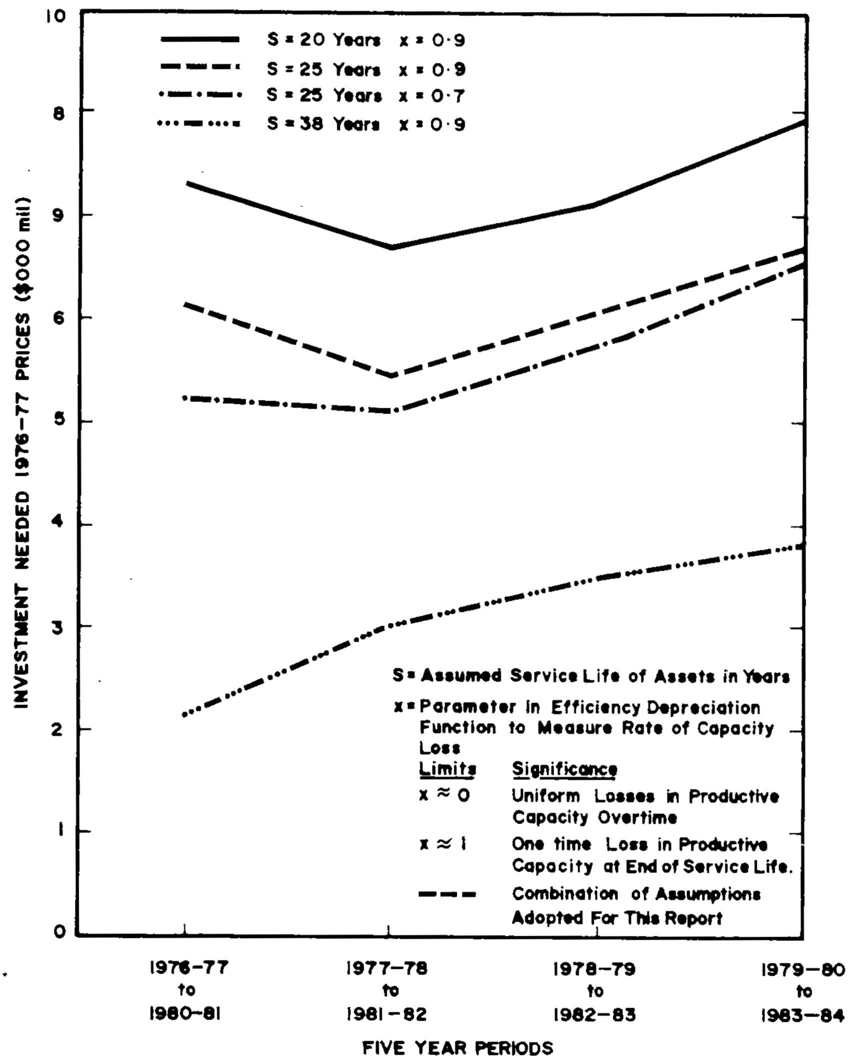

FIGURE A2·1
SENSITIVITY OF INVESTMENT TO CHANGE IN ASSET LIFE AND RATE OF CAPACITY LOSS.

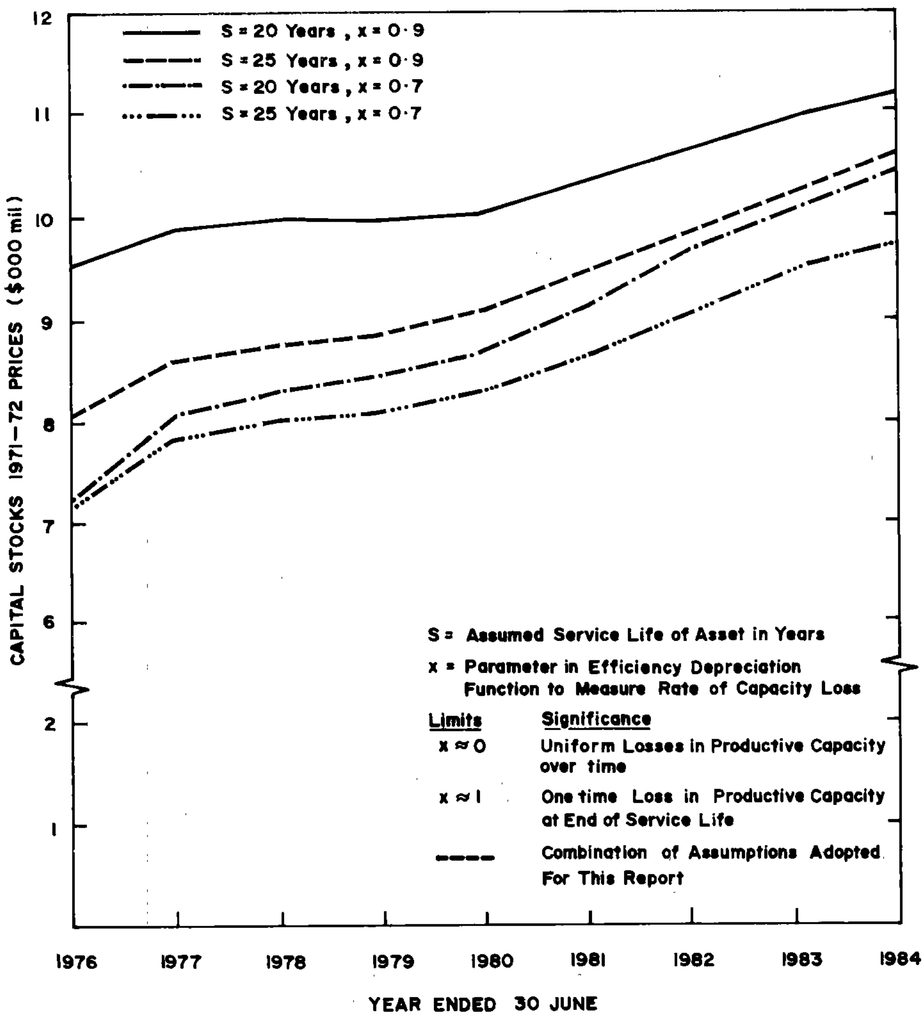

FIGURE A2·2

SENSITIVITY OF CAPITAL ROAD STOCKS REQUIREMENTS TO CHANGE IN ASSET LIFE AND RATE OF CAPACITY LOSS sensitivity in value of capital stocks required to the assumption of asset service life, and this appears to be greater than the sensitivity to the value of the parameter x.

The consequence of this sensitivity to changes in asset service life is shown up to a much more drastic extent in the implications for investment requirements in Figure A2.2. For the five year period 1978-79 to 1982-83, the road investment program needed would vary from $3500m to $7100m (1976-77 prices) for different asset lives of thirty-eight and twenty years respectively.

Service lives of road assets vary widely, both by type of asset (i.e. road structures such as bridges, crossings, etc.) and by location (climate, local materials available for construction), extent and type of maintenance, and by usage.

As it is difficult to arrive at a meaningful average service life of such disparate assets in disparate conditions of use, the capital-output method does suffer from quite serious empirical difficulties. This sensitivity indicates a need to disaggregate the road capital stock. However, existing sources of data are not sufficiently comprehensive to permit this to be done. Despite the difficulties associated with empirical application of the capital-output ratio approach, it does provide an order of magnitude estimate of road needs.

ANNEX 3

ROAD FINANCE DATA TABLES

CURRENT PRICE SERIES

Actual Series

(a) Estimated Road Expenditure by Category by State

1 Summation Table 1974-75 to 1978-79

2 1974-75

3 1975-76

4 1976-77

5 1977-78

6 1978-79

10 Estimated Road Expenditure 1974-75 to 1978-79 Annually, in Total by Source of Funds for Categories

(b) Estimated Actual Expenditure on Roads

20 Per Vehicle

21 Per Head Population

Projected Series

30 Projected Road Expenditures by State and Category 1979-80

31 Projected Road Expenditures 1980-81 to 1983-84 by State and Source of Funds

CONSTANT PRICE SERIES (1976-77 PRICES)

TABLE 1

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE

SUMMATION FOR YEARS 1974/75 TO 1978/79

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	V I C	Q L D	S.A.	W.A.	T A S	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	243.1	120.9	129.4	110.2	63.8	37.1	704.5	30.4	4.6	739.5
. MAINTENANCE	33.4	12.6	37.1	17.5	15.9	3.4	119.9	17.8	0.0	137.7
2 NATIONAL COMMERCE RDS	20.7	30.3	10.3	7.0	6.5	3.4	78.2	0.0	0.0	78.2
TOTAL (A)	297.2	163.8	176.8	134.7	86.2	43.9	902.6	48.2	4.6	955.4
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	352.3	153.5	224.5	47.1	110.5	38.9	926.8	1.0	.2	928.0
. RURAL LOCAL	497.7	276.4	307.2	61.0	157.2	66.6	1366.1	6.1	.6	1372.8
TOTAL	850.0	429.9	531.7	108.1	267.7	105.5	2292.9	7.1	.8	2300.8
. URBAN ARTERIAL	374.3	403.4	138.8	67.6	124.7	39.6	1148.4	5.1	73.7	1227.2
. URBAN LOCAL	483.4	400.1	159.6	103.8	110.9	27.1	1284.9	30.5	56.8	1372.2
TOTAL	857.7	803.5	298.4	171.4	235.6	66.7	2433.3	35.6	130.5	2599.4
. RURAL MIXERS	6.8	2.5	5.9	.8	1.0	1.9	18.9	0.0	0.0	18.9
. URBAN MIXERS	32.9	11.0	5.7	7.4	6.1	1.0	64.1	0.0	0.0	64.1
TOTAL	39.7	13.5	11.6	8.2	7.1	2.9	83.0	0.0	0.0	83.0
TOTAL CONSTRUCTION	1747.4	1246.9	841.7	287.7	510.4	175.1	4809.2	42.7	131.3	4983.2
2 MAINTENANCE										
. RURAL ARTERIAL	266.9	102.3	84.6	51.4	48.7	20.9	574.8	10.4	.4	585.6
. RURAL LOCAL	348.3	218.7	175.5	80.1	73.5	62.0	958.1	24.1	1.1	983.3
TOTAL	615.2	321.0	260.1	131.5	122.2	82.9	1532.9	34.5	1.5	1568.9
. URBAN ARTERIAL	169.0	61.0	29.3	19.0	10.2	4.9	293.4	1.3	5.4	300.1
. URBAN LOCAL	414.6	312.4	106.3	56.1	67.5	22.5	979.4	4.6	6.4	990.4
TOTAL	583.6	373.4	135.6	75.1	77.7	27.4	1272.8	5.9	11.8	1290.5
TOTAL MAINTENANCE	1198.8	694.4	395.7	206.6	199.9	110.3	2805.7	40.4	13.3	2859.4
TOTAL (B)	2946.2	1941.3	1237.4	494.3	710.3	285.4	7614.9	83.1	144.6	7842.6
(C) PLANNING AND RESEARCH	20.0	15.4	8.4	7.5	6.4	2.8	60.5	0.0	0.0	60.5
T O T A L (A, B AND C)	3263.4	2120.5	1422.6	536.5	802.9	332.1	8578.0	131.3	149.2	8858.5

TABLE 2

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1974/75

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	29.0	20.1	17.5	16.2	6.9	5.3	95.0	4.0	0.0	99.0
. MAINTENANCE	6.5	1.7	4.9	2.3	2.1	.4	17.9	5.0	0.0	22.9
2 NATIONAL COMMERCE RDS	0.0	7.4	0.0	.3	1.0	.2	8.9	0.0	0.0	8.9
TOTAL (A)	35.5	29.2	22.4	18.8	10.0	5.9	121.8	9.0	0.0	130.8
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	44.9	20.7	34.5	5.8	19.3	5.5	130.7	.1	.2	131.0
. RURAL LOCAL	73.3	41.5	49.8	9.4	26.2	8.2	208.4	.8	0.0	209.2
TOTAL	118.2	62.2	84.3	15.2	45.5	13.7	339.1	.9	.2	340.2
. URBAN ARTERIAL	81.8	72.0	26.5	13.5	23.0	6.0	222.8	.9	12.3	236.0
. URBAN LOCAL	70.7	63.8	24.6	18.8	15.4	3.0	196.3	3.6	9.2	209.1
TOTAL	152.5	135.8	51.1	32.3	38.4	9.0	419.1	4.5	21.5	445.1
. RURAL MITERS	.5	.2	.4	.1	.1	.3	1.6	0.0	0.0	1.6
. URBAN MITERS	2.0	.7	.6	.9	.3	.2	4.7	0.0	0.0	4.7
TOTAL	2.5	.9	1.0	1.0	.4	.5	6.3	0.0	0.0	6.3
TOTAL CONSTRUCTION	273.2	198.9	136.4	48.5	84.3	23.2	764.5	5.4	21.7	791.6
2 MAINTENANCE										
. RURAL ARTERIAL	39.5	18.0	13.1	8.7	5.5	2.9	87.7	.8	.2	88.7
. RURAL LOCAL	46.8	39.1	28.9	12.9	10.3	10.5	148.5	2.0	.3	150.8
TOTAL	86.3	57.1	42.0	21.6	15.8	13.4	236.2	2.8	.5	239.5
. URBAN ARTERIAL	18.9	9.2	4.8	2.9	1.2	.8	37.8	.1	.5	38.4
. URBAN LOCAL	62.3	49.8	17.7	8.7	10.2	3.3	152.0	.7	.7	153.4
TOTAL	81.2	59.0	22.5	11.6	11.4	4.1	189.8	.8	1.2	191.8
TOTAL MAINTENANCE	167.5	116.1	64.5	33.2	27.2	17.5	426.0	3.6	1.7	431.3
TOTAL (B)	440.7	315.0	200.9	81.7	111.5	40.7	1190.5	9.0	23.4	1222.9
(C) PLANNING AND RESEARCH	3.5	2.2	1.0	1.1	1.1	.3	9.2	0.0	0.0	9.2
TOTAL (A, B AND C)	479.7	346.4	224.3	101.6	122.6	40.9	1321.5	18.0	23.4	1362.9

TABLE 3

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1975/76

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	41.1	22.3	22.1	23.3	12.4	7.1	128.3	4.2	0.0	132.5
. MAINTENANCE	7.4	2.0	5.9	3.0	2.8	.6	21.7	2.6	0.0	24.3
2 NATIONAL COMMERCE RDS	2.5	6.6	1.4	1.6	.9	.6	13.6	0.0	0.0	13.6
TOTAL (A)	51.0	30.9	29.4	27.9	16.1	8.3	163.6	6.8	0.0	170.4
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	63.4	29.6	39.4	6.4	16.6	5.1	160.5	.1	0.0	160.6
. RURAL LOCAL	92.6	47.0	57.6	9.3	30.9	13.5	250.9	.8	.1	251.8
TOTAL	156.0	76.6	97.0	15.7	47.5	18.6	411.4	.9	.1	412.4
. URBAN ARTERIAL	72.9	70.4	22.4	11.5	22.3	6.4	205.9	.9	10.1	216.9
. URBAN LOCAL	101.3	68.3	29.9	20.0	18.8	3.5	241.8	4.1	15.6	261.5
TOTAL	174.2	138.7	52.3	31.5	41.1	9.9	447.7	5.0	25.7	478.4
. RURAL MITERS	1.9	.7	1.5	.2	.2	.4	4.9	0.0	0.0	4.9
. URBAN MITERS	8.8	2.0	1.1	1.8	1.4	.2	15.3	0.0	0.0	15.3
TOTAL	10.7	2.7	2.6	2.0	1.6	.6	20.2	0.0	0.0	20.2
TOTAL CONSTRUCTION	340.9	218.0	151.9	49.2	90.2	29.1	879.3	5.9	25.8	911.0
2 MAINTENANCE										
. RURAL ARTERIAL	42.4	19.9	17.1	9.5	8.4	3.7	101.0	3.0	.2	104.2
. RURAL LOCAL	65.1	40.6	33.0	13.5	12.1	11.7	176.0	6.9	.4	183.3
TOTAL	107.5	60.5	50.1	23.0	20.5	15.4	277.0	9.9	.6	287.5
. URBAN ARTERIAL	26.4	9.5	5.4	3.1	1.6	.8	46.8	.3	.9	48.0
. URBAN LOCAL	80.6	58.6	20.7	11.4	12.3	4.9	188.5	.8	1.0	190.3
TOTAL	107.0	68.1	26.1	14.5	13.9	5.7	235.3	1.1	1.9	238.3
TOTAL MAINTENANCE	214.5	128.6	76.2	37.5	34.4	21.1	512.3	11.0	2.5	525.8
TOTAL (B)	555.4	346.6	228.1	86.7	124.6	50.2	1391.6	16.9	28.3	1436.8
(C) PLANNING AND RESEARCH	3.4	4.0	1.1	1.4	1.3	.4	11.6	0.0	0.0	11.6
TOTAL (A, B AND C)	609.8	381.5	258.6	116.0	142.0	58.9	1566.8	23.7	28.3	1618.8

TABLE 4

PROJECTED ROAD EXPENDITURE BY CATEGORY, BY STATE 1976/77

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	49.2	24.5	27.0	27.9	10.5	8.8	147.9	4.5	0.0	152.4
. MAINTENANCE	2.6	2.9	7.8	3.5	2.0	.5	19.3	3.6	0.0	22.9
2 NATIONAL COMMERCE RDS	7.6	5.6	2.9	1.6	1.3	.8	19.8	0.0	0.0	19.8
TOTAL (A)	59.4	33.0	37.7	33.0	13.8	10.1	187.0	8.1	0.0	195.1
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	58.1	33.4	50.3	9.8	22.5	7.7	181.8	.2	0.0	182.0
. RURAL LOCAL	101.8	57.2	63.5	13.9	35.5	14.1	286.0	1.3	.5	287.8
TOTAL	159.9	90.6	113.8	23.7	58.0	21.8	467.8	1.5	.5	469.8
. URBAN ARTERIAL	62.3	78.4	24.4	12.8	26.3	10.2	214.4	.8	7.9	223.1
. URBAN LOCAL	91.0	82.3	32.9	19.1	22.4	7.1	254.8	7.3	19.1	281.2
TOTAL	153.3	160.7	57.3	31.9	48.7	17.3	469.2	8.1	27.0	504.3
. RURAL MITERS	1.5	.3	1.3	.1	.2	.4	3.8	0.0	0.0	3.8
. URBAN MITERS	6.8	2.3	1.3	1.4	1.4	.2	13.4	0.0	0.0	13.4
TOTAL	8.3	2.6	2.6	1.5	1.6	.6	17.2	0.0	0.0	17.2
TOTAL CONSTRUCTION	321.5	253.9	173.7	57.1	108.3	39.7	954.2	9.6	27.5	991.3
2 MAINTENANCE										
. RURAL ARTERIAL	62.6	19.7	17.5	10.0	11.2	4.0	125.0	2.2	0.0	127.2
. RURAL LOCAL	73.9	41.0	35.3	17.2	13.8	10.9	192.1	5.0	.4	197.5
TOTAL	136.5	60.7	52.8	27.2	25.0	14.9	317.1	7.2	.4	324.7
. URBAN ARTERIAL	31.5	12.3	6.2	4.0	1.8	1.0	56.8	.3	1.2	58.3
. URBAN LOCAL	79.5	61.8	21.7	10.6	13.9	3.9	191.4	.9	1.0	193.3
TOTAL	111.0	74.1	27.9	14.6	15.7	4.9	248.2	1.2	2.2	251.6
TOTAL MAINTENANCE	247.5	134.8	80.7	41.8	40.7	19.8	565.3	8.4	2.6	576.3
TOTAL (B)	569.0	388.7	254.4	98.9	149.0	59.5	1519.5	18.0	30.1	1567.6
(C) PLANNING AND RESEARCH	4.4	3.1	1.3	1.5	1.3	.5	12.1	0.0	0.0	12.1
TOTAL (A, B AND C)	632.8	424.8	293.4	133.4	164.1	70.1	1718.6	26.1	30.1	1774.8

TABLE 5

PROJECTED ROAD EXPENDITURE BY CATEGORY, BY STATE 1977/78

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	58.5	26.1	30.2	20.3	16.7	7.4	159.2	7.7	.6	167.5
. MAINTENANCE	8.3	2.8	8.7	4.1	4.5	.9	29.3	3.3	0.0	32.6
2 NATIONAL COMMERCE RDS	6.3	4.3	2.7	1.7	1.6	.9	17.5	0.0	0.0	17.5
TOTAL (A)	73.1	33.2	41.6	26.1	22.8	9.2	206.0	11.0	.6	217.6
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	86.2	33.8	47.8	11.9	24.1	9.7	213.5	.3	0.0	213.8
. RURAL LOCAL	111.6	62.6	66.5	13.6	30.4	14.3	299.0	1.4	0.0	300.4
TOTAL	197.8	96.4	114.3	25.5	54.5	24.0	512.5	1.7	0.0	514.2
. URBAN ARTERIAL	74.6	87.9	31.5	14.2	24.5	8.0	240.7	.8	24.4	265.9
. URBAN LOCAL	105.1	89.3	35.2	22.1	25.7	6.5	283.9	7.2	12.9	304.0
TOTAL	179.7	177.2	66.7	36.3	50.2	14.5	524.6	8.0	37.3	569.9
. RURAL MITERS	1.5	.6	1.2	.2	.2	.4	4.1	0.0	0.0	4.1
. URBAN MITERS	7.4	2.9	1.2	1.7	1.4	.2	14.8	0.0	0.0	14.8
TOTAL	8.9	3.5	2.4	1.9	1.6	.6	18.9	0.0	0.0	18.9
TOTAL CONSTRUCTION	386.4	277.1	183.4	63.7	106.3	39.1	1056.0	9.7	37.3	1103.0
2 MAINTENANCE										
. RURAL ARTERIAL	58.4	21.5	17.3	10.9	10.6	4.8	123.5	1.9	0.0	125.4
. RURAL LOCAL	78.0	46.9	38.0	17.5	17.6	13.9	211.9	4.4	0.0	216.3
TOTAL	136.4	68.4	55.3	28.4	28.2	18.7	335.4	6.3	0.0	341.7
. URBAN ARTERIAL	42.7	14.4	6.1	4.3	2.5	1.1	71.1	.3	1.2	72.6
. URBAN LOCAL	91.5	67.7	22.5	12.2	14.6	4.9	213.4	1.0	1.5	215.9
TOTAL	134.2	82.1	28.6	16.5	17.1	6.0	284.5	1.3	2.7	288.5
TOTAL MAINTENANCE	270.6	150.5	83.9	44.9	45.3	24.7	619.9	7.6	2.7	630.2
TOTAL (B)	657.0	427.6	267.3	108.6	151.6	63.8	1675.9	17.3	40.0	1733.2
(C) PLANNING AND RESEARCH	4.1	2.9	1.3	1.6	1.2	.7	11.8	0.0	0.0	11.8
TOTAL (A, B AND C)	734.2	463.7	310.2	136.3	175.6	73.7	1893.7	28.3	40.6	1962.6

