



Australian Government

Commonwealth Grants Commission

**Report on the review of
the interstate distribution of
local road grants**

2006

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REPORT

Report on the review of the interstate distribution of
local road grants 2006

ISBN 1741 777259

ELECTRONIC VERSION

The report is available on the Commission's web site at <http://www.cgc.gov.au>.

Printed by CanPrint Communications Pty Limited, Canberra.



Australian Government
Commonwealth Grants Commission

Senator the Hon Richard Colbeck
Parliamentary Secretary to the
Minister for Finance and Administration
Parliament House
CANBERRA ACT 2600

Dear Parliamentary Secretary

As members of the Commonwealth Grants Commission appointed under the *Commonwealth Grants Commission Act 1973*, we have prepared this report for the review of the interstate distribution of the local road grants paid as local government financial assistance grants. Terms of reference asking that this work be done were issued on 26 October 2005 by the Hon Dr Sharman Stone MP, the then Parliamentary Secretary to the Minister for Finance and Administration.

Yours sincerely

A handwritten signature in cursive script, appearing to read 'A G Morris'.

A G Morris
Chairman

A handwritten signature in cursive script, appearing to read 'R A Williams'.

R A Williams
Member

A handwritten signature in cursive script, appearing to read 'G P Appleyard'.

G P Appleyard
Member

30 June 2006
Attachment

Cypress Court 5 Torrens Street Braddon ACT 2612

Tel: (02) 6229 8800
Fax: (02) 6229 8821
Email: secretary@cgc.gov.au
Internet: <http://www.cgc.gov.au>

ACKNOWLEDGMENTS

We acknowledge the assistance provided to the Commission and its staff during this review by Australian and State Government agencies, including the Local Government Grants Commissions; Austroads; and the Australian and State Local Government Associations.

We also acknowledge the dedication and professionalism shown by the staff of the Commission who worked on this review.

TERMS OF REFERENCE



The Hon Dr Sharman Stone MP
Federal Member for Murray
Parliamentary Secretary to the Minister for Finance and Administration

Mr Alan Morris
Chairman
Commonwealth Grants Commission
Cypress Court
5 Torrens Street
BRADDON ACT 2612

26 OCT 2005

Dear Mr Morris

I am writing to convey to you the attached Terms of Reference for the Commission's review of the interstate distribution of the local road grants paid as local government financial assistance grants (FAGs). The Terms of Reference provide guidance to the Commission to recommend a new methodology for the distribution of identified local roads grants to local government. The methodology should ensure that the distribution of this funding is based on the relative needs of local government in States and Territories for local roads rather than the current historical share.

The Terms of Reference require the Commission to report to Ministers by 30 June 2006 on possible changes to the interstate distribution.

Yours sincerely

Dr Sharman Stone

Parliament House, Canberra ACT 2600 Tel: (02) 6277 2016 Fax: (02) 6277 8483 Email: s.stone.mp@aph.gov.au
426 Wyndham Street, PO Box 884, Shepparton VIC 3632 Tel: (03) 5821 5371 Toll Free: 1300 132 413 Fax: (03) 5821 8429
Departmental website: www.finance.gov.au Electorate website: www.sharmanstone.com

Terms of Reference for the Review of the Interstate Distribution of the Local Road Grants paid as Local Government Financial Assistance Grants

COMMONWEALTH GRANTS COMMISSION ACT 1973

1. I, Sharman Stone, Parliamentary Secretary to the Minister for Finance and Administration, pursuant to section 17 of the *Commonwealth Grants Commission Act 1973*, refer to the Commission for review and report upon, by 30 June 2006, the interstate distribution of the local road grants paid under section 12 of the *Local Government (Financial Assistance) Act 1995*.