TABLE 6

PROJECTED ROAD EXPENDITURE BY CATEGORY, BY STATE 1978/79

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	65.3	27.9	32.6	22.5	17.3	8.5	174.1	10.0	4.0	188.1
. MAINTENANCE	8.6	3.2	9.8	4.6	4.5	1.0	31.7	3.3	0.0	35.0
2 NATIONAL COMMERCE RDS	4.3	6.4	3.3	1.8	1.7	.9	18.4	0.0	0.0	18.4
TOTAL (A)	78.2	37.5	45.7	28.9	23.5	10.4	224.2	13.3	4.0	241.5
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	99.7	34.0	52.5	13.2	28.0	10.9	240.3	.3	0.0	240.6
. RURAL LOCAL	118.4	68.1	69.8	14.8	34.2	16.5	321.8	1.8	0.0	323.6
TOTAL	218.1	104.1	122.3	28.0	62.2	27.4	562.1	2.1	0.0	564.2
. URBAN ARTERIAL	82.7	94.7	34.0	15.6	28.6	9.0	264.6	1.7	19.0	285.3
. URBAN LOCAL	115.3	96.4	37.0	23.8	28.6	7.0	308.1	8.3	0.0	316.4
TOTAL	198.0	191.1	71.0	39.4	57.2	16.0	572.7	10.0	19.0	601.7
. RURAL MITERS	1.4	.7	1.5	.2	.3	.4	4.5	0.0	0.0	4.5
. URBAN MITERS	7.9	3.1	1.5	1.6	1.6	.2	15.9	0.0	0.0	15.9
TOTAL	9.3	3.8	3.0	1.8	1.9	.6	20.4	0.0	0.0	20.4
TOTAL CONSTRUCTION	425.4	299.0	196.3	69.2	121.3	44.0	1155.2	12.1	19.0	1186.3
2 MAINTENANCE										
. RURAL ARTERIAL	64.0	23.2	19.6	12.3	13.0	5.5	137.6	2.5	0.0	140.1
. RURAL LOCAL	84.5	51.1	40.3	19.0	19.7	15.0	229.6	5.8	0.0	235.4
TOTAL	148.5	74.3	59.9	31.3	32.7	20.5	367.2	8.3	0.0	375.5
. URBAN ARTERIAL	49.5	15.6	6.8	4.7	3.1	1.2	80.9	.3	1.6	82.8
. URBAN LOCAL	100.7	74.5	23.7	13.2	16.5	5.5	234.1	1.2	2.2	237.5
TOTAL	150.2	90.1	30.5	17.9	19.6	6.7	315.0	1.5	3.8	320.3
TOTAL MAINTENANCE	298.7	164.4	90.4	49.2	52.3	27.2	682.2	9.8	3.8	695.8
TOTAL (B)	724.1	463.4	286.7	118.4	173.6	71.2	1837.4	21.9	22.8	1882.1
(C) PLANNING AND RESEARCH	4.6	3.2	3.7	1.9	1.5	.9	15.8	0.0	0.0	15.8
TOTAL (A, B AND C)	806.9	504.1	336.1	149.2	198.6	82.5	2077.4	35.2	26.8	2139.4

TABLE 10

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, CURRENT PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
(A) COMMONWEALTH							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	93.2	120.4	137.9	158.0	177.6	687.1	17.49
. NAT. COMMERCE ROADS	1.5	11.2	18.9	16.3	16.8	64.7	82.94
. RURAL ROADS							
ARTERIAL	50.0	48.7	58.1	71.3	76.8	304.9	11.33
LOCAL	55.5	51.0	56.9	72.0	72.9	308.3	7.06
TOTAL	105.5	99.7	115.0	143.3	149.7	613.2	9.14
. URBAN ROADS							
ARTERIAL	156.2	143.3	127.2	106.1	106.6	639.4	-10.02
LOCAL	17.8	27.6	40.1	45.9	33.6	165.0	17.21
TOTAL	174.0	170.9	167.3	152.0	140.2	804.4	-5.55
. MITERS	4.8	13.8	12.2	13.5	14.6	58.9	32.06
TOTAL CONSTRUCTION	379.0	416.0	451.3	483.1	498.9	2228.3	7.11
2. MAINTENANCE	55.3	65.0	64.0	70.4	77.3	332.0	8.73
3. PLANNING AND RESEARCH	4.8	5.5	5.8	4.7	7.8	28.6	12.91
TOTAL COMMONWEALTH	439.1	486.5	521.1	558.2	584.0	2588.9	7.39

TABLE 10 (CONT)

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, CURRENT PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
(B) STATE AND TERRITORY							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	5.8	12.1	14.5	9.5	10.5	52.4	16.00
. NAT. COMMERCE ROADS	7.4	2.4	.9	1.2	1.6	13.5	-46.65
. RURAL ROADS							
ARTERIAL	81.0	111.9	123.7	142.4	163.6	622.6	19.21
LOCAL	29.0	45.5	63.9	52.4	58.6	249.4	19.23
TOTAL	110.0	157.4	187.6	194.8	222.2	872.0	19.22
. URBAN ROADS							
ARTERIAL	69.2	60.8	81.6	144.0	161.6	517.2	23.62
LOCAL	19.0	22.4	30.6	23.1	25.0	120.1	7.10
TOTAL	88.2	83.2	112.2	167.1	186.6	637.3	20.60
. MITERS	1.5	6.4	5.0	5.4	5.8	24.1	40.23
TOTAL CONSTRUCTION	212.9	261.5	320.2	378.0	426.7	1599.3	18.98
2. MAINTENANCE	138.8	179.1	206.8	233.9	261.7	1020.3	17.18
3. PLANNING AND RESEARCH	4.4	6.1	6.3	7.1	8.0	31.9	16.12
TOTAL STATE AND TERRITORY	356.1	446.7	533.3	619.0	696.4	2651.5	18.26

TABLE 10 (CONT)

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, CURRENT PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
(C) LOCAL GOVERNMENT							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
. NAT. COMMERCE ROADS	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
. RURAL ROADS							
ARTERIAL	0.0	0.0	.2	.1	.2	.5	****** NA
LOCAL	124.7	155.3	167.0	176.0	192.1	815.1	11.41
TOTAL	124.7	155.3	167.2	176.1	192.3	815.6	11.44
. URBAN ROADS							
ARTERIAL	10.6	12.8	14.3	15.8	17.1	70.6	12.70
LOCAL	172.3	211.5	210.5	235.0	257.8	1087.1	10.60
TOTAL	182.9	224.3	224.8	250.8	274.9	1157.7	10.72
. MITERS	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
TOTAL CONSTRUCTION	307.6	379.6	392.0	426.9	467.2	1973.3	11.01
2. MAINTENANCE	260.1	306.0	328.4	358.5	391.8	1644.8	10.79
3. PLANNING AND RESEARCH	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
TOTAL LOCAL GOVERNMENT	567.7	685.6	720.4	785.4	859.0	3618.1	10.91

TABLE 10 (CONT)

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, CURRENT PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
ALL LEVELS							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	99.0	132.5	152.4	167.5	188.1	739.5	17.41
. NAT. COMMERCE ROADS	8.9	13.6	19.8	17.5	18.4	78.2	19.91
. RURAL ROADS							
ARTERIAL	131.0	160.6	182.0	213.8	240.6	928.0	16.41
LOCAL	209.2	251.8	287.8	300.4	323.6	1372.8	11.52
TOTAL	340.2	412.4	469.8	514.2	564.2	2300.8	13.48
. URBAN ROADS							
ARTERIAL	236.0	216.9	223.1	265.9	285.3	1227.2	4.86
LOCAL	209.1	261.5	281.2	304.0	316.4	1372.2	10.91
TOTAL	445.1	478.4	504.3	569.9	601.7	2599.4	7.83
. OTHERS	6.3	20.2	17.2	18.9	20.4	83.0	34.14
TOTAL CONSTRUCTION	899.5	1057.1	1163.5	1288.0	1392.8	5800.9	11.55
2. MAINTENANCE	454.2	550.1	599.2	662.8	730.8	2997.1	12.63
3. PLANNING AND RESEARCH	9.2	11.6	12.1	11.8	15.8	60.5	14.48
TOTAL ALL LEVELS	1362.9	1618.8	1774.8	1962.6	2139.4	8858.5	11.93

TABLE 20

ESTIMATED ACTUAL EXPENDITURE ON ROADS

$ PER VEHICLE

CURRENT PRICES

STATE	SOURCE OF FUNDS	1974/75	1975/76	1976/77	1977/78	1978/79	ANNUAL AVERAGE GROWTH RATE
NSW	CWLTH	59.	63.	71.	75.	78.	7.05
	STATE	71.	93.	93.	118.	132.	16.63
	LOCAL	109.	138.	134.	144.	156.	9.36
	TOTAL	239.	294.	298.	338.	365.	11.15
VIC	CWLTH	54.	53.	56.	56.	60.	2.46
	STATE	58.	60.	70.	78.	84.	9.56
	LOCAL	101.	107.	116.	126.	138.	8.03
	TOTAL	214.	221.	242.	260.	281.	7.13
QLD	CWLTH	99.	101.	100.	105.	114.	3.58
	STATE	58.	71.	89.	92.	102.	15.32
	LOCAL	106.	121.	115.	117.	121.	3.39
	TOTAL	263.	293.	304.	315.	337.	6.43
SA	CWLTH	58.	69.	62.	63.	68.	3.91
	STATE	51.	53.	78.	74.	82.	12.87
	LOCAL	70.	73.	73.	77.	82.	4.12
	TOTAL	179.	195.	213.	213.	232.	6.77
WA	CWLTH	109.	107.	101.	99.	104.	-1.14
	STATE	56.	67.	85.	87.	105.	17.12
	LOCAL	74.	79.	86.	93.	103.	8.89
	TOTAL	238.	253.	272.	279.	312.	7.02
TAS	CWLTH	103.	122.	116.	105.	117.	3.12
	STATE	68.	89.	132.	148.	168.	25.45
	LOCAL	88.	96.	103.	112.	123.	8.84
	TOTAL	259.	307.	351.	365.	408.	12.05
ALL	CWLTH	69.	72.	74.	77.	81.	3.97
	STATE	62.	74.	85.	96.	107.	14.75
	LOCAL	99.	113.	114.	122.	132.	7.57
	TOTAL	230.	260.	274.	295.	321.	8.66

TABLE 21

ESTIMATED ACTUAL EXPENDITURE ON ROADS

$ PER HEAD POPULATION

CURRENT PRICES

STATE	SOURCE OF FUNDS	1974/75	1975/76	1976/77	1977/78	1978/79	ANNUAL AVERAGE GROWTH RATE
NSW	CWLTH	25.	27.	31.	33.	35.	8.93
	STATE	30.	40.	40.	52.	59.	18.68
	LOCAL	45.	59.	58.	64.	70.	11.28
	TOTAL	100.	125.	129.	149.	163.	13.11
VIC	CWLTH	24.	25.	26.	27.	28.	4.21
	STATE	26.	28.	33.	37.	40.	11.43
	LOCAL	45.	50.	55.	60.	65.	9.87
	TOTAL	95.	103.	114.	123.	134.	8.96
QLD	CWLTH	42.	43.	46.	49.	53.	6.11
	STATE	24.	30.	41.	43.	48.	18.14
	LOCAL	45.	52.	53.	54.	57.	5.92
	TOTAL	111.	125.	140.	146.	157.	9.04
SA	CWLTH	27.	33.	31.	32.	34.	6.11
	STATE	24.	25.	39.	37.	42.	15.26
	LOCAL	32.	35.	36.	39.	41.	6.33
	TOTAL	83.	93.	106.	107.	117.	9.03
WA	CWLTH	47.	53.	53.	53.	56.	4.08
	STATE	24.	33.	44.	46.	56.	23.29
	LOCAL	32.	39.	45.	49.	55.	14.62
	TOTAL	104.	125.	142.	148.	167.	12.65
TAS	CWLTH	47.	58.	57.	52.	58.	5.33
	STATE	31.	42.	65.	73.	84.	28.14
	LOCAL	40.	46.	50.	55.	61.	11.17
	TOTAL	118.	147.	173.	180.	203.	14.45
ALL	CWLTH	30.	33.	34.	36.	38.	6.27
	STATE	27.	33.	39.	45.	51.	17.30
	LOCAL	43.	51.	53.	57.	62.	9.95
	TOTAL	99.	117.	127.	138.	151.	11.07

TABLE 30

PROJECTED ROAD EXPENDITURE BY CATEGORY, BY STATE 1979/80

($ MILLION , CURRENT PRICES)

CATEGORY	N.S.W.	V I C	Q L D	S.A.	W.A.	T A S	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	68.7	29.3	34.3	23.9	18.2	8.9	183.3	13.6	2.7	199.6
. MAINTENANCE	9.0	3.4	10.3	5.0	4.8	1.1	33.6	3.6	0.0	37.2
2 NATIONAL COMMERCE RDS	4.5	6.8	3.5	2.0	1.8	.9	19.5	0.0	0.0	19.5
TOTAL (A)	82.2	39.5	48.1	30.9	24.8	10.9	236.4	17.2	2.7	256.3
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	110.8	39.0	56.5	14.1	30.3	11.9	262.6	.4	0.0	263.0
. RURAL LOCAL	129.5	74.1	74.0	15.9	37.6	18.0	349.1	2.4	0.0	351.5
TOTAL	240.3	113.1	130.5	30.0	67.9	29.9	611.7	2.8	0.0	614.5
. URBAN ARTERIAL	90.6	103.0	36.7	16.9	30.8	9.8	287.8	2.3	24.3	314.4
. URBAN LOCAL	126.7	105.7	39.1	25.5	31.8	7.6	336.4	10.8	0.0	347.2
TOTAL	217.3	208.7	75.8	42.4	62.6	17.4	624.2	13.1	24.3	661.6
. RURAL MITERS	1.5	.7	1.6	.2	.3	.4	4.7	0.0	0.0	4.7
. URBAN MITERS	8.7	3.2	1.6	1.7	1.7	.2	17.1	0.0	0.0	17.1
TOTAL	10.2	3.9	3.2	1.9	2.0	.6	21.8	0.0	0.0	21.8
TOTAL CONSTRUCTION	467.8	325.7	209.5	74.3	132.5	47.9	1257.7	15.9	24.3	1297.9
2 MAINTENANCE										
. RURAL ARTERIAL	71.8	25.5	21.5	13.5	14.3	6.0	152.6	2.7	0.0	155.3
. RURAL LOCAL	93.0	55.9	42.7	20.4	21.6	16.4	250.0	6.3	0.0	256.3
TOTAL	164.8	81.4	64.2	33.9	35.9	22.4	402.6	9.0	0.0	411.6
. URBAN ARTERIAL	55.7	17.2	7.4	5.2	3.4	1.3	90.2	.5	1.8	92.5
. URBAN LOCAL	110.9	81.9	25.0	14.2	18.6	6.1	256.7	1.2	2.2	260.1
TOTAL	166.6	99.1	32.4	19.4	22.0	7.4	346.9	1.7	4.0	352.6
TOTAL MAINTENANCE	331.4	180.5	96.6	53.3	57.9	29.8	749.5	10.7	4.0	764.2
TOTAL (B)	799.2	506.2	306.1	127.6	190.4	77.7	2007.2	26.6	28.3	2062.1
(C) PLANNING AND RESEARCH	5.0	3.5	3.9	2.1	1.6	1.0	17.1	0.0	0.0	17.1
T O T A L (A, B AND C)	886.4	549.2	358.1	160.6	216.8	89.6	2260.7	43.8	31.0	2335.5

TABLE 31

PROJECTED ROAD EXPENDITURES BEYOND 1979/80 BY STATE AND BY SOURCE OF FUNDS

($ MILLION , CURRENT PRICES)

	NSW	VIC	QLD	SA	WA	TAS	SUB TOT	NT	ACT	TOTAL
1980/81										
C/G	185.5	116.2	122.6	47.2	71.5	25.5	568.5	48.0	35.7	652.2
S/G	368.1	181.6	123.2	64.1	80.7	41.1	858.8	0.0	0.0	858.8
L/G	417.0	298.4	133.5	60.7	83.3	30.1	1023.0	4.5	0.0	1027.5
TOT	970.6	596.2	379.3	172.0	235.5	96.7	2450.3	52.5	35.7	2538.5
1981/82										
C/G	191.1	119.7	126.2	48.6	73.6	26.3	585.5	57.6	41.0	684.1
S/G	414.1	199.8	135.5	70.5	88.8	45.2	953.9	0.0	0.0	953.9
L/G	458.7	328.3	140.1	65.3	93.7	33.2	1119.3	5.2	0.0	1124.5
TOT	1063.9	647.8	401.8	184.4	256.1	104.7	2658.7	62.8	41.0	2762.5
1982/83										
C/G	196.8	123.3	130.0	50.0	75.8	27.1	603.0	69.1	47.1	719.2
S/G	465.9	219.7	149.1	77.6	97.7	49.8	1059.8	0.0	0.0	1059.8
L/G	504.6	361.1	147.1	70.2	105.4	36.5	1224.9	5.9	0.0	1230.8
TOT	1167.3	704.1	426.2	197.8	278.9	113.4	2887.7	75.0	47.1	3009.8
1983/84										
C/G	202.7	127.0	133.9	51.5	78.1	27.9	621.1	82.9	54.2	758.2
S/G	524.1	241.7	164.0	85.4	107.5	54.8	1177.5	0.0	0.0	1177.5
L/G	555.0	397.2	154.5	75.5	118.5	40.1	1340.8	6.8	0.0	1347.6
TOT	1281.8	765.9	452.4	212.4	304.1	122.8	3139.4	89.7	54.2	3283.3

TABLE 51

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE

SUMMATION FOR YEARS 1974/75 TO 1978/79

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	V I C	Q L D	S.A.	W.A.	T A S	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
• CONSTRUCTION	241.2	122.3	129.2	111.8	63.3	37.4	705.2	29.9	4.1	739.2
• MAINTENANCE	33.8	12.6	36.9	17.4	15.8	3.4	119.9	18.6	0.0	138.5
2 NATIONAL COMMERCE RDS	20.0	31.6	9.8	6.9	6.5	3.4	78.2	0.0	0.0	78.2
TOTAL (A)	295.0	166.5	175.9	136.1	85.6	44.2	903.3	48.5	4.1	955.9
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
• RURAL ARTERIAL	349.9	154.0	226.0	46.6	111.2	38.5	926.2	1.0	.2	927.4
• RURAL LOCAL	500.4	277.2	310.5	61.3	159.5	66.6	1375.5	6.1	.6	1382.2
TOTAL	850.3	431.2	536.5	107.9	270.7	105.1	2301.7	7.1	.8	2309.6
• URBAN ARTERIAL	384.2	408.2	140.3	68.8	126.8	39.7	1168.0	5.2	73.3	1246.5
• URBAN LOCAL	487.2	402.6	160.8	105.4	110.8	26.7	1293.5	30.1	59.6	1383.2
TOTAL	871.4	810.8	301.1	174.2	237.6	66.4	2461.5	35.3	132.9	2629.7
• RURAL MITERS	6.8	2.5	5.9	.8	1.0	1.9	18.9	0.0	0.0	18.9
• URBAN MITERS	32.6	10.8	5.6	7.5	6.0	1.0	63.5	0.0	0.0	63.5
TOTAL	39.4	13.3	11.5	8.3	7.0	2.9	82.4	0.0	0.0	82.4
TOTAL CONSTRUCTION	1761.1	1255.3	849.1	290.4	515.3	174.4	4845.6	42.4	133.7	5021.7
2 MAINTENANCE										
• RURAL ARTERIAL	267.6	104.0	85.6	52.0	48.2	20.9	578.3	10.5	.4	589.2
• RURAL LOCAL	348.9	221.5	177.5	80.7	73.3	62.7	964.6	24.1	1.2	989.9
TOTAL	616.5	325.5	263.1	132.7	121.5	83.6	1542.9	34.6	1.6	1579.1
• URBAN ARTERIAL	166.4	61.0	29.7	18.9	10.1	4.9	291.0	1.3	5.3	297.6
• URBAN LOCAL	417.3	315.1	107.7	56.5	67.8	22.7	987.1	4.6	6.3	998.0
TOTAL	583.7	376.1	137.4	75.4	77.9	27.6	1278.1	5.9	11.6	1295.6
TOTAL MAINTENANCE	1200.2	701.6	400.5	208.1	199.4	111.2	2821.0	40.5	13.2	2874.7
TOTAL (B)	2961.3	1956.9	1249.6	498.5	714.7	285.6	7666.6	82.9	146.9	7896.4
(C) PLANNING AND RESEARCH	20.2	15.7	8.3	7.5	6.5	2.7	60.9	0.0	0.0	60.9
T O T A L (A, B AND C)	3276.5	2139.1	1433.8	642.1	806.8	332.5	8630.8	131.4	151.0	8913.2

TABLE 52

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1974/75

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	35.5	24.6	21.4	19.8	8.5	6.5	116.3	4.9	0.0	121.2
. MAINTENANCE	7.9	2.1	6.0	2.8	2.6	.5	21.9	6.1	0.0	28.0
2 NATIONAL COMMERCE RDS	0.0	9.1	0.0	.4	1.2	.2	10.9	0.0	0.0	10.9
TOTAL (A)	43.4	35.8	27.4	23.0	12.3	7.2	149.1	11.0	0.0	160.1
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	55.0	25.4	42.2	7.1	23.6	6.7	160.0	.1	.2	160.3
. RURAL LOCAL	89.8	50.8	61.0	11.6	32.0	10.1	255.3	1.0	0.0	256.3
TOTAL	144.8	76.2	103.2	18.7	55.6	16.8	415.3	1.1	.2	416.6
. URBAN ARTERIAL	100.2	88.2	32.4	16.6	28.2	7.3	272.9	1.1	15.1	289.1
. URBAN LOCAL	86.6	78.2	30.1	23.1	18.9	3.7	240.6	4.4	11.3	256.3
TOTAL	186.8	166.4	62.5	39.7	47.1	11.0	513.5	5.5	26.4	545.4
. RURAL MITERS	.6	.2	.5	.1	.1	.4	1.9	0.0	0.0	1.9
. URBAN MITERS	2.4	.9	.7	1.1	.4	.2	5.7	0.0	0.0	5.7
TOTAL	3.0	1.1	1.2	1.2	.5	.6	7.6	0.0	0.0	7.6
TOTAL CONSTRUCTION	334.6	243.7	166.9	59.6	103.2	28.4	936.4	6.6	26.6	969.6
2 MAINTENANCE										
. RURAL ARTERIAL	48.4	22.1	16.1	10.7	6.7	3.6	107.6	1.0	.2	108.8
. RURAL LOCAL	57.3	47.8	35.4	15.8	12.7	12.9	181.9	2.4	.4	184.7
TOTAL	105.7	69.9	51.5	26.5	19.4	16.5	289.5	3.4	.6	293.5
. URBAN ARTERIAL	23.1	11.2	5.9	3.5	1.5	1.0	46.2	.1	.6	46.9
. URBAN LOCAL	76.3	61.0	21.7	10.6	12.4	4.1	186.1	.8	.9	187.8
TOTAL	99.4	72.2	27.6	14.1	13.9	5.1	232.3	.9	1.5	234.7
TOTAL MAINTENANCE	205.1	142.1	79.1	40.6	33.3	21.6	521.8	4.3	2.1	528.2
TOTAL (B)	539.7	385.8	246.0	100.2	136.5	50.0	1458.2	10.9	28.7	1497.8
(C) PLANNING AND RESEARCH	4.2	2.7	1.3	1.3	1.4	.3	11.2	0.0	0.0	11.2
TOTAL (A, B AND C)	587.3	424.3	274.7	124.5	150.2	57.5	1618.5	21.9	28.7	1669.1

TABLE 53

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1975/76

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	VIC.	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	45.3	24.6	24.4	25.6	13.7	7.8	141.4	4.6	0.0	146.0
. MAINTENANCE	8.1	2.2	6.5	3.3	3.1	.7	23.9	2.9	0.0	26.8
2 NATIONAL COMMERCE RDS	2.6	7.3	1.5	1.8	1.0	.7	15.1	0.0	0.0	15.1
TOTAL (A)	56.2	34.1	32.4	30.7	17.8	9.2	180.4	7.5	0.0	187.9
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	69.9	32.6	43.4	7.1	18.3	5.6	176.9	.1	0.0	177.0
. RURAL LOCAL	102.1	51.7	63.5	10.2	34.0	14.8	276.3	.9	.1	277.3
TOTAL	172.0	84.3	106.9	17.3	52.3	20.4	453.2	1.0	.1	454.3
. URBAN ARTERIAL	80.4	77.6	24.7	12.6	24.6	7.0	226.9	1.0	11.1	239.0
. URBAN LOCAL	111.6	75.2	33.0	22.0	20.7	3.8	266.3	4.5	17.2	288.0
TOTAL	192.0	152.8	57.7	34.6	45.3	10.8	493.2	5.5	28.3	527.0
. RURAL MITERS	2.1	.8	1.7	.2	.2	.4	5.4	0.0	0.0	5.4
. URBAN MITERS	9.7	2.2	1.2	2.0	1.5	.2	16.8	0.0	0.0	16.8
TOTAL	11.8	3.0	2.9	2.2	1.7	.6	22.2	0.0	0.0	22.2
TOTAL CONSTRUCTION	375.8	240.1	167.5	54.1	99.3	31.8	968.6	6.5	28.4	1003.5
2 MAINTENANCE										
. RURAL ARTERIAL	46.7	22.0	18.8	10.5	9.2	4.0	111.2	3.3	.2	114.7
. RURAL LOCAL	71.8	44.7	36.4	14.9	13.3	13.0	194.1	7.6	.4	202.1
TOTAL	118.5	66.7	55.2	25.4	22.5	17.0	305.3	10.9	.6	316.8
. URBAN ARTERIAL	29.1	10.5	6.0	3.4	1.8	.9	51.7	.3	1.0	53.0
. URBAN LOCAL	88.9	64.6	22.8	12.5	13.6	5.4	207.8	.9	1.1	209.8
TOTAL	118.0	75.1	28.8	15.9	15.4	6.3	259.5	1.2	2.1	262.8
TOTAL MAINTENANCE	236.5	141.8	84.0	41.3	37.9	23.3	564.8	12.1	2.7	579.6
TOTAL (B)	612.3	381.9	251.5	95.4	137.2	55.1	1533.4	18.6	31.1	1583.1
(C) PLANNING AND RESEARCH	3.8	4.4	1.2	1.6	1.4	.4	12.8	0.0	0.0	12.8
TOTAL (A, B AND C)	672.3	420.4	285.1	127.7	156.4	64.7	1726.6	26.1	31.1	1783.8

TABLE 54

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1976/77

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	49.2	24.5	27.0	27.9	10.5	8.8	147.9	4.5	0.0	152.4
. MAINTENANCE	2.6	2.9	7.8	3.5	2.0	.5	19.3	3.6	0.0	22.9
2 NATIONAL COMMERCE RDS	7.6	5.6	2.9	1.6	1.3	.8	19.8	0.0	0.0	19.8
TOTAL (A)	59.4	33.0	37.7	33.0	13.8	10.1	187.0	8.1	0.0	195.1
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	58.1	33.4	50.3	9.8	22.5	7.7	181.8	.2	0.0	182.0
. RURAL LOCAL	101.8	57.2	63.5	13.9	35.5	14.1	286.0	1.3	.5	287.8
TOTAL	159.9	90.6	113.8	23.7	58.0	21.8	467.8	1.5	.5	469.8
. URBAN ARTERIAL	62.3	78.4	24.4	12.8	26.3	10.2	214.4	.8	7.9	223.1
. URBAN LOCAL	91.0	82.3	32.9	19.1	22.4	7.1	254.8	7.3	19.1	281.2
TOTAL	153.3	160.7	57.3	31.9	48.7	17.3	469.2	8.1	27.0	504.3
. RURAL MITERS	1.5	.3	1.3	.1	.2	.4	3.8	0.0	0.0	3.8
. URBAN MITERS	6.8	2.3	1.3	1.4	1.4	.2	13.4	0.0	0.0	13.4
TOTAL	8.3	2.6	2.6	1.5	1.6	.6	17.2	0.0	0.0	17.2
TOTAL CONSTRUCTION	321.5	253.9	173.7	57.1	108.3	39.7	954.2	9.6	27.5	991.3
2 MAINTENANCE										
. RURAL ARTERIAL	62.6	19.7	17.5	10.0	11.2	4.0	125.0	2.2	0.0	127.2
. RURAL LOCAL	73.9	41.0	35.3	17.2	13.8	10.9	192.1	5.0	.4	197.5
TOTAL	136.5	60.7	52.8	27.2	25.0	14.9	317.1	7.2	.4	324.7
. URBAN ARTERIAL	31.5	12.3	6.2	4.0	1.8	1.0	56.8	.3	1.2	58.3
. URBAN LOCAL	79.5	61.8	21.7	10.6	13.9	3.9	191.4	.9	1.0	193.3
TOTAL	111.0	74.1	27.9	14.6	15.7	4.9	248.2	1.2	2.2	251.6
TOTAL MAINTENANCE	247.5	134.8	80.7	41.8	40.7	19.8	565.3	8.4	2.6	576.3
TOTAL (B)	569.0	388.7	254.4	98.9	149.0	59.5	1519.5	18.0	30.1	1567.6
(C) PLANNING AND RESEARCH	4.4	3.1	1.3	1.5	1.3	.5	12.1	0.0	0.0	12.1
TOTAL (A, B AND C)	632.8	424.8	293.4	133.4	164.1	70.1	1718.6	26.1	30.1	1774.8

TABLE 55

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1977/78

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	V I C	Q L D	S.A.	W.A.	T A S	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	54.4	24.3	28.1	18.9	15.5	6.9	148.1	7.2	.6	155.9
. MAINTENANCE	7.7	2.6	8.1	3.8	4.2	.8	27.2	3.1	0.0	30.3
2 NATIONAL COMMERCE RDS	5.9	4.0	2.5	1.6	1.5	.9	16.4	0.0	0.0	16.4
TOTAL (A)	68.0	30.9	38.7	24.3	21.2	8.6	191.7	10.3	.6	202.6
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	80.2	31.4	44.5	11.1	22.4	9.0	198.6	.3	0.0	198.9
. RURAL LOCAL	103.8	58.3	61.9	12.7	28.3	13.3	278.3	1.3	0.0	279.6
TOTAL	184.0	89.7	106.4	23.8	50.7	22.3	476.9	1.6	0.0	478.5
. URBAN ARTERIAL	69.4	81.7	29.3	13.2	22.8	7.4	223.8	.8	22.7	247.3
. URBAN LOCAL	97.8	83.1	32.7	20.5	23.9	6.0	264.0	6.7	12.0	282.7
TOTAL	167.2	164.8	62.0	33.7	46.7	13.4	487.8	7.5	34.7	530.0
. RURAL MITERS	1.4	.6	1.1	.2	.2	.4	3.9	0.0	0.0	3.9
. URBAN MITERS	6.8	2.7	1.1	1.6	1.3	.2	13.7	0.0	0.0	13.7
TOTAL	8.2	3.3	2.2	1.8	1.5	.6	17.6	0.0	0.0	17.6
TOTAL CONSTRUCTION	359.4	257.8	170.6	59.3	98.9	36.3	982.3	9.1	34.7	1026.1
2 MAINTENANCE										
. RURAL ARTERIAL	54.3	20.0	16.1	10.1	9.9	4.5	114.9	1.8	0.0	116.7
. RURAL LOCAL	72.5	43.6	35.3	16.3	16.4	12.9	197.0	4.1	0.0	201.1
TOTAL	126.8	63.6	51.4	26.4	26.3	17.4	311.9	5.9	0.0	317.8
. URBAN ARTERIAL	39.7	13.4	5.7	4.0	2.3	1.0	66.1	.3	1.1	67.5
. URBAN LOCAL	85.1	63.0	20.9	11.3	13.6	4.6	198.5	.9	1.4	200.8
TOTAL	124.8	76.4	26.6	15.3	15.9	5.6	264.6	1.2	2.5	268.3
TOTAL MAINTENANCE	251.6	140.0	78.0	41.7	42.2	23.0	576.5	7.1	2.5	586.1
TOTAL (B)	611.0	397.8	248.6	101.0	141.1	59.3	1558.8	16.2	37.2	1612.2
(C) PLANNING AND RESEARCH	3.8	2.7	1.3	1.5	1.1	.7	11.1	0.0	0.0	11.1
T O T A L (A, B AND C)	682.8	431.4	288.6	126.8	163.4	68.6	1761.6	26.5	37.8	1825.9

TABLE 56

ESTIMATED ACTUAL ROAD EXPENDITURE BY CATEGORY, BY STATE 1978/79

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	V I C	Q L D	S.A.	W.A.	T A S	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	56.8	24.3	28.3	19.6	15.1	7.4	151.5	8.7	3.5	163.7
. MAINTENANCE	7.5	2.8	8.5	4.0	3.9	.9	27.6	2.9	0.0	30.5
2 NATIONAL COMMERCE RDS	3.7	5.6	2.9	1.5	1.5	.8	16.0	0.0	0.0	16.0
TOTAL (A)	68.0	32.7	39.7	25.1	20.5	9.1	195.1	11.6	3.5	210.2
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	86.7	31.2	45.6	11.5	24.4	9.5	208.9	.3	0.0	209.2
. RURAL LOCAL	102.9	59.2	60.6	12.9	29.7	14.3	279.6	1.6	0.0	281.2
TOTAL	189.6	90.4	106.2	24.4	54.1	23.8	488.5	1.9	0.0	490.4
. URBAN ARTERIAL	71.9	82.3	29.5	13.6	24.9	7.8	230.0	1.5	16.5	248.0
. URBAN LOCAL	100.2	83.8	32.1	20.7	24.9	6.1	267.8	7.2	0.0	275.0
TOTAL	172.1	166.1	61.6	34.3	49.8	13.9	497.8	8.7	16.5	523.0
. RURAL MITERS	1.2	.6	1.3	.2	.3	.3	3.9	0.0	0.0	3.9
. URBAN MITERS	6.9	2.7	1.3	1.4	1.4	.2	13.9	0.0	0.0	13.9
TOTAL	8.1	3.3	2.6	1.6	1.7	.5	17.8	0.0	0.0	17.8
TOTAL CONSTRUCTION	369.8	259.8	170.4	60.3	105.6	38.2	1004.1	10.6	16.5	1031.2
2 MAINTENANCE										
. RURAL ARTERIAL	55.6	20.2	17.1	10.7	11.2	4.8	119.6	2.2	0.0	121.8
. RURAL LOCAL	73.4	44.4	35.1	16.5	17.1	13.0	199.5	5.0	0.0	204.5
TOTAL	129.0	64.6	52.2	27.2	28.3	17.8	319.1	7.2	0.0	326.3
. URBAN ARTERIAL	43.0	13.6	5.9	4.0	2.7	1.0	70.2	.3	1.4	71.9
. URBAN LOCAL	87.5	64.7	20.6	11.5	14.3	4.7	203.3	1.1	1.9	206.3
TOTAL	130.5	78.3	26.5	15.5	17.0	5.7	273.5	1.4	3.3	278.2
TOTAL MAINTENANCE	259.5	142.9	78.7	42.7	45.3	23.5	592.6	8.6	3.3	604.5
TOTAL (B)	629.3	402.7	249.1	193.0	150.9	61.7	1596.7	19.2	19.8	1635.7
(C) PLANNING AND RESEARCH	4.0	2.8	3.2	1.6	1.3	.8	13.7	0.0	0.0	13.7
T O T A L (A, B AND C)	701.3	438.2	292.0	129.7	172.7	71.6	1805.5	30.8	23.3	1859.6

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TABLE 60

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, 1976/77 PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
(A) COMMONWEALTH							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	114.2	132.6	137.9	147.1	154.5	686.3	7.85
. NAT. COMMERCE ROADS	1.8	12.4	18.9	15.2	14.6	62.9	68.76
. RURAL ROADS							
ARTERIAL	61.1	53.6	58.1	66.3	66.8	305.9	2.25
LOCAL	68.0	56.0	56.9	67.0	63.4	311.3	-1.77
TOTAL	129.1	109.6	115.0	133.3	130.2	617.2	.21
. URBAN ROADS							
ARTERIAL	191.3	157.9	127.2	98.7	92.7	667.8	-19.86
LOCAL	21.8	30.3	40.1	42.6	29.4	164.2	7.76
TOTAL	213.1	188.2	167.3	141.3	122.1	832.0	-14.94
. MITERS	5.8	15.2	12.2	12.6	12.7	58.5	21.64
TOTAL CONSTRUCTION	464.0	458.0	451.3	449.5	434.1	2256.9	-1.68
2. MAINTENANCE	67.8	71.6	64.0	65.5	67.2	336.1	-.22
3. PLANNING AND RESEARCH	5.9	6.1	5.8	4.5	6.7	29.0	3.23
TOTAL COMMONWEALTH	537.7	535.7	521.1	519.5	508.0	2622.0	-1.43

TABLE 60 (CONT)

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, 1976/77 PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
(B) STATE AND TERRITORY							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	7.0	13.4	14.5	8.8	9.2	52.9	7.07
. NAT. COMMERCE ROADS	9.1	2.7	.9	1.2	1.4	15.3	-59.67
. RURAL ROADS							
ARTERIAL	99.2	123.4	123.7	132.5	142.2	621.0	9.42
LOCAL	35.5	50.1	63.9	48.9	51.0	249.4	9.48
TOTAL	134.7	173.5	187.6	181.4	193.2	870.4	9.44
. URBAN ROADS							
ARTERIAL	84.8	67.0	81.6	133.9	140.5	507.8	13.45
LOCAL	23.3	24.7	30.6	21.6	21.6	121.8	-1.91
TOTAL	108.1	91.7	112.2	155.5	162.1	629.6	10.66
. OTHERS	1.8	7.0	5.0	5.0	5.1	23.9	29.74
TOTAL CONSTRUCTION	260.7	288.3	320.2	351.9	371.0	1592.1	9.22
2. MAINTENANCE	170.0	197.5	206.8	217.6	227.2	1019.1	7.52
3. PLANNING AND RESEARCH	5.3	6.7	6.3	6.6	7.0	31.9	7.20
TOTAL STATE AND TERRITORY	436.0	492.5	533.3	576.1	605.2	2643.1	8.54

TABLE 60 (CONT)

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION, 1976/77 PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
(C) LOCAL GOVERNMENT							
1. CONSTRUCTION							
• NATIONAL HIGHWAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
• NAT. COMMERCE ROADS	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
• RURAL ROADS							
ARTERIAL	0.0	0.0	.2	.1	.2	.5	****** NA
LOCAL	152.8	171.2	167.0	163.7	166.8	821.5	2.22
TOTAL	152.8	171.2	167.2	163.8	167.0	822.0	2.25
• URBAN ROADS							
ARTERIAL	13.0	14.1	14.3	14.7	14.8	70.9	3.30
LOCAL	211.2	233.0	210.5	218.5	224.0	1097.2	1.48
TOTAL	224.2	247.1	224.8	233.2	238.8	1168.1	1.59
• MITERS	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
TOTAL CONSTRUCTION	377.0	418.3	392.0	397.0	405.8	1990.1	1.86
2. MAINTENANCE	318.4	337.3	328.4	333.3	340.6	1658.0	1.70
3. PLANNING AND RESEARCH	0.0	0.0	0.0	0.0	0.0	0.0	0.00 NA
TOTAL LOCAL GOVERNMENT	695.4	755.6	720.4	730.3	746.4	3648.1	1.79

TABLE 60 (CONT)

ESTIMATED ACTUAL ROAD EXPENDITURE 1974/75 TO 1978/79

ANNUALLY AND IN TOTAL BY

LEVEL - OF - GOVERNMENT SOURCE OF FUNDS, AND BY CATEGORY

($ MILLION , 1976/77 PRICES)

SOURCE OF FUNDS AND CATEGORY	1974/75	1975/76	1976/77	1977/78	1978/79	TOTAL FOR PERIOD	AVERAGE ANNUAL GROWTH RATE PERCENT
ALL LEVELS							
1. CONSTRUCTION							
. NATIONAL HIGHWAYS	121.2	146.0	152.4	155.9	163.7	739.2	7.80
. NAT. COMMERCE ROADS	10.9	15.1	19.8	16.4	16.0	78.2	10.07
. RURAL ROADS							
ARTERIAL	160.3	177.0	182.0	198.9	209.2	927.4	6.88
LOCAL	256.3	277.3	287.8	279.6	281.2	1382.2	2.35
TOTAL	416.6	454.3	469.8	478.5	490.4	2309.6	4.16
. URBAN ROADS							
ARTERIAL	289.1	239.0	223.1	247.3	248.0	1246.5	-3.91
LOCAL	256.3	288.0	281.2	282.7	275.0	1383.2	1.78
TOTAL	545.4	527.0	504.3	530.0	523.0	2629.7	-1.05
. MITERS	7.6	22.2	17.2	17.6	17.8	82.4	23.71
TOTAL CONSTRUCTION	1101.7	1164.6	1163.5	1198.4	1210.9	5839.1	2.39
2. MAINTENANCE	556.2	606.4	599.2	616.4	635.0	3013.2	3.37
3. PLANNING AND RESEARCH	11.2	12.8	12.1	11.1	13.7	60.9	5.17
TOTAL ALL LEVELS	1669.1	1783.8	1774.8	1825.9	1859.6	8913.2	2.74

TABLE 70

ESTIMATED ACTUAL EXPENDITURE ON ROADS

$ PER VEHICLE

1976/77 PRICES

STATE	SOURCE OF FUNDS	1974/75	1975/76	1976/77	1977/78	1978/79	ANNUAL AVERAGE GROWTH RATE
NSW	CWLTH	72.	70.	71.	70.	67.	-1.79
	STATE	87.	103.	93.	110.	114.	7.07
	LOCAL	133.	152.	134.	134.	135.	.37
	TOTAL	293.	325.	298.	314.	317.	2.02
VIC	CWLTH	67.	59.	56.	52.	52.	-6.31
	STATE	71.	67.	70.	73.	73.	.54
	LOCAL	124.	118.	116.	117.	120.	-.86
	TOTAL	262.	243.	242.	242.	245.	-1.70
QLD	CWLTH	121.	111.	100.	98.	99.	-5.17
	STATE	71.	79.	89.	86.	89.	5.85
	LOCAL	130.	133.	115.	109.	106.	-5.43
	TOTAL	322.	323.	304.	293.	293.	-2.38
SA	CWLTH	71.	76.	62.	59.	59.	-4.89
	STATE	62.	59.	78.	68.	72.	3.61
	LOCAL	85.	80.	73.	71.	71.	-4.65
	TOTAL	219.	215.	213.	198.	202.	-2.05
WA	CWLTH	133.	118.	101.	92.	90.	-10.17
	STATE	68.	74.	85.	81.	91.	7.52
	LOCAL	90.	87.	86.	86.	90.	-.09
	TOTAL	292.	279.	272.	259.	272.	-1.80
TAS	CWLTH	126.	133.	116.	98.	102.	-5.42
	STATE	83.	97.	132.	138.	146.	14.93
	LOCAL	108.	106.	103.	104.	107.	-.32
	TOTAL	318.	337.	351.	340.	354.	2.78
ALL	CWLTH	85.	80.	74.	71.	71.	-4.78
	STATE	76.	82.	85.	90.	93.	5.33
	LOCAL	121.	125.	114.	113.	115.	-1.30
	TOTAL	282.	286.	274.	275.	279.	-.27

TABLE 71

ESTIMATED ACTUAL EXPENDITURE ON ROADS

$ PER HEAD POPULATION

1976/77 PRICES

STATE	SOURCE OF FUNDS	1974/75	1975/76	1976/77	1977/78	1978/79	ANNUAL AVERAGE GROWTH RATE
NSW	CWLTH	30.	30.	31.	31.	30.	-.02
	STATE	36.	44.	40.	48.	51.	8.96
	LOCAL	56.	65.	58.	59.	61.	2.14
	TOTAL	122.	138.	129.	138.	142.	3.82
VIC	CWLTH	30.	27.	26.	25.	25.	-4.53
	STATE	32.	31.	33.	35.	35.	2.26
	LOCAL	55.	55.	55.	55.	57.	.84
	TOTAL	116.	114.	114.	115.	116.	.00
QLD	CWLTH	51.	47.	46.	46.	46.	-2.66
	STATE	30.	34.	41.	40.	41.	8.44
	LOCAL	55.	57.	53.	50.	49.	-2.91
	TOTAL	136.	138.	140.	136.	137.	.07
SA	CWLTH	33.	36.	31.	30.	30.	-2.72
	STATE	29.	28.	39.	34.	36.	5.81
	LOCAL	40.	38.	36.	36.	36.	-2.48
	TOTAL	101.	102.	106.	100.	102.	.06
WA	CWLTH	58.	58.	53.	49.	48.	-4.67
	STATE	30.	36.	44.	43.	49.	13.18
	LOCAL	39.	43.	45.	46.	48.	5.17
	TOTAL	127.	138.	142.	138.	145.	3.40
TAS	CWLTH	57.	64.	57.	48.	51.	-3.21
	STATE	38.	47.	65.	68.	72.	17.39
	LOCAL	49.	51.	50.	51.	53.	1.82
	TOTAL	145.	161.	173.	168.	176.	4.98
ALL	CWLTH	37.	36.	34.	33.	33.	-2.50
	STATE	33.	37.	39.	42.	44.	7.67
	LOCAL	52.	56.	53.	53.	54.	.90
	TOTAL	122.	129.	127.	129.	132.	1.94