2. For the review, the Commonwealth Grants Commission should recommend a distribution between the States and Territories of the section 12 grants. The allocation method used in deriving the recommendation should:

- (a) assess the relative needs of local government in the States and the Northern Territory, and the ACT Government for expenditure on maintenance and preservation of local roads and, to the extent practicable, bridges on local roads; and
- (b) not take account of local roads in unincorporated areas of the States and Territories.

3. The Commission should also recommend how the interstate distribution of the section 12 grants could be updated in future years.

4. The review will not address the quantum of funds available for section 12 grants.

5. The Commission should use the latest available data for the review.

The Australian Government's Department of Transport and Regional Services has undertaken to provide information in its possession required for the review in a timely manner.

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OVERVIEW

THE TASK

- 1 The terms of reference for this Review ask the Commission to:
 - recommend an interstate distribution of the local road grants based on the relative needs of local government to incur maintenance and preservation expenditure for local roads (excluding local roads in unincorporated areas) and, to the extent practicable, bridges; and
 - advise how the distribution could be updated in future years.

RECOMMENDATIONS

The recommended distribution

- 2 The Commission recommends that as an interim measure, until reliable and comparable data on road characteristics are available for all States, the local roads grants be distributed among the States on the basis of average expenditure per person in urban, rural and remote areas and the population of each State resident in those areas.
- 3 The assessed State shares of local road maintenance expenditure, based on that approach and using data for 2002-03 to 2004-05 are shown in Table 1.

Table 1 Assessed State shares of local road maintenance expenditure based on data for 2002-03 to 2004-05 and recommended distribution for 2006-07

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Current shares including supplementary funds for South Australia	28.3	20.1	18.3	14.9	7.8	5.2	3.1	2.3	100.0
Recommended shares— based on data 2002-03 to 2004-05	31.3	22.0	20.2	11.3	8.9	3.3	1.2	1.8	100.0
Recommended shares for 2006-07 ^(a)	31.1	22.0	20.5	11.3	8.8	3.3	1.2	1.8	100.0

(a) The calculated shares have been adjusted for movements in population shares to December 2005.

Updating the distribution

- 4 To make the assessed shares more relevant to the year in which they are to apply, they should be adjusted by changes in relative population growth. As an illustration, Table 1 shows the recommended shares adjusted for use in 2006-07.
- 5 The Commission considers that updating should be confined to changes in each State's total population. Because the terms of reference ask us to focus on roads which are the responsibility of local government, State policies can influence assessed maintenance expenditures. There is a danger that widening the scope of data to be updated could result in attempts to change definitions or data collection methods purely to affect State shares. The Commission considers that relying on historical data wherever possible avoids this danger.

Further work

- 6 This Review has been hampered by the lack of reliable and consistent national data on matters such as local roads, their use, the physical environment and other factors that affect maintenance costs.
- 7 If governments want local road grants to be allocated across States in a more rigorous way, which better reflects differences in State relative needs, resources will need to be committed to ensuring that consistent and comparable national data are available on:
 - the length of local roads in each State, with 'a local road' defined consistently across States;
 - the number and deck area of bridges on local roads with 'a bridge' defined consistently across States;
 - local road use in each State; and
 - the maintenance expenditure by local governing bodies on local roads and bridges on local roads in each State.
- 8 Reliable assessments that modify the recommended distribution to reflect these influences are not possible without these data being available on a consistent and reliable basis.
- 9 The Commission is of the view that a further review should be undertaken to assess the relative needs of each State to incur expenditure on the maintenance of local roads once improved national data become available. If possible that review should complement the Commission's 2010 review of how GST revenue should be distributed between the States so that there can be a consistent treatment of maintenance needs on local and arterial roads.

THE APPROACH TAKEN BY THE COMMISSION

Which roads should be covered?

- 10 Consistent with the terms of reference, the Commission has focused on the maintenance expenditure on local roads for which local government has responsibility, as opposed to

maintenance expenditure on local roads defined on the basis of their nature and purpose. We note that the resulting State shares of local road grants could be affected by State policies because local roads for which local government is responsible are determined at State level and there are differences between the States.