TABLE 80

PROJECTED ROAD EXPENDITURE BY CATEGORY, BY STATE 1979/80

($ MILLION , 1976/77 PRICES)

CATEGORY	N.S.W.	VIC	QLD	S.A.	W.A.	TAS	ALL STATES	N.T.	A.C.T.	TOTAL AUST.
(A) NATIONAL ROADS										
1 NATIONAL HIGHWAYS										
. CONSTRUCTION	56.8	24.3	28.4	19.8	15.0	7.4	151.7	11.3	2.2	165.2
. MAINTENANCE	7.5	2.8	8.5	4.1	4.0	.9	27.8	3.0	0.0	30.8
2 NATIONAL COMMERCE RDS	3.7	5.6	2.9	1.7	1.5	.8	16.2	0.0	0.0	16.2
TOTAL (A)	68.0	32.7	39.8	25.6	20.5	9.1	195.7	14.3	2.2	212.2
(B) ROADS OTHER THAN NATIONAL										
1 CONSTRUCTION										
. RURAL ARTERIAL	91.7	32.2	46.8	11.7	25.1	9.8	217.3	.3	0.0	217.6
. RURAL LOCAL	107.1	61.3	61.3	13.1	31.1	14.9	288.8	2.0	0.0	290.8
TOTAL	198.8	93.5	108.1	24.8	56.2	24.7	506.1	2.3	0.0	508.4
. URBAN ARTERIAL	74.9	85.2	30.3	13.9	25.5	8.1	237.9	1.9	20.1	259.9
. URBAN LOCAL	104.8	87.5	32.4	21.1	26.4	6.3	278.5	9.0	0.0	287.5
TOTAL	179.7	172.7	62.7	35.0	51.9	14.4	516.4	10.9	20.1	547.4
. RURAL MITERS	1.3	.6	1.3	.2	.2	.3	3.9	0.0	0.0	3.9
. URBAN MITERS	7.2	2.6	1.3	1.4	1.4	.2	14.1	0.0	0.0	14.1
TOTAL	8.5	3.2	2.6	1.6	1.6	.5	18.0	0.0	0.0	18.0
TOTAL CONSTRUCTION	387.0	269.4	173.4	61.4	109.7	39.6	1040.5	13.2	20.1	1073.8
2 MAINTENANCE										
. RURAL ARTERIAL	59.4	21.1	17.8	11.2	11.8	5.0	126.3	2.2	0.0	128.5
. RURAL LOCAL	77.0	46.2	35.4	16.9	17.9	13.6	207.0	5.2	0.0	212.2
TOTAL	136.4	67.3	53.2	28.1	29.7	18.6	333.3	7.4	0.0	340.7
. URBAN ARTERIAL	46.1	14.3	6.2	4.3	2.8	1.1	74.8	.4	1.5	76.7
. URBAN LOCAL	91.8	67.8	20.7	11.8	15.4	5.1	212.6	1.0	1.8	215.4
TOTAL	137.9	82.1	26.9	16.1	18.2	6.2	287.4	1.4	3.3	292.1
TOTAL MAINTENANCE	274.3	149.4	80.1	44.2	47.9	24.8	620.7	8.8	3.3	632.8
TOTAL (B)	661.3	418.8	253.5	105.6	157.6	64.4	1661.2	22.0	23.4	1706.6
(C) PLANNING AND RESEARCH	4.1	2.9	3.3	1.7	1.3	.8	14.1	0.0	0.0	14.1
TOTAL (A, B AND C)	733.4	454.4	296.6	132.9	179.4	74.3	1871.0	36.3	25.6	1932.9

TABLE 81

PROJECTED ROAD EXPENDITURES BEYOND 1979/80

BY STATE AND BY SOURCE OF FUNDS

($ MILLION , 1976/77 PRICES)

	NSW	VIC	QLD	SA	WA	TAS	SUB TOT	NT	ACT	TOTAL
1980/81										
C/G	149.0	93.4	98.5	37.9	57.4	20.5	456.7	38.6	28.7	524.0
S/G	295.8	145.9	99.0	51.5	64.8	33.0	690.0	0.0	0.0	690.0
L/G	335.0	239.8	107.3	48.8	66.9	24.2	822.0	3.6	0.0	825.6
TOT	779.9	479.0	304.8	138.2	189.2	77.7	1968.8	42.2	28.7	2039.7
1981/82										
C/G	149.1	93.4	98.4	37.9	57.4	20.5	456.7	44.9	32.0	533.6
S/G	323.0	155.8	105.7	55.0	69.3	35.3	744.1	0.0	0.0	744.1
L/G	357.8	256.1	109.3	50.9	73.1	25.9	873.1	4.1	0.0	877.2
TOT	829.8	505.3	313.4	143.8	199.8	81.7	2073.8	49.0	32.0	2154.8
1982/83										
C/G	149.0	93.4	98.4	37.9	57.4	20.5	456.6	52.3	35.7	544.6
S/G	352.8	166.4	112.9	58.8	74.0	37.7	802.6	0.0	0.0	802.6
L/G	382.1	273.5	111.4	53.2	79.8	27.6	927.6	4.5	0.0	932.1
TOT	884.0	533.2	322.8	149.8	211.2	85.9	2186.9	56.8	35.7	2279.4
1983/84										
C/G	149.1	93.4	98.5	37.9	57.4	20.5	456.8	61.0	39.9	557.7
S/G	385.4	177.7	120.6	62.8	79.0	40.3	865.8	0.0	0.0	865.8
L/G	408.1	292.1	113.6	55.5	87.1	29.5	985.9	5.0	0.0	990.9
TOT	942.6	563.2	332.7	156.2	223.5	90.3	2308.6	66.0	39.9	2414.5

ANNEX 4

INPUT-OUTPUT TABLES

Table A4.1 provides details of the direct and indirect industry requirements for each $100 of expenditure by the road construction industry.

The following Table provide the results of the input-output model by fifty-eight industry sectors for the years 1979-80 to 1982-83 inclusive for the following projections of road finance:

- evaluation projection (100% of warranted program)
- 95% of warranted program
- 90% of warranted program
- 85% of warranted program
- 80% of warranted program

TABLE A4.1 - DIRECT AND INDIRECT INDUSTRY REQUIREMENTS FOR EACH $100 OF EXPENDITURE BY THE ROAD CONSTRUCTION INDUSTRY

	INDUSTRY	Direct	Direct and Indirect
1	AGRICULTURE	-	0.17
2	FORESTRY LOGGING	0.31	0.45
3	IRON	-	0.11
4	OTHER METALLIC MINERALS	-	0.41
5	COAL	-	0.32
6	CRUDE OIL	-	1.63
7	QUARRY MATERIALS	10.95	11.52
8	NON METALLIC MINERALS NES	-	0.26
9	SERVICES TO MINING	-	0.10
10	FOOD PRODUCTS	-	0.21
11	ALCOHOLIC BEVERAGES	-	0.03
12	TOBACCO PRODUCTS	-	0.02
13	TEXTILE PRODUCTS	-	0.64
14	TIMBER AND PAPER PRODUCTS	0.93	2.88
15	CHEMICALS	1.58	3.14
16	PETROLEUM PRODUCTS (AUST. OIL)	5.04	6.49
17	PETROLEUM PRODUCTS (IMP. OIL)	2.47	4.55
18	GLASS AND CLAY PRODUCTS	-	0.12
19	CEMENT	0.19	0.99
20	READYMIXED CONCRETE	1.68	1.72
21	CONCRETE PRODUCTS	3.26	3.29
22	NON-METALLIC MINERAL PRODUCT	0.02	0.11
23	METAL PRODUCTS	2.79	5.19
24	MOTOR VEHICLES AND PARTS	0.07	1.06
25	SHIP AND BOAT BUILDING	-	0.15
26	LOCOMOTIVES ROLLING STOCK	..	0.15
27	AIRCRAFT BUILDING	-	0.04
28	SCIENTIFIC, ELECTRONIC EQUIPMENT	-	0.23
29	HOUSEHOLD APPLIANCES	-	0.04
30	ELECTRICAL MACHINERY	0.02	0.49
31	AGRICULTURAL MACHINERY	..	0.02
32	CONSTRUCTION EQUIPMENT	0.37	0.48
33	OTHER MACHINERY	0.37	0.71
34	RUBBER PRODUCTS	-	0.82
35	OTHER MANUFACTURER PRODUCTS	0.19	0.60
36	ELECTRICITY	0.37	1.40
37	GAS	0.02	0.06
38	WATER SEWERAGE AND DRAINAGE	0.18	0.38
39	RESIDENTIAL BUILDING	-	..
40	ROAD CONSTRUCTION	-	-
41	RAIL CONSTRUCTION	-	0.17
42	OTHER CONSTRUCTION	-	0.69
43	WHOLESALE AND RETAIL TRADE	4.30	6.82
44	MOTOR VEHICLE REPAIRS	0.33	0.89
45	OTHER REPAIRS	0.20	0.50
46	ROAD TRANSPORT	9.72	10.74
47	RAILWAY AND OTHER TRANSPORT	0.18	0.99
48	WATER TRANSPORT	-	0.66
49	AIR TRANSPORT	-	0.30
50	COMMUNICATION	-	0.86
51	BUSINESS SERVICES	0.33	4.25
52	OWNERSHIP OF DWELLINGS	..	..
53	PUBLIC ADMINISTRATION	-	0.04
54	DEFENCE	-	-
55	HEALTH	-	0.02
56	EDUCATION LIBRARIES, ETC.	-	0.01
57	WELFARE SERVICES	..	0.12
58	OTHER SERVICES	4.09	8.66

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1979-80
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1506.00	4016.71	0.000	0.000	1.190	0.030
2 FORESTRY LOGGING	32.00	190.52	2.175	1.142	3.204	1.682
3 IRON	491.00	589.21	0.000	0.000	0.793	0.135
4 OTHER METALLIC MINERALS	562.00	919.24	0.000	0.000	2.926	0.318
5 COAL	343.00	568.09	0.000	0.000	2.261	0.398
6 CRUDE OIL	0.00	252.82	0.000	0.000	11.606	4.591
7 QUARRY MATERIALS	3.00	161.56	77.822	48.169	81.897	50.691
8 NON METALLIC MINERALS NES	0.00	61.17	0.000	0.000	1.859	3.040
9 SERVICES TO MINING	12.00	44.89	0.000	0.000	0.719	1.601
10 FOOD PRODUCTS	3707.00	4387.69	0.000	0.000	1.498	0.034
11 ALCOHOLIC BEVERAGES	261.00	288.17	0.000	0.000	0.218	0.076
12 TOBACCO PRODUCTS	163.00	178.11	0.000	0.000	0.134	0.075
13 TEXTILE PRODUCTS	1562.00	2672.53	0.000	0.000	4.542	0.170
14 TIMBER AND PAPER PRODUCTS	647.00	3035.38	6.608	0.218	20.506	0.676
15 CHEMICALS	441.00	1825.34	11.233	0.615	22.329	1.223
16 PETROLEUM PRODUCTS (AUST. OIL)	309.00	884.62	35.814	4.049	46.164	5.219
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	301.66	17.577	5.827	32.382	10.735
18 GLASS AND CLAY PRODUCTS	45.00	421.77	0.000	0.000	0.846	0.201
19 CEMENT	0.00	104.26	1.322	1.268	7.042	6.754
20 READY MIXED CONCRETE	0.00	137.37	11.921	8.678	12.221	8.896
21 CONCRETE PRODUCTS	1.00	193.29	23.172	11.988	23.422	12.117
22 NON-METALLIC MINERAL PRODUCT	10.00	132.38	0.132	0.100	0.793	0.599
23 MINERAL PRODUCT	1667.00	4551.10	19.823	0.436	36.874	0.810
24 MOTOR VEHICLES AND PARTS	963.00	1375.77	0.529	0.038	7.503	0.545
25 SHIP AND BOAT BUILDING	77.00	236.18	0.000	0.000	1.042	0.441
26 LOCOMOTIVES ROLLING STOCK	33.00	179.44	0.000	0.000	1.052	0.586
27 AIRCRAFT BUILDING	25.00	267.97	0.000	0.000	0.308	0.115
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	310.00	679.65	0.000	0.000	1.650	0.243

TABLE [illegible] : [illegible] PROJECTIONS (RISING PROFILE) FOR 1979-80 (cont.)
(National Accounting Definitions : $million 1966-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	333.[illegible]	[illegible]9.66	0.000	0.000	0.289	0.058
30 ELECTRICAL MACHINERY	209.00	695.45	0.132	0.019	3.470	0.499
31 AGRICULTURAL MACHINERY	123.00	167.30	0.000	0.000	0.136	0.081
32 CONSTRUCTION EQUIPMENT	221.00	303.20	2.643	0.872	3.414	1.126
33 OTHER MACHINERY	[illegible]19.00	929.76	2.643	0.284	5.019	0.540
34 RUBBER PRODUCTS	46.00	281.64	0.000	0.000	5.813	2.068
35 OTHER MANUFACTURED PRODUCTS	555.00	1101.67	1.322	0.120	4.228	0.383
36 ELECTRICITY	520.00	1246.54	2.643	0.212	9.917	0.794
37 GAS	139.00	167.85	0.132	0.079	0.390	0.233
38 WATER SEWERAGE AND DRAINAGE	120.00	560.14	1.322	0.236	2.724	0.486
39 RESIDENTIAL BUILDING	2033.00	2033.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	711.00	711.00	0.000	0.000	711.000	100.000
41 RAIL CONSTRUCTION	70.00	247.09	0.000	0.000	1.225	0.496
42 OTHER CONSTRUCTION	1521.00	2733.98	0.000	0.000	4.886	0.179
43 WHOLESALE AND RETAIL TRADE	1540.00	6651.21	30.607	0.460	48.496	0.729
44 MOTOR VEHICLE REPAIRS	593.[illegible]	825.43	2.379	0.288	6.344	0.769
45 OTHER REPAIRS	132.00	294.47	1.454	0.494	3.530	1.199
46 ROAD TRANSPORT	1029.00	1727.28	69.118	4.002	76.343	4.420
47 RAILWAY AND OTHER TRANSPORT	511.00	1021.83	1.322	0.129	7.070	0.692
48 WATER TRANSPORT	684.00	966.23	0.000	0.000	4.693	0.486
49 AIR TRANSPORT	554.00	831.08	0.000	0.000	2.110	0.254
50 COMMUNICATION	775.00	1468.28	0.000	0.000	6.086	0.415
51 BUSINESS SERVICES	1325.00	4700.17	2.342	0.050	30.218	0.643
52 OWNERSHIP OF DWELLINGS	3605.00	3605.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1903.00	1936.78	0.000	0.000	0.301	0.016
54 DEFENCE	1086.00	1086.00	0.000	0.000	0.000	0.000
55 HEALTH	2169.00	2191.11	0.000	0.000	0.172	0.008
56 EDUCATION, LIBRARIES, ETC.	2198.00	2206.83	0.000	0.000	0.078	0.004
57 WELFARE SERVICES	317.00	[illegible]2.13	0.000	0.000	0.857	0.194
58 OTHER SERVICES	[illegible]	[illegible].75	29.074	0.420	61.596	0.890

[illegible] INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1980-81
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1617.00	4144.80	0.000	0.000	1.382	0.033
2 FORESTRY LOGGING	35.00	199.19	2.527	1.269	3.722	1.869
3 IRON	498.00	601.14	0.000	0.000	0.921	0.153
4 OTHER METALLIC MINERALS	573.00	948.16	0.000	0.000	3.399	0.358
5 COAL	353.00	587.10	0.000	0.000	2.626	0.447
6 CRUDE OIL	0.00	265.52	0.000	0.000	13.483	5.078
7 QUARRY MATERIALS	3.00	177.78	90.410	50.856	95.143	53.519
8 NON METALLIC MINERALS NES	0.00	63.73	0.000	0.000	2.160	3.389
9 SERVICES TO MINING	13.00	47.11	0.000	0.000	0.835	1.772
10 FOOD PRODUCTS	3693.00	4365.28	0.000	0.000	1.740	0.040
11 ALCOHOLIC BEVERAGES	271.00	298.56	0.000	0.000	0.253	0.085
12 TOBACCO PRODUCTS	166.00	183.59	0.000	0.000	0.156	0.085
13 TEXTILE PRODUCTS	1612.00	2758.88	0.000	0.000	5.276	0.191
14 TIMBER AND PAPER PRODUCTS	669.00	3136.28	7.677	0.245	23.823	0.760
15 CHEMICALS	462.00	1896.13	13.050	0.688	25.941	1.368
16 PETROLEUM PRODUCTS (AUST. OIL)	325.00	930.01	41.607	4.474	53.631	5.767
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	319.07	20.420	6.400	37.619	11.790
18 GLASS AND CLAY PRODUCTS	47.00	437.22	0.000	0.000	0.983	0.225
19 CEMENT	0.00	109.10	1.535	1.407	8.181	7.498
20 READY MIXED CONCRETE	0.00	144.27	13.849	9.599	14.198	9.841
21 CONCRETE PRODUCTS	1.00	203.62	26.920	13.221	27.211	13.363
22 NON-METALLIC MINERAL PRODUCT	10.00	137.25	0.154	0.112	0.921	0.671
23 MINERAL PRODUCT	1776.00	4780.79	23.030	0.482	42.838	0.896
24 MOTOR VEHICLES AND PARTS	1000.00	1430.11	0.614	0.043	8.716	0.609
25 SHIP AND BOAT BUILDING	80.00	244.37	0.000	0.000	1.210	0.495
26 LOCOMOTIVES ROLLING STOCK	36.00	187.74	0.000	0.000	1.223	0.651
27 AIRCRAFT BUILDING	25.00	274.32	0.000	0.000	0.358	0.130
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	323.00	704.99	0.000	0.000	1.917	0.272

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1980-81 (cont.)
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	345.00	517.78	0.000	0.000	0.336	0.065
30 ELECTRICAL MACHINERY	219.00	723.65	0.154	0.021	4.032	0.557
31 AGRICULTURAL MACHINERY	127.00	172.72	0.000	0.000	0.158	0.091
32 CONSTRUCTION EQUIPMENT	242.00	320.08	3.071	0.959	3.967	1.239
33 OTHER MACHINERY	[illegible]	971.02	3.071	0.316	5.831	0.601
34 [illegible]	[illegible]	291.25	0.000	0.000	6.753	2.314
35 OTHER MANUFACTURING PRODUCTS	578.00	1144.59	1.535	0.134	4.912	0.429
36 ELECTRICITY	515.00	1299.13	3.071	0.236	11.521	0.887
37 GAS	110.00	175.03	0.154	0.088	0.453	0.259
38 WATER SEWERAGE & DRAINAGE	123.00	581.65	1.535	0.264	3.165	0.544
39 RESIDENTIAL BUILDING	2105.00	2109.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	826.00	826.00	0.000	0.000	826.000	100.000
41 RAIL CONSTRUCTION	74.00	257.50	0.000	0.000	1.424	0.553
42 OTHER CONSTRUCTION	1589.00	2645.26	0.000	0.000	5.676	0.199
43 WHOLESALE AND RETAIL TRADE	4680.00	6867.19	35.558	0.518	56.340	0.820
44 MOTOR VEHICLE REPAIRS	623.00	863.96	2.764	0.320	7.370	0.853
45 OTHER REPAIRS	136.00	304.16	1.689	0.555	4.101	1.348
46 ROAD TRANSPORT	1067.00	1795.95	80.297	4.471	88.691	4.938
47 RAILWAY AND OTHER TRANSPORT	934.00	1058.61	1.535	0.145	8.214	0.776
48 WATER TRANSPORT	768.00	1001.29	0.000	0.000	5.452	0.545
49 AIR TRANSPORT	573.00	859.16	0.000	0.000	2.451	0.285
50 COMMUNICATION	811.00	1526.08	0.000	0.000	7.070	0.463
51 BUSINESS SERVICES	1373.00	4856.87	2.721	0.056	35.106	0.723
52 OWNERSHIP OF DWELLINGS	3760.00	3760.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1949.00	1983.84	0.000	0.000	0.349	0.018
54 DEFENCE	1106.00	1106.06	0.000	0.000	0.000	0.000
55 HEALTH	2275.00	2256.90	0.000	0.000	0.200	0.009
56 EDUCATION, LIBRARIES, ETC.	2246.00	2255.11	0.000	0.000	0.091	0.004
57 WELFARE SERVICES	325.00	453.92	0.000	0.000	0.995	0.219
58 OTHER SERVICES	2545.00	7139.12	33.777	0.473	71.559	1.002

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1981-82
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1705.00	4253.41	0.000	0.000	1.605	0.038
2 FORESTRY LOGGING	38.00	206.79	2.934	1.419	4.322	2.090
3 IRON	505.00	612.02	0.000	0.000	1.070	0.175
4 OTHER METALLIC MINERALS	582.00	971.31	0.000	0.000	3.946	0.406
5 COAL	356.00	600.60	0.000	0.000	3.049	0.508
6 CRUDE OIL	0.00	278.41	0.000	0.000	15.654	5.623
7 QUARRY MATERIALS	3.00	193.42	104.967	54.270	110.463	57.111
8 NON METALLIC MINERALS NES	0.00	65.22	0.000	0.000	2.508	3.845
9 SERVICES TO MINING	14.00	49.20	0.000	0.000	0.969	1.970
10 FOOD PRODUCTS	3687.00	4392.57	0.000	0.000	2.020	0.046
11 ALCOHOLIC BEVERAGES	261.00	309.85	0.000	0.000	0.294	0.095
12 TOBACCO PRODUCTS	173.00	189.13	0.000	0.000	0.181	0.096
13 TEXTILE PRODUCTS	1669.00	2857.51	0.000	0.000	6.126	0.214
14 TIMBER AND PAPER PRODUCTS	692.00	3234.33	8.913	0.276	27.659	0.855
15 CHEMICALS	489.00	1975.35	15.151	0.767	30.118	1.525
16 REFINERY PRODUCTS (AUST. OIL)	350.00	975.42	48.306	4.952	62.267	6.384
17 REFINERY PRODUCTS (IMP. OIL)	0.00	336.90	23.708	7.037	43.677	12.964
18 GLASS AND CLAY PRODUCTS	50.00	449.67	0.000	0.000	1.142	0.254
19 CEMENT	0.00	169.50	1.783	1.628	9.498	8.674
20 READY MIXED CONCRETE	0.00	143.55	16.079	11.201	16.484	11.483
21 CONCRETE PRODUCTS	1.00	206.15	31.255	15.161	31.592	15.325
22 NON-METALLIC MINERAL PRODUCT	10.00	138.99	0.178	0.128	1.069	0.769
23 MINERAL PRODUCT	1901.00	4961.32	26.738	0.539	49.736	1.002
24 MOTOR VEHICLES AND PARTS	1042.00	1491.34	0.713	0.048	10.120	0.679
25 SHIP AND BOAT BUILDING	84.00	255.55	0.000	0.000	1.405	0.550
26 LOCOMOTIVES ROLLING STOCK	34.00	190.15	0.000	0.000	1.419	0.747
27 AIRCRAFT BUILDING	28.00	291.66	0.000	0.000	0.415	0.142
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	334.00	734.09	0.000	0.000	2.226	0.303

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1981-82 (cont.)
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	359.00	534.80	0.000	0.000	0.390	0.073
30 ELECTRICAL MACHINERY	227.00	738.27	0.178	0.024	4.681	0.634
31 AGRICULTURAL MACHINERY	132.00	179.01	0.000	0.000	0.183	0.102
32 CONSTRUCTION EQUIPMENT	243.00	323.85	3.565	1.101	4.605	1.422
33 OTHER MACHINERY	682.00	1010.39	3.565	0.353	6.770	0.670
34 RUBBER PRODUCTS	51.00	304.11	0.000	0.000	7.841	2.578
35 OTHER MANUFACTURED PRODUCTS	604.00	1186.55	1.783	0.150	5.703	0.481
36 ELECTRICITY	572.00	1353.34	3.565	0.263	13.376	0.988
37 GAS	147.00	183.27	0.178	0.097	0.526	0.287
38 WATER SEWERAGE AND DRAINAGE	130.00	609.35	1.783	0.293	3.674	0.603
39 RESIDENTIAL BUILDING	2190.00	2190.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	959.00	959.00	0.000	0.000	959.000	100.000
41 RAIL CONSTRUCTION	74.00	262.85	0.000	0.000	1.653	0.629
42 OTHER CONSTRUCTION	1361.00	2677.62	0.000	0.000	6.590	0.246
43 WHOLESALE AND RETAIL TRADE	4810.00	7056.53	41.283	0.585	65.412	0.927
44 MOTOR VEHICLE REPAIRS	657.00	905.67	3.209	0.354	8.557	0.945
45 OTHER REPAIRS	140.00	312.73	1.961	0.627	4.761	1.522
46 ROAD TRANSPORT	1105.00	1863.91	93.226	5.002	102.971	5.524
47 RAILWAY AND OTHER TRANSPORT	551.00	1089.65	1.783	0.164	9.536	0.875
48 WATER TRANSPORT	734.00	1037.72	0.000	0.000	6.330	0.610
49 AIR TRANSPORT	602.00	898.95	0.000	0.000	2.846	0.317
50 COMMUNICATION	855.00	1598.98	0.000	0.000	8.209	0.513
51 BUSINESS SERVICES	1426.00	5030.59	3.159	0.063	40.759	0.810
52 OWNERSHIP OF DWELLINGS	3962.00	3962.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2074.00	2110.04	0.000	0.000	0.405	0.019
54 DEFENCE	1181.00	1181.00	0.000	0.000	0.000	0.000
55 HEALTH	2344.00	2370.76	0.000	0.000	0.233	0.010
56 EDUCATION LIBRARIES, ETC.	2365.00	2398.43	0.000	0.000	0.105	0.004
57 WELFARE SERVICES	341.00	475.17	0.000	0.000	1.156	0.243
58 OTHER SERVICES	2634.00	7385.20	39.216	0.531	83.081	1.125

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1982-83
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1833.00	4398.19	0.000	0.000	1.864	0.042
2 FORESTRY LOGGING	40.00	213.81	3.408	1.594	5.020	2.348
3 IRON	523.00	632.68	0.000	0.000	1.243	0.196
4 OTHER METALLIC MINERALS	604.00	1003.03	0.000	0.000	4.584	0.457
5 COAL	372.00	622.58	0.000	0.000	3.542	0.569
6 CRUDE OIL	0.00	289.02	0.000	0.000	18.184	6.292
7 QUARRY MATERIALS	3.00	212.78	121.933	57.306	128.317	60.306
8 NON METALLIC MINERALS NES	0.00	67.03	0.000	0.000	2.913	4.346
9 SERVICES TO MINING	15.00	51.45	0.000	0.000	1.126	2.189
10 FOOD PRODUCTS	3659.00	4377.05	0.000	0.000	2.347	0.054
11 ALCOHOLIC BEVERAGES	302.00	331.69	0.000	0.000	0.341	0.103
12 TOBACCO PRODUCTS	186.00	204.64	0.000	0.000	0.211	0.103
13 TEXTILE PRODUCTS	1713.00	2936.95	0.000	0.000	7.116	0.242
14 TIMBER AND PAPER PRODUCTS	707.00	3325.71	10.353	0.311	32.130	0.966
15 CHEMICALS	506.00	2043.63	17.600	0.861	34.986	1.712
16 PETROLEUM PRODUCTS (AUST. OIL)	359.00	1010.99	56.114	5.550	72.331	7.154
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	352.13	27.539	7.821	50.736	14.408
18 GLASS AND CLAY PRODUCTS	52.00	462.83	0.000	0.000	1.326	0.287
19 CEMENT	0.00	112.14	2.071	1.847	11.033	9.839
20 READY MIXED CONCRETE	0.00	146.42	18.678	12.757	19.149	13.078
21 CONCRETE PRODUCTS	1.00	212.89	36.306	17.054	36.698	17.238
22 NON-METALLIC MINERAL PRODUCT	11.00	142.95	0.207	0.145	1.242	0.869
23 MINERAL PRODUCT	1961.00	5084.33	31.059	0.611	57.774	1.136
24 MOTOR VEHICLES AND PARTS	1075.00	1544.10	0.828	0.054	11.755	0.761
25 SHIP AND BOAT BUILDING	68.00	266.41	0.000	0.000	1.632	0.613
26 LOCOMOTIVES ROLLING STOCK	31.00	192.84	0.000	0.000	1.649	0.855
27 AIRCRAFT BUILDING	26.00	301.83	0.000	0.000	0.483	0.160
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	335.00	751.64	0.000	0.000	2.585	0.344

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : EVALUATION PROJECTIONS (RISING PROFILE) FOR 1982-83 (cont.)
(National Accounting Definitions : $million 1968-69 Prices)

INDUSTRY	FINAL DEMAND $m	TOTAL OUTPUT $m	DIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $m	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	372.00	552.03	0.000	0.000	0.453	0.082
30 ELECTRICAL MACHINERY	231.00	752.84	0.207	0.028	5.437	0.722
31 AGRICULTURAL MACHINERY	135.00	183.56	0.000	0.000	0.213	0.116
32 CONSTRUCTION EQUIPMENT	249.00	333.13	4.141	1.243	5.350	1.606
33 OTHER MACHINERY	692.00	1028.48	4.141	0.403	7.864	0.765
34 RUBBER PRODUCTS	53.00	315.19	0.000	0.000	9.108	2.890
35 OTHER MANUFACTURED PRODUCTS	625.00	1222.05	2.071	0.169	6.625	0.542
36 ELECTRICITY	602.00	1409.66	4.141	0.294	15.538	1.102
37 GAS	155.00	192.40	0.207	0.108	0.611	0.318
38 WATER SEWERAGE AND DRAINAGE	137.00	637.64	2.071	0.325	4.268	0.669
39 RESIDENTIAL BUILDING	2271.00	2271.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	1114.00	1114.00	0.000	0.000	1114.000	100.000
41 RAIL CONSTRUCTION	76.00	271.74	0.000	0.000	1.920	0.706
42 OTHER CONSTRUCTION	1244.00	2619.81	0.000	0.000	7.655	0.292
43 WHOLESALE AND RETAIL TRADE	4866.00	7198.42	47.956	0.666	75.984	1.056
44 MOTOR VEHICLE REPAIRS	692.00	949.01	3.727	0.393	9.940	1.047
45 OTHER REPAIRS	144.00	321.32	2.278	0.709	5.531	1.721
46 ROAD TRANSPORT	1146.00	1937.04	108.294	5.591	119.614	6.175
47 RAILWAY AND OTHER TRANSPORT	577.00	1129.44	2.071	0.183	11.078	0.981
48 WATER TRANSPORT	761.00	1074.25	0.000	0.000	7.353	0.685
49 AIR TRANSPORT	619.00	926.23	0.000	0.000	3.306	0.357
50 COMMUNICATION	901.00	1664.79	0.000	0.000	9.536	0.573
51 BUSINESS SERVICES	1477.00	5195.12	3.669	0.071	47.346	0.911
52 OWNERSHIP OF DWELLINGS	4151.00	4151.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2190.00	2227.19	0.000	0.000	0.471	0.021
54 DEFENCE	1248.00	1248.00	0.000	0.000	0.000	0.000
55 HEALTH	2456.00	2483.62	0.000	0.000	0.270	0.011
56 EDUCATION LIBRARIES, ETC.	2521.00	2530.73	0.000	0.000	0.122	0.005
57 WELFARE SERVICES	356.00	495.07	0.000	0.000	1.342	0.271
58 OTHER SERVICES	2722.00	7620.67	45.554	0.598	96.509	1.266

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1506.00	4016.71	0.000	0.000	1.190	.030
2 FORESTRY LOGGING	32.00	190.52	2.175	1.142	3.204	1.682
3 IRON	491.00	589.21	0.000	0.000	.793	.135
4 OTHER METALLIC MINERALS	562.00	919.24	0.000	0.000	2.926	.318
5 COAL	343.00	568.09	0.000	0.000	2.261	.398
6 CRUDE OIL	0.00	252.82	0.000	0.000	11.606	4.591
7 QUARRY MATERIALS	3.00	161.56	77.822	48.169	81.897	50.691
8 NON METALLIC MINERALS NES	0.00	61.17	0.000	0.000	1.859	3.040
9 SERVICES TO MINING	12.00	44.89	0.000	0.000	.719	1.601
10 FOOD PRODUCTS	3707.00	4387.69	0.000	0.000	1.498	.034
11 ALCOHOLIC BEVERAGES	261.00	288.17	0.000	0.000	.218	.076
12 TOBACCO PRODUCTS	163.00	178.11	0.000	0.000	.134	.075
13 TEXTILE PRODUCTS	1562.00	2672.53	0.000	0.000	4.542	.170
14 TIMBER AND PAPER PRODUCTS	647.00	3035.38	6.608	.218	20.506	.676
15 CHEMICALS	441.00	1825.34	11.233	.615	22.329	1.223
16 PETROLEUM PRODUCTS (AUST. OIL)	309.00	884.62	35.814	4.049	46.164	5.219
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	301.66	17.577	5.827	32.382	10.735
18 GLASS AND CLAY PRODUCTS	45.00	421.77	0.000	0.000	.846	.201
19 CEMENT	0.00	104.26	1.322	1.268	7.042	6.754
20 READY MIXED CONCRETE	0.00	137.37	11.921	8.678	12.221	8.896
21 CONCRETE PRODUCTS	1.00	193.29	23.172	11.988	23.422	12.117
22 NON-METALLIC MINERAL PRODUCT	10.00	132.38	.132	.100	.793	.599
23 MINERAL PRODUCT	1667.00	4551.40	19.823	.436	36.874	.810
24 MOTOR VEHICLES AND PARTS	963.00	1375.77	.529	.038	7.503	.545
25 SHIP AND BOAT BUILDING	77.00	236.18	0.000	0.000	1.042	.441
26 LOCOMOTIVES ROLLING STOCK	33.00	179.44	0.000	0.000	1.052	.586
27 AIRCRAFT BUILDING	25.00	267.97	0.000	0.000	.308	.115
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	310.00	679.65	0.000	0.000	1.650	.243

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	333.00	499.66	0.000	0.000	.289	.058
30 ELECTRICAL MACHINERY	209.00	695.45	.132	.019	3.470	.499
31 AGRICULTURAL MACHINERY	123.00	167.30	0.000	0.000	.136	.081
32 CONSTRUCTION EQUIPMENT	228.00	303.20	2.643	.872	3.414	1.126
33 OTHER MACHINERY	619.00	929.76	2.643	.284	5.019	.540
34 RUBBER PRODUCTS	46.00	281.04	0.000	0.000	5.813	2.068
35 OTHER MANUFACTURER PRODUCTS	555.00	1104.67	1.322	.120	4.228	.383
36 ELECTRICITY	520.00	1248.54	2.643	.212	9.917	.794
37 GAS	134.00	167.85	.132	.079	.390	.233
38 WATER SEWERAGE AND DRAINAGE	120.00	560.14	1.322	.236	2.724	.486
39 RESIDENTIAL BUILDING	2033.00	2033.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	711.00	711.00	0.000	0.000	711.000	100.000
41 RAIL CONSTRUCTION	70.00	247.09	0.000	0.000	1.225	.496
42 OTHER CONSTRUCTION	1521.00	2733.98	0.000	0.000	4.886	.179
43 WHOLESALE AND RETAIL TRADE	4540.00	6651.21	30.607	.460	48.496	.729
44 MOTOR VEHICLE REPAIRS	593.00	825.43	2.379	.288	6.344	.769
45 OTHER REPAIRS	132.00	294.47	1.454	.494	3.530	1.199
46 ROAD TRANSPORT	1029.00	1727.28	69.118	4.002	76.343	4.420
47 RAILWAY AND OTHER TRANSPORT	514.00	1021.83	1.322	.129	7.070	.692
48 WATER TRANSPORT	684.00	966.23	0.000	0.000	4.693	.486
49 AIR TRANSPORT	554.00	831.08	0.000	0.000	2.110	.254
50 COMMUNICATION	775.00	1468.28	0.000	0.000	6.086	.415
51 BUSINESS SERVICES	1325.00	4700.17	2.342	.050	30.218	.643
52 OWNERSHIP OF DWELLINGS	3605.00	3605.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1903.00	1936.78	0.000	0.000	.301	.016
54 DEFENCE	1086.00	1086.00	0.000	0.000	0.000	0.000
55 HEALTH	2169.00	2194.11	0.000	0.000	.172	.008
56 EDUCATION LIBRARIES, ETC.	2198.00	2206.83	0.000	0.000	.078	.004
57 WELFARE SERVICES	317.00	442.13	0.000	0.000	.857	.194
58 OTHER SERVICES	2476.00	6920.75	29.074	.420	61.596	.890

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1980/81
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1617.00	4144.82	0.000	0.000	1.342	.032
2 FORESTRY LOGGING	35.00	199.23	2.454	1.232	3.614	1.814
3 IRON	498.00	601.26	0.000	0.000	.895	.149
4 OTHER METALLIC MINERALS	573.00	948.56	0.000	0.000	3.300	.348
5 COAL	353.00	587.18	0.000	0.000	2.550	.434
6 CRUDE OIL	0.00	265.22	0.000	0.000	13.092	4.936
7 QUARRY MATERIALS	3.00	175.23	87.783	50.095	92.379	52.718
8 NON METALLIC MINERALS NES	0.00	63.78	0.000	0.000	2.097	3.288
9 SERVICES TO MINING	13.00	47.10	0.000	0.000	.811	1.721
10 FOOD PRODUCTS	3693.00	4385.30	0.000	0.000	1.690	.039
11 ALCOHOLIC BEVERAGES	271.00	298.96	0.000	0.000	.246	.082
12 TOBACCO PRODUCTS	168.00	183.59	0.000	0.000	.152	.083
13 TEXTILE PRODUCTS	1612.00	2758.93	0.000	0.000	5.123	.186
14 TIMBER AND PAPER PRODUCTS	669.00	3137.30	7.454	.238	23.131	.737
15 CHEMICALS	462.00	1896.16	12.671	.668	25.187	1.328
16 PETROLEUM PRODUCTS (AUST. OIL)	329.00	928.81	40.398	4.349	52.073	5.606
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	318.10	19.826	6.233	36.526	11.483
18 GLASS AND CLAY PRODUCTS	47.00	437.66	0.000	0.000	.955	.218
19 CEMENT	0.00	109.26	1.491	1.364	7.943	7.270
20 READY MIXED CONCRETE	0.00	144.55	13.447	9.303	13.786	9.537
21 CONCRETE PRODUCTS	1.00	203.57	26.138	12.840	26.420	12.979
22 NON-METALLIC MINERAL PRODUCT	10.00	137.50	.149	.108	.894	.650
23 MINERAL PRODUCT	1776.00	4785.99	22.361	.467	41.593	.869
24 MOTOR VEHICLES AND PARTS	1000.00	1429.95	.596	.042	8.463	.592
25 SHIP AND BOAT BUILDING	80.00	244.39	0.000	0.000	1.175	.481
26 LOCOMOTIVES ROLLING STOCK	36.00	187.77	0.000	0.000	1.187	.632
27 AIRCRAFT BUILDING	25.00	274.32	0.000	0.000	.347	.127
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	323.00	705.00	0.000	0.000	1.861	.264

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1980/81
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	345.00	518.10	0.000	0.000	.326	.063
30 ELECTRICAL MACHINERY	219.00	725.04	.149	.021	3.915	.540
31 AGRICULTURAL MACHINERY	127.00	172.72	0.000	0.000	.153	.089
32 CONSTRUCTION EQUIPMENT	242.00	319.98	2.981	.932	3.851	1.204
33 OTHER MACHINERY	648.00	971.54	2.981	.307	5.662	.583
34 RUBBER PRODUCTS	48.00	291.73	0.000	0.000	6.557	2.248
35 OTHER MANUFACTURER PRODUCTS	578.00	1144.86	1.491	.130	4.770	.417
36 ELECTRICITY	545.00	1299.20	2.981	.229	11.186	.861
37 GAS	140.00	175.04	.149	.085	.440	.252
38 WATER SEWERAGE AND DRAINAGE	123.00	581.61	1.491	.256	3.073	.528
39 RESIDENTIAL BUILDING	2109.00	2109.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	802.00	802.00	0.000	0.000	802.000	100.000
41 RAIL CONSTRUCTION	74.00	257.54	0.000	0.000	1.382	.537
42 OTHER CONSTRUCTION	1613.00	2869.25	0.000	0.000	5.511	.192
43 WHOLESALE AND RETAIL TRADE	4680.00	6867.99	34.525	.503	54.703	.796
44 MOTOR VEHICLE REPAIRS	623.00	863.90	2.683	.311	7.156	.828
45 OTHER REPAIRS	136.00	304.14	1.640	.539	3.982	1.309
46 ROAD TRANSPORT	1067.00	1793.84	77.964	4.346	86.114	4.801
47 RAILWAY AND OTHER TRANSPORT	534.00	1059.04	1.491	.141	7.975	.753
48 WATER TRANSPORT	708.00	1001.43	0.000	0.000	5.294	.529
49 AIR TRANSPORT	573.00	859.18	0.000	0.000	2.380	.277
50 COMMUNICATION	811.00	1526.09	0.000	0.000	6.865	.450
51 BUSINESS SERVICES	1373.00	4856.99	2.642	.054	34.086	.702
52 OWNERSHIP OF DWELLINGS	3780.00	3780.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1949.00	1983.84	0.000	0.000	.339	.017
54 DEFENCE	1108.00	1108.00	0.000	0.000	0.000	0.000
55 HEALTH	2225.00	2250.91	0.000	0.000	.194	.009
56 EDUCATION LIBRARIES, ETC.	2246.00	2255.11	0.000	0.000	.088	.004
57 WELFARE SERVICES	325.00	453.92	0.000	0.000	.966	.213
58 OTHER SERVICES	2545.00	7139.19	32.796	.459	69.479	.973

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1981/82
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1705.00	4253.44	0.000	0.000	1.511	.036
2 FORESTRY LOGGING	38.00	206.87	2.763	1.335	4.069	1.967
3 IRON	505.00	612.28	0.000	0.000	1.007	.165
4 OTHER METALLIC MINERALS	582.00	972.25	0.000	0.000	3.716	.382
5 COAL	358.00	600.80	0.000	0.000	2.871	.478
6 CRUDE OIL	0.00	277.72	0.000	0.000	14.740	5.308
7 QUARRY MATERIALS	3.00	187.48	98.838	52.719	104.013	55.479
8 NON METALLIC MINERALS NES	0.00	65.34	0.000	0.000	2.361	3.614
9 SERVICES TO MINING	14.00	49.19	0.000	0.000	.913	1.856
10 FOOD PRODUCTS	3687.00	4392.62	0.000	0.000	1.902	.043
11 ALCOHOLIC BEVERAGES	281.00	309.85	0.000	0.000	.277	.089
12 TOBACCO PRODUCTS	173.00	189.13	0.000	0.000	.171	.090
13 TEXTILE PRODUCTS	1669.00	2857.63	0.000	0.000	5.768	.202
14 TIMBER AND PAPER PRODUCTS	692.00	3236.71	8.392	.259	26.044	.805
15 CHEMICALS	489.00	1975.41	14.267	.722	28.359	1.436
16 PETROLEUM PRODUCTS (AUST. OIL)	350.00	972.62	45.486	4.677	58.631	6.028
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	334.62	22.323	6.671	41.126	12.290
18 GLASS AND CLAY PRODUCTS	50.00	450.69	0.000	0.000	1.075	.239
19 CEMENT	0.00	109.88	1.678	1.527	8.943	8.139
20 READY MIXED CONCRETE	0.00	144.20	15.140	10.500	15.522	10.764
21 CONCRETE PRODUCTS	1.00	206.02	29.430	14.285	29.747	14.439
22 NON-METALLIC MINERAL PRODUCT	10.00	139.58	.168	.120	1.007	.721
23 MINERAL PRODUCT	1901.00	4973.46	25.177	.506	46.831	.942
24 MOTOR VEHICLES AND PARTS	1042.00	1490.99	.671	.045	9.529	.639
25 SHIP AND BOAT BUILDING	84.00	255.59	0.000	0.000	1.323	.518
26 LOCOMOTIVES ROLLING STOCK	34.00	190.22	0.000	0.000	1.337	.703
27 AIRCRAFT BUILDING	28.00	291.66	0.000	0.000	.391	.134
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	334.00	734.11	0.000	0.000	2.096	.285