Interpreting ‘relative needs’

- 11 We have attempted to determine the maintenance expenditure each State would incur if it were to perform the same level of maintenance work as the other States given the features of its local road network.
- 12 We have not attempted to determine the amount of expenditure needed in States to bring all similar local roads to a common standard. Our experience makes it clear that the data to enable such an exercise to be done do not exist.

Measuring relative needs

- 13 In the course of this review, we examined several alternate methods for assessing relative expenditures. These included:
 - the approach used by the Commission to assess the relative needs of States for expenditure on maintaining arterial roads (called the average standard approach), in which Australian average expenditure per person is adjusted for the effects of non-policy influences that increase the size of the maintenance task or its cost;
 - the asset preservation approach, in which costs that would be incurred in each State to maintain and preserve roads over their whole life are calculated and converted to annual amounts; and
 - the indicator approaches (for example, an equal weighting of population and road length) used by some local government grants commissions to allocate local road grants to local authorities.
- 14 The Commission sought the most reliable data on which to base its views. That process revealed serious deficiencies in the nationally available data. Much data are collected to meet the needs of individual States, but are not comparable across States and are affected, in many respects, by individual State policies.
- 15 The Commission also sought the views of external experts on certain key parameters. The advice we received from them was contested by several States, mainly because it was also based on incomplete data and data whose reliability could be questioned.

Conclusions

- 16 The Commission has concluded that:
 - because the share of the local road grants currently received by each State has been unchanged since 1995-96 and in most cases reflected funding received prior to 1991-92, the existing interstate distribution does not reflect current local road expenditure needs;

- there are sufficient differences in the maintenance task facing local governments in different States that using population shares to allocate available funds would be inappropriate;
 - because the observed State shares of maintenance expenditure are affected by State policy differences, they would be an inappropriate basis for allocating the grants;
 - an approach based on using several indicators is unreliable. The outcomes are sensitive to the choice of weights to use in combining indicators. There are widely differing views on what weights are appropriate and little firm evidence on which to base a choice between them; and
 - data quality or availability is insufficient to allow the use of the asset preservation model.
- 17 On conceptual grounds, the Commission's preference would have been to construct shares which reflected relative road lengths of different types, relative use of those roads and different costs of road maintenance. However, issues of data quality and reliability preclude that course of action. Until data quality can be improved, the Commission cannot recommend a distribution produced by its preferred method.
- 18 As an interim approach, the Commission has decided to take some of the elements of its preferred approach and apply them in a way that is consistent with available data.
- An approach based on applying the average expenditure per person in urban, rural and remote areas to the population in each State living in those areas would provide a more appropriate distribution than that currently being used. This approach accepts that there are different maintenance requirements in urban, rural and remote areas, but assumes that urban, rural and remote areas are similar in all States so that the same per person expenditure would provide the same maintenance service.
 - There are other influences that affect the relative need to incur local road maintenance expenditure such as different levels of road use, different physical environments and different wage levels. However, the available data are not sufficiently reliable for us to include those influences in these assessments.
 - We have not separately identified bridge maintenance expenditure requirements because differences in State needs would have only a small impact, even if they could be measured.
 - The recommended approach is conceptually appropriate, it reflects relative needs as required by the terms of reference, it requires fewer assumptions than other approaches considered and it uses data that are appropriate for the task.