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1981/82
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	359.00	535.56	0.000	0.000	.367	.069
30 ELECTRICAL MACHINERY	227.00	741.04	.168	.023	4.407	.595
31 AGRICULTURAL MACHINERY	132.00	179.01	0.000	0.000	.173	.096
32 CONSTRUCTION EQUIPMENT	243.00	323.67	3.357	1.037	4.336	1.340
33 OTHER MACHINERY	682.00	1011.60	3.357	.332	6.375	.630
34 RUBBER PRODUCTS	51.00	303.84	0.000	0.000	7.383	2.430
35 OTHER MANUFACTURER PRODUCTS	604.00	1187.16	1.678	.141	5.370	.452
36 ELECTRICITY	572.00	1353.52	3.357	.248	12.595	.931
37 GAS	147.00	183.30	.168	.092	.496	.270
38 WATER SEWERAGE AND DRAINAGE	130.00	609.25	1.678	.275	3.460	.568
39 RESIDENTIAL BUILDING	2190.00	2190.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	903.00	903.00	0.000	0.000	903.000	100.000
41 RAIL CONSTRUCTION	74.00	262.94	0.000	0.000	1.556	.592
42 OTHER CONSTRUCTION	1417.00	2733.60	0.000	0.000	6.205	.227
43 WHOLESALE AND RETAIL TRADE	4810.00	7058.38	38.873	.551	61.592	.873
44 MOTOR VEHICLE REPAIRS	657.00	905.52	3.021	.334	8.058	.890
45 OTHER REPAIRS	140.00	312.70	1.846	.590	4.483	1.434
46 ROAD TRANSPORT	1105.00	1859.00	87.782	4.722	96.959	5.216
47 RAILWAY AND OTHER TRANSPORT	551.00	1090.17	1.678	.154	8.979	.824
48 WATER TRANSPORT	734.00	1038.05	0.000	0.000	5.961	.574
49 AIR TRANSPORT	602.00	898.99	0.000	0.000	2.680	.298
50 COMMUNICATION	859.00	1599.00	0.000	0.000	7.730	.483
51 BUSINESS SERVICES	1426.00	5030.87	2.974	.059	38.379	.763
52 OWNERSHIP OF DWELLINGS	3962.00	3962.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2074.00	2110.05	0.000	0.000	.382	.018
54 DEFENCE	1181.00	1181.00	0.000	0.000	0.000	0.000
55 HEALTH	2344.00	2370.76	0.000	0.000	.219	.009
56 EDUCATION LIBRARIES, ETC.	2389.00	2398.43	0.000	0.000	.099	.004
57 WELFARE SERVICES	341.00	475.17	0.000	0.000	1.088	.229
58 OTHER SERVICES	2634.00	7385.35	36.926	.500	78.229	1.059

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1833.00	4398.25	0.000	0.000	1.702	.039
2 FORESTRY LOGGING	40.00	213.95	3.111	1.454	4.583	2.142
3 IRON	523.00	633.14	0.000	0.000	1.134	.179
4 OTHER METALLIC MINERALS	604.00	1004.66	0.000	0.000	4.185	.417
5 COAL	372.00	622.92	0.000	0.000	3.234	.519
6 CRUDE OIL	0.00	287.82	0.000	0.000	16.601	5.768
7 QUARRY MATERIALS	3.00	202.49	111.316	54.972	117.144	57.851
8 NON METALLIC MINERALS NES	0.00	67.23	0.000	0.000	2.659	3.956
9 SERVICES TO MINING	15.00	51.41	0.000	0.000	1.028	2.000
10 FOOD PRODUCTS	3659.00	4377.14	0.000	0.000	2.143	.049
11 ALCOHOLIC BEVERAGES	302.00	331.69	0.000	0.000	.311	.094
12 TOBACCO PRODUCTS	186.00	204.64	0.000	0.000	.192	.094
13 TEXTILE PRODUCTS	1713.00	2937.16	0.000	0.000	6.496	.221
14 TIMBER AND PAPER PRODUCTS	707.00	3329.83	9.452	.284	29.332	.881
15 CHEMICALS	506.00	2043.75	16.068	.786	31.939	1.563
16 PETROLEUM PRODUCTS (AUST. OIL)	359.00	1006.14	51.228	5.092	66.032	6.563
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	348.19	25.141	7.221	46.318	13.303
18 GLASS AND CLAY PRODUCTS	52.00	464.59	0.000	0.000	1.211	.261
19 CEMENT	0.00	112.79	1.890	1.676	10.072	8.930
20 READY MIXED CONCRETE	0.00	147.53	17.052	11.558	17.481	11.849
21 CONCRETE PRODUCTS	1.00	212.66	33.145	15.586	33.503	15.754
22 NON-METALLIC MINERAL PRODUCT	11.00	143.98	.189	.131	1.134	.788
23 MINERAL PRODUCT	1961.00	5105.36	28.355	.555	52.744	1.033
24 MOTOR VEHICLES AND PARTS	1075.00	1543.48	.756	.049	10.732	.695
25 SHIP AND BOAT BUILDING	88.00	266.48	0.000	0.000	1.490	.559
26 LOCOMOTIVES ROLLING STOCK	31.00	192.97	0.000	0.000	1.505	.780
27 AIRCRAFT BUILDING	26.00	301.83	0.000	0.000	.441	.146
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	335.00	751.66	0.000	0.000	2.360	.314

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 95% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	372.00	553.34	0.000	0.000	.413	.075
30 ELECTRICAL MACHINERY	231.00	757.64	.189	.025	4.964	.655
31 AGRICULTURAL MACHINERY	135.00	183.57	0.000	0.000	.194	.106
32 CONSTRUCTION EQUIPMENT	249.00	332.82	3.781	1.136	4.884	1.467
33 OTHER MACHINERY	692.00	1030.56	3.781	.367	7.180	.697
34 RUBBER PRODUCTS	53.00	314.72	0.000	0.000	8.315	2.642
35 OTHER MANUFACTURER PRODUCTS	625.00	1223.10	1.890	.155	6.048	.495
36 ELECTRICITY	602.00	1409.96	3.781	.268	14.185	1.006
37 GAS	155.00	192.45	.189	.098	.558	.290
38 WATER SEWERAGE AND DRAINAGE	137.00	637.47	1.890	.297	3.896	.611
39 RESIDENTIAL BUILDING	2271.00	2271.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	1017.00	1017.00	0.000	0.000	1017.000	100.000
41 RAIL CONSTRUCTION	76.00	271.90	0.000	0.000	1.753	.645
42 OTHER CONSTRUCTION	1341.00	2716.77	0.000	0.000	6.989	.257
43 WHOLESALE AND RETAIL TRADE	4886.00	7201.62	43.780	.608	69.368	.963
44 MOTOR VEHICLE REPAIRS	692.00	948.75	3.403	.359	9.075	.956
45 OTHER REPAIRS	144.00	321.27	2.079	.647	5.049	1.572
46 ROAD TRANSPORT	1146.00	1928.52	98.864	5.126	109.199	5.662
47 RAILWAY AND OTHER TRANSPORT	577.00	1130.35	1.890	.167	10.113	.895
48 WATER TRANSPORT	761.00	1074.83	0.000	0.000	6.713	.625
49 AIR TRANSPORT	619.00	926.30	0.000	0.000	3.018	.326
50 COMMUNICATION	901.00	1664.82	0.000	0.000	8.705	.523
51 BUSINESS SERVICES	1477.00	5195.59	3.350	.064	43.224	.832
52 OWNERSHIP OF DWELLINGS	4151.00	4151.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2190.00	2227.19	0.000	0.000	.430	.019
54 DEFENCE	1248.00	1248.00	0.000	0.000	0.000	0.000
55 HEALTH	2456.00	2483.62	0.000	0.000	.247	.010
56 EDUCATION LIBRARIES, ETC.	2521.00	2530.73	0.000	0.000	.112	.004
57 WELFARE SERVICES	356.00	495.07	0.000	0.000	1.226	.248
58 OTHER SERVICES	2722.00	7620.93	41.587	.546	88.105	1.156

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1506.00	4016.71	0.000	0.000	1.190	.030
2 FORESTRY LOGGING	32.00	190.52	2.175	1.142	3.204	1.682
3 IRON	491.00	589.21	0.000	0.000	.793	.135
4 OTHER METALLIC MINERALS	562.00	919.24	0.000	0.000	2.926	.318
5 COAL	343.00	568.09	0.000	0.000	2.261	.398
6 CRUDE OIL	0.00	252.82	0.000	0.000	11.606	4.591
7 QUARRY MATERIALS	3.00	161.56	77.822	48.169	81.897	50.691
8 NON METALLIC MINERALS NES	0.00	61.17	0.000	0.000	1.859	3.040
9 SERVICES TO MINING	12.00	44.89	0.000	0.000	.719	1.601
10 FOOD PRODUCTS	3707.00	4387.69	0.000	0.000	1.498	.034
11 ALCOHOLIC BEVERAGES	261.00	288.17	0.000	0.000	.218	.076
12 TOBACCO PRODUCTS	163.00	178.11	0.000	0.000	.134	.075
13 TEXTILE PRODUCTS	1562.00	2672.53	0.000	0.000	4.542	.170
14 TIMBER AND PAPER PRODUCTS	647.00	3035.38	6.608	.218	20.506	.676
15 CHEMICALS	441.00	1825.34	11.233	.615	22.329	1.223
16 PETROLEUM PRODUCTS (AUST. OIL)	309.00	884.62	35.814	4.049	46.164	5.219
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	301.66	17.577	5.827	32.382	10.735
18 GLASS AND CLAY PRODUCTS	45.00	421.77	0.000	0.000	.846	.201
19 CEMENT	0.00	104.26	1.322	1.268	7.042	6.754
20 READY MIXED CONCRETE	0.00	137.37	11.921	8.678	12.221	8.896
21 CONCRETE PRODUCTS	1.00	193.29	23.172	11.988	23.422	12.117
22 NON-METALLIC MINERAL PRODUCT	10.00	132.38	.132	.100	.793	.599
23 MINERAL PRODUCT	1667.00	4551.40	19.823	.436	36.874	.810
24 MOTOR VEHICLES AND PARTS	963.00	1375.77	.529	.038	7.503	.545
25 SHIP AND BOAT BUILDING	77.00	236.18	0.000	0.000	1.042	.441
26 LOCOMOTIVES ROLLING STOCK	33.00	179.44	0.000	0.000	1.052	.586
27 AIRCRAFT BUILDING	25.00	267.97	0.000	0.000	.308	.115
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	310.00	679.65	0.000	0.000	1.650	.243

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	333.00	499.66	0.000	0.000	.289	.058
30 ELECTRICAL MACHINERY	209.00	695.45	.132	.019	3.470	.499
31 AGRICULTURAL MACHINERY	123.00	167.30	0.000	0.000	.136	.081
32 CONSTRUCTION EQUIPMENT	228.00	303.20	2.643	.872	3.414	1.126
33 OTHER MACHINERY	619.00	929.76	2.643	.284	5.019	.540
34 RUBBER PRODUCTS	46.00	281.04	0.000	0.000	5.813	2.068
35 OTHER MANUFACTURER PRODUCTS	555.00	1104.67	1.322	.120	4.228	.383
36 ELECTRICITY	520.00	1248.54	2.643	.212	9.917	.794
37 GAS	134.00	167.85	.132	.079	.390	.233
38 WATER SEWERAGE AND DRAINAGE	120.00	560.14	1.322	.236	2.724	.486
39 RESIDENTIAL BUILDING	2033.00	2033.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	711.00	711.00	0.000	0.000	711.000	100.000
41 RAIL CONSTRUCTION	70.00	247.09	0.000	0.000	1.225	.496
42 OTHER CONSTRUCTION	1521.00	2733.98	0.000	0.000	4.886	.179
43 WHOLESALE AND RETAIL TRADE	4540.00	6651.21	30.607	.460	48.496	.729
44 MOTOR VEHICLE REPAIRS	593.00	825.43	2.379	.288	6.344	.769
45 OTHER REPAIRS	132.00	294.47	1.454	.494	3.530	1.199
46 ROAD TRANSPORT	1029.00	1727.28	69.118	4.002	76.343	4.420
47 RAILWAY AND OTHER TRANSPORT	514.00	1021.83	1.322	.129	7.070	.692
48 WATER TRANSPORT	684.00	966.23	0.000	0.000	4.693	.486
49 AIR TRANSPORT	554.00	831.08	0.000	0.000	2.110	.254
50 COMMUNICATION	775.00	1468.28	0.000	0.000	6.086	.415
51 BUSINESS SERVICES	1325.00	4700.17	2.342	.050	30.218	.643
52 OWNERSHIP OF DWELLINGS	3605.00	3605.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1903.00	1936.78	0.000	0.000	.301	.016
54 DEFENCE	1086.00	1086.00	0.000	0.000	0.000	0.000
55 HEALTH	2169.00	2194.11	0.000	0.000	.172	.008
56 EDUCATION LIBRARIES, ETC.	2198.00	2206.83	0.000	0.000	.078	.004
57 WELFARE SERVICES	317.00	442.13	0.000	0.000	.857	.194
58 OTHER SERVICES	2476.00	6920.75	29.074	.420	61.596	.890

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1980/81
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1617.00	4144.83	0.000	0.000	1.298	.031
2 FORESTRY LOGGING	35.00	199.27	2.374	1.191	3.497	1.755
3 IRON	498.00	601.38	0.000	0.000	.866	.144
4 OTHER METALLIC MINERALS	573.00	949.00	0.000	0.000	3.193	.336
5 COAL	353.00	587.27	0.000	0.000	2.467	.420
6 CRUDE OIL	0.00	264.90	0.000	0.000	12.667	4.782
7 QUARRY MATERIALS	3.00	172.48	84.937	49.246	89.384	51.824
8 NON METALLIC MINERALS NES	0.00	63.84	0.000	0.000	2.029	3.179
9 SERVICES TO MINING	13.00	47.09	0.000	0.000	.784	1.666
10 FOOD PRODUCTS	3693.00	4385.32	0.000	0.000	1.635	.037
11 ALCOHOLIC BEVERAGES	271.00	298.96	0.000	0.000	.238	.079
12 TOBACCO PRODUCTS	168.00	183.59	0.000	0.000	.147	.080
13 TEXTILE PRODUCTS	1612.00	2758.99	0.000	0.000	4.957	.180
14 TIMBER AND PAPER PRODUCTS	669.00	3138.40	7.212	.230	22.381	.713
15 CHEMICALS	462.00	1896.19	12.260	.647	24.371	1.285
16 PETROLEUM PRODUCTS (AUST. OIL)	329.00	927.51	39.088	4.214	50.385	5.432
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	317.04	19.184	6.051	35.342	11.147
18 GLASS AND CLAY PRODUCTS	47.00	438.13	0.000	0.000	.924	.211
19 CEMENT	0.00	109.44	1.442	1.318	7.686	7.023
20 READY MIXED CONCRETE	0.00	144.85	13.011	8.982	13.339	9.209
21 CONCRETE PRODUCTS	1.00	203.51	25.291	12.427	25.564	12.562
22 NON-METALLIC MINERAL PRODUCT	10.00	137.78	.144	.105	.865	.628
23 MINERAL PRODUCT	1776.00	4791.63	21.636	.452	40.245	.840
24 MOTOR VEHICLES AND PARTS	1000.00	1429.79	.577	.040	8.189	.573
25 SHIP AND BOAT BUILDING	80.00	244.41	0.000	0.000	1.137	.465
26 LOCOMOTIVES ROLLING STOCK	36.00	187.81	0.000	0.000	1.149	.612
27 AIRCRAFT BUILDING	25.00	274.32	0.000	0.000	.336	.123
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	323.00	705.01	0.000	0.000	1.801	.255

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1980/81
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	345.00	518.45	0.000	0.000	.315	.061
30 ELECTRICAL MACHINERY	219.00	726.32	.144	.020	3.788	.521
31 AGRICULTURAL MACHINERY	127.00	172.72	0.000	0.000	.148	.086
32 CONSTRUCTION EQUIPMENT	242.00	319.89	2.885	.902	3.727	1.165
33 OTHER MACHINERY	646.00	972.10	2.885	.297	5.478	.564
34 RUBBER PRODUCTS	48.00	291.60	0.000	0.000	6.345	2.176
35 OTHER MANUFACTURER PRODUCTS	576.00	1145.14	1.442	.126	4.615	.403
36 ELECTRICITY	545.00	1299.28	2.885	.222	10.823	.833
37 GAS	140.00	175.05	.144	.082	.426	.243
38 WATER SEWERAGE AND DRAINAGE	123.00	581.56	1.442	.248	2.973	.511
39 RESIDENTIAL BUILDING	2109.00	2109.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	776.00	776.00	0.000	0.000	776.000	100.000
41 RAIL CONSTRUCTION	74.00	257.58	0.000	0.000	1.337	.519
42 OTHER CONSTRUCTION	1639.00	2895.24	0.000	0.000	5.332	.184
43 WHOLESALE AND RETAIL TRADE	4680.00	6868.84	33.405	.486	52.930	.771
44 MOTOR VEHICLE REPAIRS	623.00	863.83	2.596	.301	6.924	.802
45 OTHER REPAIRS	136.00	304.13	1.587	.522	3.853	1.267
46 ROAD TRANSPORT	1067.00	1791.56	75.436	4.211	83.322	4.651
47 RAILWAY AND OTHER TRANSPORT	534.00	1059.28	1.442	.136	7.717	.728
48 WATER TRANSPORT	708.00	1001.59	0.000	0.000	5.122	.511
49 AIR TRANSPORT	573.00	859.20	0.000	0.000	2.303	.268
50 COMMUNICATION	811.00	1526.09	0.000	0.000	6.642	.435
51 BUSINESS SERVICES	1373.00	4857.12	2.556	.053	32.981	.679
52 OWNERSHIP OF DWELLINGS	3780.00	3780.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1949.00	1983.84	0.000	0.000	.328	.017
54 DEFENCE	1108.00	1108.00	0.000	0.000	0.000	0.000
55 HEALTH	2225.00	2250.91	0.000	0.000	.188	.008
56 EDUCATION LIBRARIES, ETC.	2246.00	2255.11	0.000	0.000	.085	.004
57 WELFARE SERVICES	325.00	453.92	0.000	0.000	.935	.206
58 OTHER SERVICES	2545.00	7139.26	31.732	.444	67.227	.942

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1981/82
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1705.00	4253.48	0.000	0.000	1.414	.033
2 FORESTRY LOGGING	38.00	206.96	2.585	1.249	3.808	1.840
3 IRON	505.00	612.55	0.000	0.000	.943	.154
4 OTHER METALLIC MINERALS	582.00	973.23	0.000	0.000	3.477	.357
5 COAL	358.00	601.00	0.000	0.000	2.687	.447
6 CRUDE OIL	0.00	277.00	0.000	0.000	13.793	4.980
7 QUARRY MATERIALS	3.00	181.33	92.489	51.005	97.332	53.676
8 NON METALLIC MINERALS NES	0.00	65.46	0.000	0.000	2.210	3.375
9 SERVICES TO MINING	14.00	49.17	0.000	0.000	.854	1.737
10 FOOD PRODUCTS	3687.00	4392.68	0.000	0.000	1.780	.041
11 ALCOHOLIC BEVERAGES	281.00	309.85	0.000	0.000	.259	.084
12 TOBACCO PRODUCTS	173.00	189.13	0.000	0.000	.160	.084
13 TEXTILE PRODUCTS	1669.00	2857.75	0.000	0.000	5.397	.189
14 TIMBER AND PAPER PRODUCTS	692.00	3239.17	7.853	.242	24.371	.752
15 CHEMICALS	489.00	1975.48	13.350	.676	26.538	1.343
16 PETROLEUM PRODUCTS (AUST. OIL)	350.00	969.72	42.564	4.389	54.865	5.658
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	332.27	20.889	6.287	38.485	11.582
18 GLASS AND CLAY PRODUCTS	50.00	451.74	0.000	0.000	1.006	.223
19 CEMENT	0.00	110.28	1.571	1.424	8.369	7.589
20 READY MIXED CONCRETE	0.00	144.87	14.168	9.780	14.525	10.026
21 CONCRETE PRODUCTS	1.00	205.88	27.539	13.376	27.837	13.521
22 NON-METALLIC MINERAL PRODUCT	10.00	140.20	.157	.112	.942	.672
23 MINERAL PRODUCT	1901.00	4986.03	23.559	.473	43.823	.879
24 MOTOR VEHICLES AND PARTS	1042.00	1490.62	.628	.042	8.917	.598
25 SHIP AND BOAT BUILDING	84.00	255.63	0.000	0.000	1.238	.484
26 LOCOMOTIVES ROLLING STOCK	34.00	190.29	0.000	0.000	1.251	.657
27 AIRCRAFT BUILDING	28.00	291.66	0.000	0.000	.366	.126
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	334.00	734.13	0.000	0.000	1.961	.267

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1981/82
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	359.00	536.34	0.000	0.000	.343	.064
30 ELECTRICAL MACHINERY	227.00	743.91	.157	.021	4.124	.554
31 AGRICULTURAL MACHINERY	132.00	179.02	0.000	0.000	.161	.090
32 CONSTRUCTION EQUIPMENT	243.00	323.48	3.141	.971	4.058	1.254
33 OTHER MACHINERY	682.00	1012.84	3.141	.310	5.965	.589
34 RUBBER PRODUCTS	51.00	303.55	0.000	0.000	6.909	2.276
35 OTHER MANUFACTURER PRODUCTS	604.00	1187.79	1.571	.132	5.025	.423
36 ELECTRICITY	572.00	1353.70	3.141	.232	11.786	.871
37 GAS	147.00	183.33	.157	.086	.464	.253
38 WATER SEWERAGE AND DRAINAGE	130.00	609.14	1.571	.258	3.237	.531
39 RESIDENTIAL BUILDING	2190.00	2190.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	845.00	845.00	0.000	0.000	845.000	100.000
41 RAIL CONSTRUCTION	74.00	263.03	0.000	0.000	1.456	.554
42 OTHER CONSTRUCTION	1475.00	2791.58	0.000	0.000	5.807	.208
43 WHOLESALE AND RETAIL TRADE	4810.00	7060.29	36.376	.515	57.636	.816
44 MOTOR VEHICLE REPAIRS	657.00	905.37	2.827	.312	7.540	.833
45 OTHER REPAIRS	140.00	312.67	1.728	.553	4.195	1.342
46 ROAD TRANSPORT	1105.00	1853.90	82.144	4.431	90.731	4.894
47 RAILWAY AND OTHER TRANSPORT	551.00	1090.72	1.571	.144	8.403	.770
48 WATER TRANSPORT	734.00	1038.40	0.000	0.000	5.578	.537
49 AIR TRANSPORT	602.00	899.03	0.000	0.000	2.508	.279
50 COMMUNICATION	85[illegible].00	1599.02	0.000	0.000	7.233	.452
51 BUSINESS SERVICES	1426.00	5031.15	2.783	.055	35.914	.714
52 OWNERSHIP OF DWELLINGS	3962.00	3962.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2074.00	2110.05	0.000	0.000	.357	.017
54 DEFENCE	1181.00	1181.00	0.000	0.000	0.000	0.000
55 HEALTH	2344.00	2370.76	0.000	0.000	.205	.009
56 EDUCATION LIBRARIES, ETC.	2389.00	2398.43	0.000	0.000	.093	.004
57 WELFARE SERVICES	341.00	475.17	0.000	0.000	1.018	.214
58 OTHER SERVICES	2634.00	7385.51	34.554	.468	73.205	.991