CHAPTER 1

THE REVIEW

INTRODUCTION

- 1 During 2006-07, the Australian Government expects to provide around \$1.68 billion in untied local government financial assistance grants to around 700 local governing bodies¹. Around 70 per cent (\$1.16 billion) of these grants will be provided as general purpose grants and the remainder (\$515 million) as identified local road grants. An additional \$300 million is to be provided to local government in 2006-07 through the Roads to Recovery Programme.
- 2 The general purpose grants are distributed between the States and Territories² on an equal per person basis whereas the local road grants are distributed using fixed shares inherited from a former Federal programme of tied road grants. Both sets of grants are then distributed to local governing bodies within a State according to recommendations of the State's local government grants commission³, which must follow distribution guidelines called National Principles⁴ in reaching its recommendations⁵.
- 3 On 26 October 2005, the Hon Dr Sharman Stone MP, the then Parliamentary Secretary to the Minister for Finance and Administration, asked the Commonwealth Grants Commission

¹ 'Local governing bodies' is the term used to define bodies eligible for financial assistance grants. It covers mainstream councils, other bodies established under or by State legislation, and bodies declared to be local governing bodies by the Australian Government Minister on the advice of the State Minister.

² In the rest of this report, the term State(s) includes the Australian Capital Territory and the Northern Territory unless the context indicates otherwise.

³ A local government grants commission is established in each State and the Northern Territory to recommend the distribution of financial assistance grants to local governing bodies in their jurisdiction.

⁴ The National Principle for the local road grants states:

The grants should be allocated to local governing bodies as far as practicable on the basis of the relative needs of each local governing body for roads expenditure and to preserve its road assets. In assessing road needs, relevant considerations include length, type and usage of roads in each local governing area.

⁵ Details on the distribution of the grants to local governing bodies can be found in DOTARS 2004-05 *Report on the Operation of the Local Government (Financial Assistance) Act 1995* and a copy is at www.dotars.gov.au/local/publications/reports/2004_2005/pdf/Local_report.pdf

(the Commission) to review the interstate distribution of the local road grants. The terms of reference, which are at the beginning of this report, asked us to:

- recommend the interstate distribution of the local road grants and to base that recommendation on an assessment of the relative needs of local government in the States for expenditure on maintenance and preservation⁶ of local roads and to the extent practicable, bridges; and
- advise on how the distribution could be updated in future years.

4 The Australian Government had foreshadowed this Review in its formal response to the report of the House of Representatives Standing Committee on Economics, Finance and Public Administration on its inquiry into local government and cost shifting (also known as the Hawker Report)⁷.

- Chapter 4 of the Hawker Report noted that many submissions to their inquiry into local government and cost shifting, particularly from South Australia, argued that the interstate distribution of the local road grants was unfair. The Committee acknowledged the disadvantage of South Australian councils and said the existing formula was not transparent⁸.
- In March 2004, the Australian Government made an interim response to the Hawker Report to address the apparent disadvantage of South Australian councils. It agreed to provide supplementary funding to South Australian councils of \$26.25 million over the three years to 2006-07 — \$4.25 million in 2004-05, \$9 million in 2005-06 and \$13 million in 2006-07.
- The Government's June 2005 formal response to the Hawker Report⁹, said that it:
... will ask the Commonwealth Grants Commission to review the current interstate distribution of the identified roads component of the financial assistance grants and to report back to the Government by 30 June 2006. The Government will provide a long term solution to South Australia's disadvantage after the Commonwealth Grants Commission reports.

HOW THE COMMISSION CONDUCTED THE REVIEW

5 For the Review, the Commission:

- released an issues paper (CGC 2005/2) in November 2005 and sought comments on it;

⁶ In the rest of this report, maintenance includes preservation unless the context indicates otherwise.

⁷ The report, *Rates and Taxes: A fair share for responsible local government*, was tabled in Parliament in November 2003 and a copy is at www.aph.gov.au/house/committee/efpa/localgovt/report.htm. The Australian Government response to the report was tabled in Parliament in June 2005 and a copy is at www.dotars.gov.au/localgovt/publications/hawker_report

⁸ See *Rates and Taxes: A fair share for responsible local government*, pp 63-64.

⁹ See *Government Response to the Report of the House of Representatives Standing Committee on Economics, Finance and Public Administration. Rates and Taxes — A Fair Share for Responsible Local Government*, p.14.