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1833.00	4398.31	0.000	0.000	1.539	.035
2 FORESTRY LOGGING	40.00	214.10	2.815	1.315	4.146	1.936
3 IRON	523.00	633.59	0.000	0.000	1.026	.162
4 OTHER METALLIC MINERALS	604.00	1006.28	0.000	0.000	3.786	.376
5 COAL	372.00	623.26	0.000	0.000	2.925	.469
6 CRUDE OIL	0.00	286.62	0.000	0.000	15.018	5.240
7 QUARRY MATERIALS	3.00	192.21	100.699	52.389	105.971	55.132
8 NON METALLIC MINERALS NES	0.00	67.43	0.000	0.000	2.406	3.568
9 SERVICES TO MINING	15.00	51.38	0.000	0.000	.930	1.810
10 FOOD PRODUCTS	3659.00	4377.23	0.000	0.000	1.938	.044
11 ALCOHOLIC BEVERAGES	302.00	331.69	0.000	0.000	.282	.085
12 TOBACCO PRODUCTS	188.00	204.64	0.000	0.000	.174	.085
13 TEXTILE PRODUCTS	1713.00	2937.37	0.000	0.000	5.877	.200
14 TIMBER AND PAPER PRODUCTS	707.00	3333.95	8.550	.256	26.534	.796
15 CHEMICALS	506.00	2043.87	14.535	.711	28.893	1.414
16 PETROLEUM PRODUCTS (AUST. OIL)	359.00	1001.29	46.342	4.628	59.734	5.966
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	344.25	22.743	6.607	41.900	12.172
18 GLASS AND CLAY PRODUCTS	52.00	466.35	0.000	0.000	1.095	.235
19 CEMENT	0.00	113.45	1.710	1.507	9.112	8.031
20 READY MIXED CONCRETE	0.00	148.65	15.425	10.377	15.814	10.639
21 CONCRETE PRODUCTS	1.00	212.44	29.984	14.114	30.307	14.267
22 NON-METALLIC MINERAL PRODUCT	11.00	145.02	.171	.118	1.026	.707
23 MINERAL PRODUCT	1961.00	5126.39	25.651	.500	47.713	.931
24 MOTOR VEHICLES AND PARTS	1075.00	1542.86	.684	.044	9.708	.629
25 SHIP AND BOAT BUILDING	88.00	266.55	0.000	0.000	1.348	.506
26 LOCOMOTIVES ROLLING STOCK	31.00	193.09	0.000	0.000	1.362	.705
27 AIRCRAFT BUILDING	26.00	301.84	0.000	0.000	.399	.132
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	335.00	751.69	0.000	0.000	2.135	.284

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 90% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	372.00	554.65	0.000	0.000	.374	.067
30 ELECTRICAL MACHINERY	231.00	762.45	.171	.022	4.490	.589
31 AGRICULTURAL MACHINERY	135.00	183.57	0.000	0.000	.176	.096
32 CONSTRUCTION EQUIPMENT	249.00	332.50	3.420	1.029	4.418	1.329
33 OTHER MACHINERY	692.00	1032.64	3.420	.331	6.495	.629
34 RUBBER PRODUCTS	53.00	314.25	0.000	0.000	7.522	2.394
35 OTHER MANUFACTURER PRODUCTS	625.00	1224.16	1.710	.140	5.471	.447
36 ELECTRICITY	602.00	1410.26	3.420	.243	12.832	.910
37 GAS	155.00	192.50	.171	.089	.505	.262
38 WATER SEWERAGE AND DRAINAGE	137.00	637.30	1.710	.268	3.525	.553
39 RESIDENTIAL BUILDING	2271.00	2271.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	920.00	920.00	0.000	0.000	920.000	100.000
41 RAIL CONSTRUCTION	76.00	272.06	0.000	0.000	1.586	.583
42 OTHER CONSTRUCTION	1438.00	2813.72	0.000	0.000	6.322	.225
43 WHOLESALE AND RETAIL TRADE	4886.00	7204.82	39.604	.550	62.752	.871
44 MOTOR VEHICLE REPAIRS	692.00	948.49	3.078	.325	8.209	.866
45 OTHER REPAIRS	144.00	321.22	1.881	.586	4.567	1.422
46 ROAD TRANSPORT	1146.00	1920.00	89.435	4.658	98.784	5.145
47 RAILWAY AND OTHER TRANSPORT	577.00	1131.26	1.710	.151	9.148	.809
48 WATER TRANSPORT	761.00	1075.41	0.000	0.000	6.073	.565
49 AIR TRANSPORT	619.00	926.37	0.000	0.000	2.730	.295
50 COMMUNICATION	901.00	1664.84	0.000	0.000	7.875	.473
51 BUSINESS SERVICES	1477.00	5196.07	3.030	.058	39.101	.753
52 OWNERSHIP OF DWELLINGS	4151.00	4151.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2190.00	2227.20	0.000	0.000	.389	.017
54 DEFENCE	1248.00	1248.00	0.000	0.000	0.000	0.000
55 HEALTH	2456.00	2483.63	0.000	0.000	.223	.009
56 EDUCATION LIBRARIES, ETC.	2521.00	2530.73	0.000	0.000	.101	.004
57 WELFARE SERVICES	356.00	495.07	0.000	0.000	1.109	.224
58 OTHER SERVICES	2722.00	7621.20	37.621	.494	79.702	1.046

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 85% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1506.00	4016.71	0.000	0.000	1.190	.030
2 FORESTRY LOGGING	32.00	190.52	2.175	1.142	3.204	1.682
3 IRON	491.00	589.21	0.000	0.000	.793	.135
4 OTHER METALLIC MINERALS	562.00	919.24	0.000	0.000	2.926	.318
5 COAL	343.00	568.09	0.000	0.000	2.261	.398
6 CRUDE OIL	0.00	252.82	0.000	0.000	11.606	4.591
7 QUARRY MATERIALS	3.00	161.56	77.822	48.169	81.897	50.691
8 NON METALLIC MINERALS NES	0.00	61.17	0.000	0.000	1.859	3.040
9 SERVICES TO MINING	12.00	44.89	0.000	0.000	.719	1.601
10 FOOD PRODUCTS	3707.00	4387.69	0.000	0.000	1.498	.034
11 ALCOHOLIC BEVERAGES	261.00	288.17	0.000	0.000	.218	.076
12 TOBACCO PRODUCTS	163.00	178.11	0.000	0.000	.134	.075
13 TEXTILE PRODUCTS	1562.00	2672.53	0.000	0.000	4.542	.170
14 TIMBER AND PAPER PRODUCTS	647.00	3035.38	6.608	.218	20.506	.676
15 CHEMICALS	441.00	1825.34	11.233	.615	22.329	1.223
16 PETROLEUM PRODUCTS (AUST. OIL)	309.00	884.62	35.814	4.049	46.164	5.219
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	301.66	17.577	5.827	32.382	10.735
18 GLASS AND CLAY PRODUCTS	45.00	421.77	0.000	0.000	.846	.201
19 CEMENT	0.00	104.26	1.322	1.268	7.042	6.754
20 READY MIXED CONCRETE	0.00	137.37	11.921	8.678	12.221	8.896
21 CONCRETE PRODUCTS	1.00	193.29	23.172	11.988	23.422	12.117
22 NON-METALLIC MINERAL PRODUCT	10.00	132.38	.132	.100	.793	.599
23 MINERAL PRODUCT	1667.00	4551.40	19.823	.436	36.874	.810
24 MOTOR VEHICLES AND PARTS	963.00	1375.77	.529	.038	7.503	.545
25 SHIP AND BOAT BUILDING	77.00	236.18	0.000	0.000	1.042	.441
26 LOCOMOTIVES ROLLING STOCK	33.00	179.44	0.000	0.000	1.052	.586
27 AIRCRAFT BUILDING	25.00	267.97	0.000	0.000	.308	.115
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	310.00	679.65	0.000	0.000	1.650	.243

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 85% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	333.00	499.66	0.000	0.000	.289	.058
30 ELECTRICAL MACHINERY	209.00	695.45	.132	.019	3.470	.499
31 AGRICULTURAL MACHINERY	123.00	167.30	0.000	0.000	.136	.081
32 CONSTRUCTION EQUIPMENT	228.00	303.20	2.643	.872	3.414	1.126
33 OTHER MACHINERY	619.00	929.76	2.643	.284	5.019	.540
34 RUBBER PRODUCTS	46.00	281.04	0.000	0.000	5.813	2.068
35 OTHER MANUFACTURER PRODUCTS	555.00	1104.67	1.322	.120	4.228	.383
36 ELECTRICITY	520.00	1248.54	2.643	.212	9.917	.794
37 GAS	134.00	167.85	.132	.079	.390	.233
38 WATER SEWERAGE AND DRAINAGE	120.00	560.14	1.322	.236	2.724	.486
39 RESIDENTIAL BUILDING	2033.00	2033.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	711.00	711.00	0.000	0.000	711.000	100.000
41 RAIL CONSTRUCTION	70.00	247.09	0.000	0.000	1.225	.496
42 OTHER CONSTRUCTION	1521.00	2733.98	0.000	0.000	4.886	.179
43 WHOLESALE AND RETAIL TRADE	4540.00	6651.21	30.607	.460	48.496	.729
44 MOTOR VEHICLE REPAIRS	593.00	825.43	2.379	.288	6.344	.769
45 OTHER REPAIRS	132.00	294.47	1.454	.494	3.530	1.199
46 ROAD TRANSPORT	1029.00	1727.28	69.118	4.002	76.343	4.420
47 RAILWAY AND OTHER TRANSPORT	514.00	1021.83	1.322	.129	7.070	.692
48 WATER TRANSPORT	684.00	966.23	0.000	0.000	4.693	.486
49 AIR TRANSPORT	554.00	831.08	0.000	0.000	2.110	.254
50 COMMUNICATION	775.00	1468.28	0.000	0.000	6.086	.415
51 BUSINESS SERVICES	1325.00	4700.17	2.342	.050	30.218	.643
52 OWNERSHIP OF DWELLINGS	3605.00	3605.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1903.00	1936.78	0.000	0.000	.301	.016
54 DEFENCE	1086.00	1086.00	0.000	0.000	0.000	0.000
55 HEALTH	2169.00	2194.11	0.000	0.000	.172	.008
56 EDUCATION LIBRARIES, ETC.	2198.00	2206.83	0.000	0.000	.078	.004
57 WELFARE SERVICES	317.00	442.13	0.000	0.000	.857	.194
58 OTHER SERVICES	2476.00	6920.75	29.074	.420	61.596	.890

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 85% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1833.00	4398.37	0.000	0.000	1.380	.031
2 FORESTRY LOGGING	40.00	214.24	2.524	1.178	3.718	1.735
3 IRON	523.00	634.04	0.000	0.000	.920	.145
4 OTHER METALLIC MINERALS	604.00	1007.88	0.000	0.000	3.395	.337
5 COAL	372.00	623.59	0.000	0.000	2.623	.421
6 CRUDE OIL	0.00	285.44	0.000	0.000	13.467	4.718
7 QUARRY MATERIALS	3.00	182.14	90.300	49.577	95.028	52.173
8 NON METALLIC MINERALS NES	0.00	67.63	0.000	0.000	2.157	3.190
9 SERVICES TO MINING	15.00	51.35	0.000	0.000	.834	1.624
10 FOOD PRODUCTS	3659.00	4377.32	0.000	0.000	1.738	.040
11 ALCOHOLIC BEVERAGES	302.00	331.69	0.000	0.000	.253	.076
12 TOBACCO PRODUCTS	188.00	204.64	0.000	0.000	.156	.076
13 TEXTILE PRODUCTS	1713.00	2937.58	0.000	0.000	5.270	.179
14 TIMBER AND PAPER PRODUCTS	707.00	3337.98	7.667	.230	23.794	.713
15 CHEMICALS	506.00	2043.98	13.034	.638	25.910	1.266
16 PETROLEUM PRODUCTS (AUST. OIL)	359.00	996.54	41.557	4.170	53.566	5.375
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	340.39	20.395	5.992	37.574	11.038
18 GLASS AND CLAY PRODUCTS	52.00	468.08	0.000	0.000	.982	.210
19 CEMENT	0.00	114.10	1.533	1.344	8.171	7.161
20 READY MIXED CONCRETE	0.00	149.74	13.833	9.238	14.181	9.470
21 CONCRETE PRODUCTS	1.00	212.21	26.888	12.670	27.178	12.807
22 NON-METALLIC MINERAL PRODUCT	11.00	146.03	.153	.105	.920	.630
23 MINERAL PRODUCT	1961.00	5146.99	23.002	.447	42.786	.831
24 MOTOR VEHICLES AND PARTS	1075.00	1542.25	.613	.040	8.706	.564
25 SHIP AND BOAT BUILDING	88.00	266.62	0.000	0.000	1.209	.453
26 LOCOMOTIVES ROLLING STOCK	31.00	193.21	0.000	0.000	1.221	.632
27 AIRCRAFT BUILDING	26.00	301.84	0.000	0.000	.357	.118
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	335.00	751.72	0.000	0.000	1.915	.255

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 85% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	372.00	555.93	0.000	0.000	.335	.060
30 ELECTRICAL MACHINERY	231.00	767.15	.153	.020	4.027	.525
31 AGRICULTURAL MACHINERY	135.00	183.57	0.000	0.000	.158	.086
32 CONSTRUCTION EQUIPMENT	249.00	332.19	3.067	.923	3.962	1.193
33 OTHER MACHINERY	692.00	1034.68	3.067	.296	5.824	.563
34 RUBBER PRODUCTS	53.00	313.78	0.000	0.000	6.745	2.150
35 OTHER MANUFACTURER PRODUCTS	625.00	1225.19	1.533	.125	4.906	.400
36 ELECTRICITY	602.00	1410.56	3.067	.217	11.507	.816
37 GAS	155.00	192.55	.153	.080	.453	.235
38 WATER SEWERAGE AND DRAINAGE	137.00	637.13	1.533	.241	3.161	.496
39 RESIDENTIAL BUILDING	2271.00	2271.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	825.00	825.00	0.000	0.000	825.000	100.000
41 RAIL CONSTRUCTION	76.00	272.21	0.000	0.000	1.422	.522
42 OTHER CONSTRUCTION	1533.00	2908.68	0.000	0.000	5.669	.195
43 WHOLESALE AND RETAIL TRADE	4886.00	7207.96	35.515	.493	56.272	.781
44 MOTOR VEHICLE REPAIRS	692.00	948.24	2.760	.291	7.362	.776
45 OTHER REPAIRS	144.00	321.17	1.687	.525	4.096	1.275
46 ROAD TRANSPORT	1146.00	1911.65	80.200	4.195	88.583	4.634
47 RAILWAY AND OTHER TRANSPORT	577.00	1132.15	1.533	.135	8.204	.725
48 WATER TRANSPORT	761.00	1075.98	0.000	0.000	5.446	.506
49 AIR TRANSPORT	619.00	926.45	0.000	0.000	2.449	.264
50 COMMUNICATION	901.00	1664.87	0.000	0.000	7.062	.424
51 BUSINESS SERVICES	1477.00	5196.53	2.717	.052	35.064	.675
52 OWNERSHIP OF DWELLINGS	4151.00	4151.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2190.00	2227.20	0.000	0.000	.349	.016
54 DEFENCE	1248.00	1248.00	0.000	0.000	0.000	0.000
55 HEALTH	2456.00	2483.63	0.000	0.000	.200	.008
56 EDUCATION LIBRARIES, ETC.	2521.00	2530.73	0.000	0.000	.091	.004
57 WELFARE SERVICES	356.00	495.08	0.000	0.000	.994	.201
58 OTHER SERVICES	2722.00	7621.45	33.736	.443	71.472	.938

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1506.00	4016.71	0.000	0.000	1.190	.030
2 FORESTRY LOGGING	32.00	190.52	2.175	1.142	3.204	1.682
3 IRON	491.00	589.21	0.000	0.000	.793	.135
4 OTHER METALLIC MINERALS	562.00	919.24	0.000	0.000	2.926	.318
5 COAL	343.00	568.09	0.000	0.000	2.261	.398
6 CRUDE OIL	0.00	252.82	0.000	0.000	11.606	4.591
7 QUARRY MATERIALS	3.00	161.56	77.822	48.169	81.897	50.691
8 NON METALLIC MINERALS NES	0.00	61.17	0.000	0.000	1.859	3.040
9 SERVICES TO MINING	12.00	44.89	0.000	0.000	.719	1.601
10 FOOD PRODUCTS	3707.00	4387.69	0.000	0.000	1.498	.034
11 ALCOHOLIC BEVERAGES	261.00	288.17	0.000	0.000	.218	.076
12 TOBACCO PRODUCTS	163.00	178.11	0.000	0.000	.134	.075
13 TEXTILE PRODUCTS	1562.00	2672.53	0.000	0.000	4.542	.170
14 TIMBER AND PAPER PRODUCTS	647.00	3035.38	6.608	.218	20.506	.676
15 CHEMICALS	441.00	1825.34	11.233	.615	22.329	1.223
16 PETROLEUM PRODUCTS (AUST. OIL)	309.00	884.62	35.814	4.049	46.164	5.219
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	301.66	17.577	5.827	32.382	10.735
18 GLASS AND CLAY PRODUCTS	45.00	421.77	0.000	0.000	.846	.201
19 CEMENT	0.00	104.26	1.322	1.268	7.042	6.754
20 READY MIXED CONCRETE	0.00	137.37	11.921	8.678	12.221	8.896
21 CONCRETE PRODUCTS	1.00	193.29	23.172	11.988	23.422	12.117
22 NON-METALLIC MINERAL PRODUCT	10.00	132.38	.132	.100	.793	.599
23 MINERAL PRODUCT	1667.00	4551.40	19.823	.436	36.874	.810
24 MOTOR VEHICLES AND PARTS	963.00	1375.77	.529	.038	7.503	.545
25 SHIP AND BOAT BUILDING	77.00	236.18	0.000	0.000	1.042	.441
26 LOCOMOTIVES ROLLING STOCK	33.00	179.44	0.000	0.000	1.052	.586
27 AIRCRAFT BUILDING	25.00	267.97	0.000	0.000	.308	.115
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	310.00	679.65	0.000	0.000	1.650	.243

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1979/80
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	333.00	499.66	0.000	0.000	.289	.058
30 ELECTRICAL MACHINERY	209.00	695.45	.132	.019	3.470	.499
31 AGRICULTURAL MACHINERY	123.00	167.30	0.000	0.000	.136	.081
32 CONSTRUCTION EQUIPMENT	228.00	303.20	2.643	.872	3.414	1.126
33 OTHER MACHINERY	619.00	929.76	2.643	.284	5.019	.540
34 RUBBER PRODUCTS	46.00	281.04	0.000	0.000	5.813	2.068
35 OTHER MANUFACTURER PRODUCTS	555.00	1104.67	1.322	.120	4.228	.383
36 ELECTRICITY	520.00	1248.54	2.643	.212	9.917	.794
37 GAS	134.00	167.85	.132	.079	.390	.233
38 WATER SEWERAGE AND DRAINAGE	120.00	560.14	1.322	.236	2.724	.486
39 RESIDENTIAL BUILDING	2033.00	2033.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	711.00	711.00	0.000	0.000	711.000	100.000
41 RAIL CONSTRUCTION	70.00	247.09	0.000	0.000	1.225	.496
42 OTHER CONSTRUCTION	1521.00	2733.98	0.000	0.000	4.886	.179
43 WHOLESALE AND RETAIL TRADE	4540.00	6651.21	30.607	.460	48.496	.729
44 MOTOR VEHICLE REPAIRS	593.00	825.43	2.379	.288	6.344	.769
45 OTHER REPAIRS	132.00	294.47	1.454	.494	3.530	1.199
46 ROAD TRANSPORT	1029.00	1727.26	69.118	4.002	76.343	4.420
47 RAILWAY AND OTHER TRANSPORT	514.00	1021.83	1.322	.129	7.070	.692
48 WATER TRANSPORT	684.00	966.23	0.000	0.000	4.693	.486
49 AIR TRANSPORT	554.00	831.08	0.000	0.000	2.110	.254
50 COMMUNICATION	775.00	1468.28	0.000	0.000	6.086	.415
51 BUSINESS SERVICES	1325.00	4700.17	2.342	.050	30.218	.643
52 OWNERSHIP OF DWELLINGS	3605.00	3605.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1903.00	1936.78	0.000	0.000	.301	.016
54 DEFENCE	1086.00	1086.00	0.000	0.000	0.000	0.000
55 HEALTH	2169.00	2194.11	0.000	0.000	.172	.008
56 EDUCATION LIBRARIES, ETC.	2198.00	2206.83	0.000	0.000	.078	.004
57 WELFARE SERVICES	317.00	442.13	0.000	0.000	.857	.194
58 OTHER SERVICES	2476.00	6920.75	29.074	.420	61.596	.890

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1980/81
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1617.00	4144.87	0.000	0.000	1.203	.029
2 FORESTRY LOGGING	35.00	199.35	2.200	1.103	3.240	1.625
3 IRON	498.00	601.65	0.000	0.000	.802	.133
4 OTHER METALLIC MINERALS	573.00	949.96	0.000	0.000	2.959	.311
5 COAL	353.00	587.47	0.000	0.000	2.286	.389
6 CRUDE OIL	0.00	264.19	0.000	0.000	11.737	4.442
7 QUARRY MATERIALS	3.00	166.43	78.698	47.285	82.819	49.761
8 NON METALLIC MINERALS NES	0.00	63.96	0.000	0.000	1.880	2.940
9 SERVICES TO MINING	13.00	47.07	0.000	0.000	.727	1.544
10 FOOD PRODUCTS	3693.00	4385.37	0.000	0.000	1.515	.035
11 ALCOHOLIC BEVERAGES	271.00	298.96	0.000	0.000	.220	.074
12 TOBACCO PRODUCTS	168.00	183.59	0.000	0.000	.136	.074
13 TEXTILE PRODUCTS	1612.00	2759.11	0.000	0.000	4.593	.166
14 TIMBER AND PAPER PRODUCTS	669.00	3140.82	6.682	.213	20.737	.660
15 CHEMICALS	462.00	1896.26	11.360	.599	22.581	1.191
16 PETROLEUM PRODUCTS (AUST. OIL)	329.00	924.66	36.217	3.917	46.684	5.049
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	314.73	17.775	5.648	32.746	10.405
18 GLASS AND CLAY PRODUCTS	47.00	439.16	0.000	0.000	.856	.195
19 CEMENT	0.00	109.83	1.336	1.217	7.121	6.484
20 READY MIXED CONCRETE	0.00	145.50	12.055	8.285	12.359	8.494
21 CONCRETE PRODUCTS	1.00	203.37	23.433	11.522	23.686	11.647
22 NON-METALLIC MINERAL PRODUCT	10.00	138.39	.134	.097	.802	.579
23 MINERAL PRODUCT	1776.00	4803.99	20.046	.417	37.289	.776
24 MOTOR VEHICLES AND PARTS	1000.00	1429.42	.535	.037	7.587	.531
25 SHIP AND BOAT BUILDING	80.00	244.45	0.000	0.000	1.054	.431
26 LOCOMOTIVES ROLLING STOCK	36.00	187.88	0.000	0.000	1.064	.566
27 AIRCRAFT BUILDING	25.00	274.32	0.000	0.000	.312	.114
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	323.00	705.02	0.000	0.000	1.669	.237

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1980/81
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	345.00	519.22	0.000	0.000	.292	.056
30 ELECTRICAL MACHINERY	219.00	729.15	.134	.018	3.509	.481
31 AGRICULTURAL MACHINERY	127.00	172.72	0.000	0.000	.137	.080
32 CONSTRUCTION EQUIPMENT	242.00	319.71	2.673	.836	3.453	1.080
33 OTHER MACHINERY	648.00	973.32	2.673	.275	5.076	.521
34 RUBBER PRODUCTS	48.00	291.33	0.000	0.000	5.878	2.018
35 OTHER MANUFACTURER PRODUCTS	578.00	1145.76	1.336	.117	4.276	.373
36 ELECTRICITY	545.00	1299.46	2.673	.206	10.028	.772
37 GAS	140.00	175.08	.134	.076	.395	.225
38 WATER SEWERAGE AND DRAINAGE	123.00	581.46	1.336	.230	2.755	.474
39 RESIDENTIAL BUILDING	2109.00	2109.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	719.00	719.00	0.000	0.000	719.000	100.000
41 RAIL CONSTRUCTION	74.00	257.68	0.000	0.000	1.239	.481
42 OTHER CONSTRUCTION	1696.00	2952.21	0.000	0.000	4.941	.167
43 WHOLESALE AND RETAIL TRADE	4680.00	6870.73	30.952	.450	49.042	.714
44 MOTOR VEHICLE REPAIRS	623.00	863.68	2.406	.279	6.416	.743
45 OTHER REPAIRS	136.00	304.10	1.470	.483	3.570	1.174
46 ROAD TRANSPORT	1067.00	1786.55	69.895	3.912	77.202	4.321
47 RAILWAY AND OTHER TRANSPORT	534.00	1059.82	1.336	.126	7.150	.675
48 WATER TRANSPORT	708.00	1001.93	0.000	0.000	4.746	.474
49 AIR TRANSPORT	573.00	859.24	0.000	0.000	2.134	.248
50 COMMUNICATION	811.00	1526.11	0.000	0.000	6.155	.403
51 BUSINESS SERVICES	1373.00	4857.40	2.368	.049	30.558	.629
52 OWNERSHIP OF DWELLINGS	3780.00	3780.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	1949.00	1983.84	0.000	0.000	.304	.015
54 DEFENCE	1108.00	1108.00	0.000	0.000	0.000	0.000
55 HEALTH	2225.00	2250.91	0.000	0.000	.174	.008
56 EDUCATION LIBRARIES, ETC.	2246.00	2255.11	0.000	0.000	.079	.004
57 WELFARE SERVICES	325.00	453.92	0.000	0.000	.866	.191
58 OTHER SERVICES	2545.00	7139.42	29.401	.412	62.289	.872

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1981/82
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1705.00	4253.56	0.000	0.000	1.216	.029
2 FORESTRY LOGGING	38.00	207.14	2.224	1.074	3.276	1.582
3 IRON	505.00	613.11	0.000	0.000	.811	.132
4 OTHER METALLIC MINERALS	582.00	975.21	0.000	0.000	2.991	.307
5 COAL	358.00	601.41	0.000	0.000	2.312	.384
6 CRUDE OIL	0.00	275.54	0.000	0.000	11.867	4.307
7 QUARRY MATERIALS	3.00	168.82	79.574	47.134	83.740	49.602
8 NON METALLIC MINERALS NES	0.00	65.71	0.000	0.000	1.901	2.893
9 SERVICES TO MINING	14.00	49.13	0.000	0.000	.735	1.496
10 FOOD PRODUCTS	3687.00	4392.79	0.000	0.000	1.532	.035
11 ALCOHOLIC BEVERAGES	281.00	309.85	0.000	0.000	.223	.072
12 TOBACCO PRODUCTS	173.00	189.13	0.000	0.000	.137	.073
13 TEXTILE PRODUCTS	1669.00	2858.01	0.000	0.000	4.644	.162
14 TIMBER AND PAPER PRODUCTS	692.00	3244.17	6.756	.208	20.968	.646
15 CHEMICALS	489.00	1975.62	11.486	.581	22.832	1.156
16 PETROLEUM PRODUCTS (AUST. OIL)	350.00	963.82	36.620	3.800	47.203	4.898
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	327.47	17.972	5.488	33.110	10.111
18 GLASS AND CLAY PRODUCTS	50.00	453.88	0.000	0.000	.865	.191
19 CEMENT	0.00	111.08	1.351	1.217	7.200	6.482
20 READY MIXED CONCRETE	0.00	146.22	12.189	8.336	12.496	8.546
21 CONCRETE PRODUCTS	1.00	205.60	23.694	11.524	23.949	11.648
22 NON-METALLIC MINERAL PRODUCT	10.00	141.46	.135	.096	.811	.573
23 MINERAL PRODUCT	1901.00	5011.61	20.269	.404	37.704	.752
24 MOTOR VEHICLES AND PARTS	1042.00	1489.86	.541	.036	7.672	.515
25 SHIP AND BOAT BUILDING	84.00	255.72	0.000	0.000	1.065	.417
26 LOCOMOTIVES ROLLING STOCK	34.00	190.44	0.000	0.000	1.076	.565
27 AIRCRAFT BUILDING	28.00	291.67	0.000	0.000	.315	.108
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	334.00	734.16	0.000	0.000	1.687	.230

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1981/82
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	359.00	537.94	0.000	0.000	.295	.055
30 ELECTRICAL MACHINERY	227.00	749.76	.135	.018	3.548	.473
31 AGRICULTURAL MACHINERY	132.00	179.02	0.000	0.000	.139	.078
32 CONSTRUCTION EQUIPMENT	243.00	323.09	2.703	.836	3.491	1.081
33 OTHER MACHINERY	682.00	1015.37	2.703	.266	5.132	.505
34 RUBBER PRODUCTS	51.00	302.98	0.000	0.000	5.944	1.962
35 OTHER MANUFACTURER PRODUCTS	604.00	1189.07	1.351	.114	4.324	.364
36 ELECTRICITY	572.00	1354.07	2.703	.200	10.140	.749
37 GAS	147.00	183.39	.135	.074	.399	.219
38 WATER SEWERAGE AND DRAINAGE	130.00	608.94	1.351	.222	2.785	.457
39 RESIDENTIAL BUILDING	2190.00	2190.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	727.00	727.00	0.000	0.000	727.000	100.000
41 RAIL CONSTRUCTION	74.00	263.22	0.000	0.000	1.253	.476
42 OTHER CONSTRUCTION	1593.00	2909.53	0.000	0.000	4.996	.172
43 WHOLESALE AND RETAIL TRADE	4810.00	7064.19	31.296	.443	49.587	.702
44 MOTOR VEHICLE REPAIRS	657.00	905.05	2.432	.269	6.487	.717
45 OTHER REPAIRS	140.00	312.61	1.486	.475	3.609	1.155
46 ROAD TRANSPORT	1105.00	1843.53	70.673	3.834	78.061	4.234
47 RAILWAY AND OTHER TRANSPORT	551.00	1091.82	1.351	.124	7.229	.662
48 WATER TRANSPORT	734.00	1039.11	0.000	0.000	4.799	.462
49 AIR TRANSPORT	602.00	899.12	0.000	0.000	2.158	.240
50 COMMUNICATION	859.00	1599.05	0.000	0.000	6.223	.389
51 BUSINESS SERVICES	1426.00	5031.73	2.395	.048	30.898	.614
52 OWNERSHIP OF DWELLINGS	3962.00	3962.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2074.00	2110.05	0.000	0.000	.307	.015
54 DEFENCE	1181.00	1181.00	0.000	0.000	0.000	0.000
55 HEALTH	2344.00	2370.76	0.000	0.000	.176	.007
56 EDUCATION LIBRARIES, ETC.	2389.00	2398.43	0.000	0.000	.080	.003
57 WELFARE SERVICES	341.00	475.18	0.000	0.000	.876	.184
58 OTHER SERVICES	2634.00	7385.83	29.729	.403	62.982	.853

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
1 AGRICULTURE	1833.00	4398.43	0.000	0.000	1.228	.028
2 FORESTRY LOGGING	40.00	214.38	2.246	1.048	3.308	1.543
3 IRON	523.00	634.47	0.000	0.000	.819	.129
4 OTHER METALLIC MINERALS	604.00	1009.41	0.000	0.000	3.020	.299
5 COAL	372.00	623.91	0.000	0.000	2.334	.374
6 CRUDE OIL	0.00	284.31	0.000	0.000	11.982	4.214
7 QUARRY MATERIALS	3.00	172.49	80.340	46.575	84.546	49.014
8 NON METALLIC MINERALS NES	0.00	67.83	0.000	0.000	1.919	2.830
9 SERVICES TO MINING	15.00	51.32	0.000	0.000	.742	1.446
10 FOOD PRODUCTS	3659.00	4377.40	0.000	0.000	1.546	.035
11 ALCOHOLIC BEVERAGES	302.00	331.69	0.000	0.000	.225	.068
12 TOBACCO PRODUCTS	188.00	204.64	0.000	0.000	.139	.068
13 TEXTILE PRODUCTS	1713.00	2937.78	0.000	0.000	4.688	.160
14 TIMBER AND PAPER PRODUCTS	707.00	3341.84	6.822	.204	21.170	.633
15 CHEMICALS	506.00	2044.09	11.597	.567	23.052	1.128
16 PETROLEUM PRODUCTS (AUST. OIL)	359.00	991.99	36.973	3.727	47.656	4.804
17 PETROLEUM PRODUCTS (IMP. OIL)	0.00	336.69	18.145	5.389	33.429	9.929
18 GLASS AND CLAY PRODUCTS	52.00	469.73	0.000	0.000	.874	.186
19 CEMENT	0.00	114.72	1.364	1.189	7.270	6.337
20 READY MIXED CONCRETE	0.00	150.79	12.307	8.162	12.617	8.367
21 CONCRETE PRODUCTS	1.00	212.00	23.922	11.284	24.180	11.406
22 NON-METALLIC MINERAL PRODUCT	11.00	147.00	.136	.093	.818	.557
23 MINERAL PRODUCT	1961.00	5166.72	20.465	.396	38.067	.737
24 MOTOR VEHICLES AND PARTS	1075.00	1541.67	.546	.035	7.745	.502
25 SHIP AND BOAT BUILDING	88.00	266.69	0.000	0.000	1.076	.403
26 LOCOMOTIVES ROLLING STOCK	31.00	193.33	0.000	0.000	1.086	.562
27 AIRCRAFT BUILDING	26.00	301.85	0.000	0.000	.318	.105
28 SCIENTIFIC ,ELECTRONIC EQUIPMENT	335.00	751.74	0.000	0.000	1.704	.227

ROAD CONSTRUCTION INDUSTRY REQUIREMENTS : 80% OF WARRANTED PROGRAM : 1982/83
(NATIONAL ACCOUNTING DEFINITIONS : $MILLION 1968-69 PRICES)

INDUSTRY	FINAL DEMAND $M	TOTAL OUTPUT $M	DIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %	DIRECT AND INDIRECT REQUIREMENTS $M	PERCENTAGE OF INDUSTRY OUTPUT %
29 HOUSEHOLD APPLIANCES	372.00	557.16	0.000	0.000	.298	.054
30 ELECTRICAL MACHINERY	231.00	771.66	.136	.018	3.583	.464
31 AGRICULTURAL MACHINERY	135.00	183.57	0.000	0.000	.140	.076
32 CONSTRUCTION EQUIPMENT	249.00	331.89	2.729	.822	3.525	1.062
33 OTHER MACHINERY	692.00	1036.63	2.729	.263	5.182	.500
34 RUBBER PRODUCTS	53.00	313.34	0.000	0.000	6.001	1.915
35 OTHER MANUFACTURER PRODUCTS	625.00	1226.18	1.364	.111	4.365	.356
36 ELECTRICITY	602.00	1410.84	2.729	.193	10.238	.726
37 GAS	155.00	192.60	.136	.071	.403	.209
38 WATER SEWERAGE AND DRAINAGE	137.00	636.97	1.364	.214	2.812	.441
39 RESIDENTIAL BUILDING	2271.00	2271.00	0.000	0.000	0.000	0.000
40 ROAD CONSTRUCTION	734.00	734.00	0.000	0.000	734.000	100.000
41 RAIL CONSTRUCTION	76.00	272.36	0.000	0.000	1.265	.464
42 OTHER CONSTRUCTION	1624.00	2999.65	0.000	0.000	5.044	.168
43 WHOLESALE AND RETAIL TRADE	4886.00	7210.96	31.597	.438	50.065	.694
44 MOTOR VEHICLE REPAIRS	692.00	948.00	2.456	.259	6.550	.691
45 OTHER REPAIRS	144.00	321.12	1.501	.467	3.644	1.135
46 ROAD TRANSPORT	1146.00	1903.66	71.353	3.748	78.812	4.140
47 RAILWAY AND OTHER TRANSPORT	577.00	1133.00	1.364	.120	7.299	.644
48 WATER TRANSPORT	761.00	1076.53	0.000	0.000	4.845	.450
49 AIR TRANSPORT	619.00	926.51	0.000	0.000	2.178	.235
50 COMMUNICATION	901.00	1664.90	0.000	0.000	6.283	.377
51 BUSINESS SERVICES	1477.00	5196.98	2.418	.047	31.196	.600
52 OWNERSHIP OF DWELLINGS	4151.00	4151.00	0.000	0.000	0.000	0.000
53 PUBLIC ADMINISTRATION	2190.00	2227.20	0.000	0.000	.310	.014
54 DEFENCE	1248.00	1248.00	0.000	0.000	0.000	0.000
55 HEALTH	2456.00	2483.63	0.000	0.000	.178	.007
56 EDUCATION LIBRARIES, ETC.	2521.00	2530.73	0.000	0.000	.081	.003
57 WELFARE SERVICES	356.00	495.08	0.000	0.000	.885	.179
58 OTHER SERVICES	2722.00	7621.70	30.015	.394	63.588	.834

ANNEX 5

ROAD STANDARDS

INTRODUCTION

Standards are applied to design, construction and operational aspects of roads.

In road design alone there is a multiplicity of engineering standards applied to such characteristics as:

- pavement surface type (gravel, seal);
- width of formation, pavement and seal;
- gradient;
- curvature and alignment geometry and sight distances;
- degree of limit on access;
- grade separation; and
- traffic separation (divided highway).

These standards may vary with traffic and terrain conditions. Generally they have been developed from the considerable experience and judgement of road engineers, but there is certainly an element of arbitrariness in their formulation. There is little evidence that variations to standards (usually in a higher or more costly direction) have been explicitly measured against the extra benefits or costs those higher standards provide or impose.

Aplin(1) has pointed out that if the superseded imperial measures of minimum pavement widths for various types of road facility of twenty-four feet, twenty-two feet and twenty feet had been converted to 7.3 metres, 6.7 metres and 6.1 metres respectively, instead of the proposed 7.4 metres, 6.8 metres and 6.2 metres, a

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(1) Aplin W.N., The Roles of Standards and Project Size in Road Investment Appraisal, Australian Transport Research Forum April 1979, Sydney.

reduction of over 1.5 million square metres of pavement would have been achieved for the 16 300 kilometre national highway system alone - enough to pave and seal nearly 230 kilometres of 6.8 metre wide road.

Road standards are used in this report, and for the administration of grants to the States for roads, in the following ways.

- Existing road conditions are compared with assessment standards to identify parts of the Australian road system which are deficient in an engineering sense.
- Improvements to deficient road sections are selected and costed on the basis of design standards - i.e., "engineering needs".
- A cost-benefit analysis of such improvements is applied to determine economically warranted programs.
- The Commonwealth Government has stipulated design standards to which improvements must conform for the expenditure of funds granted to the States for national highways.

THE AUSTRALIAN ROADS SURVEY (ARS)

The standards on which the assessment of engineering need were based were those developed for the Australian Road Survey 1969-74 jointly by the CBR and the National Association of State Road Authorities (NAASRA) and described in more detail in the Specification for the Australian Roads Survey[1]. The ARS used two sets of standards, deficiency assessment standards and design standards.

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(1) Commonwealth Bureau of Roads, Australian Roads Survey 1969-74: Specification, Melbourne, 1975. Table A5.1 sets out the functional road classification system used for the ARS.

Deficiency standards include criteria such as traffic volumes, pavement width, surface type, etc. Although these standards were set arbitrarily they do reflect desirable engineering practice. Improvement projects were generated for deficient roads and costed. While lower deficiency standards would generate <u>fewer</u> projects, some of those thus excluded may well be socially or economically worthwhile.

Design standards were used to specify and cost improvement projects to remedy road 'deficiencies'. These standards vary with the forecast road and traffic conditions for the forward design period of fifteen years for roads and thirty years for structures (i.e. bridges, etc).

However the standards used in the ARS are not necessarily applied by constructing authorities. Availability of funds will often influence the choice of some standards - particularly those relating to traffic volumes.

APPLICATION OF STANDARDS IN PRACTICE

Many road construction authorities, particularly at the State level, alter or modify their standards of road design to accord with local factors and availability of road funds. Examples of such modification include:

- adoption of say a 6 per cent or 7 per cent grade in lieu of a 'normal' design standard of 5 per cent; and

- adoption of staged construction, i.e., implementing the ultimate standard in discrete steps phased to meet growth in traffic, in terms of both depth and width of pavement, thereby avoiding over-capacity in the early years of improvement.

A CBR study of residential streets[1] suggests that many local

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(1) Unpublished CBR report.

government authorities use relatively high standards for design, e.g., for road widths, drainage and pavement depth. One reason for such a practice may be that it reduces recurrent maintenance costs (which local authorities bear) whereas often others pay the cost of construction (e.g. developers/house buyers in new areas). Local authorities may also prefer one time costs to recurrent expenditures on roads. However, there has been insufficient study of the trade-off between construction and maintenance costs to enable the economic consequences of varying standards for residential streets to be assessed.

VARYING DESIGN STANDARDS - EFFECT ON "NEEDS" AND WARRANTED PROGRAMS

Clearly a reduction in deficiency assessment standards and 'design standards' would effect a reduction in needs as assessed in terms of engineering cost criteria. Although this would reduce the present gap between 'engineering needs' and actual road budgets, it could prevent the identification of some of the deficiencies in the road network for which improvement projects are economically warranted.

The consequence of reducing standards on the assessment of warranted programs are not clear cut. Studies made by the CBR of the sensitivity of economic analysis procedures to changes in various parameters, have included some limited testing of unit road construction costs and of various road standards in rural areas. Generally these results show that the total levels (costs) of warranted programs are insensitive to appreciable changes in design standards and/or unit construction costs. Results from these studies show that:

- a change in design period from fifteen years for roads and thirty years for structures, to ten and fifteen years respectively would result in a reduction of about 5 per cent in both engineering and warranted expenditures. This is considered to be a fairly insensitive response to such a large and drastic reduction in road standards.

- at the existing ARS design standards the size of the warranted program at 10 per cent discount rate increased by 1.5 per cent for a 20 per cent increase in construction costs[1]. This would be likely to understate the increment in warranted funds if increased design standards had caused the increase in the construction costs, for increased road user benefits would also have eventuated, and more projects would have been warranted.

- conversely a decrease in the costs of road construction of 20 per cent resulted in a 4 per cent decrease in the magnitude of the warranted program[2]. If this has been attributable to reduced design standards it is possible that the reduced benefits would have compounded the decrease in warranted funds. Nevertheless it is considered that response in the level of warranted expenditure to changes in design standards and unit construction costs would still not have been great.

These results reflect the skewed distribution of the benefits and costs relating to warranted projects, i.e., the warranted program of construction consists of a substantial body of projects which are warranted by economic criteria (which have a benefit cost ratio (BCR) substantially greater than one) so that changing the BCR's of these projects by altering design standards and/or construction costs eliminates or adds marginal projects to the warranted program with a relatively small total cost compared to variations in the cost of the projects already warranted. Thus the magnitude of the warranted construction program appears rather insensitive to changes in design standards.

Further, the maintenance cost, which is about 25 per cent of the total warranted program, would generally increase if design standards were reduced. Hence, warranted expenditure on roads in total would be even less sensitive to changes in design standards than the construction program.

(1) In other words although costs were increased by 20 per cent the reduction in the original warranted program (from marginal projects "dropping out") was slightly more than compensated for by the increase in cost of the projects remaining in the new warranted program.

(2) The converse of the previous case.

TABLE A5.1

COMMONWEALTH BUREAU OF ROADS/BUREAU OF TRANSPORT ECONOMICS/ NATIONAL ASSOCIATION OF STATE ROAD AUTHORITIES: FUNCTIONAL CLASSIFICATION OF ROADS

Functional Class	Definition	Corresponding Category of Road in Commonwealth Roads legislation
1	Those roads which form the principal avenue for communications between major regions of Australia including direct connexion between capital cities	
2	Those roads, not being Class 1, whose main function is to form the principal avenue of communications for movements: (i) between a capital city and adjoining States and their capital cities: (ii) between a capital city and key towns: (iii) between key towns	"RURAL ARTERIAL ROADS" except those declared as National Roads. (Cl 1, 2, 3)
3	Those roads, not being Class 1, or 2, whose main function is to form an avenue of communication for movements: (i) between important centres and the Class 1 and Class 2 roads and/or key towns; (ii) between important centres; (iii) of an arterial nature within a town in a rural area.	
4	Those roads, not being Class 1, 2 or 3 whose main function is to provide access to abutting property (including property within a town in a rural area).	"RURAL LOCAL ROADS" (Cl 4, 5)
5	Those roads which provide almost exclusively for one activity or function and which cannot be assigned to Classes 1, 2, 3 or 4.	
	URBAN AREAS (as defined)	
6	Those roads whose main function is to perform the principal avenue of communication for massive traffic movements. (Arterial Roads)	"URBAN ARTERIAL ROADS" except those declared as National Roads. (Cl 6, 7)
7	Those roads, not being Class 6, whose main function is to supplement the Class 6 roads in providing for traffic movements or which distribute traffic to local street systems. (Sub-arterial Roads)	
8	Those roads not being Class 6 or 7, whose main function is to provide access to abutting property.	"URBAN LOCAL ROADS" (Cl 8, 9)
9	Those roads which provide almost exclusively for one activity or function and which cannot be assigned to Classes 6, 7 or 8.	