- received 17 submissions in response to the issues paper from all State governments (including their local government grants commissions), all State local government associations, the Department of Transport and Regional Services (DOTARS) and one council;
 - sought data from local government grants commissions, the ACT Department of Urban Services, DOTARS, the Australian Bureau of Statistics (ABS) and Austroads¹⁰;
 - engaged the Public Sector Mapping Agencies¹¹ (PSMA) and ARRB Group Ltd¹² (ARRB) to provide specialist services and advice;
 - released a draft report at the beginning of May 2006 and sought comments on it;
 - held a conference on 18 May 2006 to discuss the draft report with State governments, local government associations and relevant Australian Government agencies;
 - received a further 12 submissions in response to the draft report; and
 - provided this final report to the Government in June 2006.
- 6 The Commission's views on the appropriate methods to use in responding to the terms of reference have evolved over time. We exposed some potential approaches in the draft report. Those approaches attracted substantial comment at the May 2006 conference and in subsequent submissions. Those comments and our recent analysis meant the approach recommended in this report is substantially different from those in the draft report.
- 7 A list of all submissions received is at Attachment A. Copies of submissions are available on the Commission's website, www.cgc.gov.au. Those present at the 18 May 2006 conference are listed in Attachment B.

STRUCTURE OF THIS REPORT

- 8 Chapter 2 provides some background on the existing distribution of local road grants. Chapter 3 discusses our interpretation of aspects of the reference. Chapter 4 examines alternative approaches to determining a distribution of the grants among the States and provides our recommendation on the most appropriate distribution. We discuss updating the distribution in Chapter 5.

¹⁰ Austroads is the association of Australian and New Zealand road transport and traffic authorities. Austroads members are the Australian State road transport and traffic authorities, DOTARS, the Australian Local Government Association (ALGA), and Transit New Zealand.

¹¹ The Public Sector Mapping Agencies Australia Limited is an unlisted public company wholly owned by the State, Territory and Australian Governments. It combines spatial data from governments to create national spatial information datasets.

¹² ARRB Group Ltd is an independent road and transport research body. It undertakes research, provides consultancy services and facilitates technology transfer in the road and transport fields.

CHAPTER 2

BACKGROUND TO THE REVIEW

LOCAL ROADS IN AUSTRALIA

- 1 Austroads classifies roads in Australia as follows:
 - national highways;
 - arterials, which are sub-divided into urban and rural; and
 - local roads, which are sub-divided into urban and rural.
- 2 The primary purpose of local roads is to provide access to property including farms, factories, offices and homes. Local roads also connect traffic moving between properties and higher level roads such as arterial roads and highways. In Australia, local governing bodies are generally responsible for local roads.
- 3 In 2005-06, 700 local governing bodies in the States and the Northern Territory received local road grants. Some basic information about them is in Table 2-1. The Australian Classification of Local Government (ACLG)¹ has been used to classify local governing bodies as urban, rural and remote.
- 4 Total actual expenditure on local roads (including maintenance and construction) by local governing bodies in 2003-04 was estimated as \$2 513 million. We estimate that \$1 735 million of this was maintenance expenditure (see Attachment C).
- 5 Table 2-2 shows the estimated local road financial assistance grants by State for 2006-07 along with grants per person and grants per kilometre of local roads. The table shows that:
 - South Australia received the lowest local road grants per person and per kilometre;
 - Western Australia, Tasmania, the ACT and the Northern Territory received above average grants per person; and
 - Tasmania and the ACT received grants well above the average per kilometre.

¹ See Appendix F of DOTARS 2006, *Local Government National Report 2004-05*, for a description of the ACLG and the classifications for all local governing bodies.

Table 2-1 Basic information on local governing bodies^(a)

		NSW	Vic	Qld	WA	SA	Tas	ACT ^(b)	NT	Aust
Number as at June 2005										
Urban		82	57	65	39	26	10	0	6	285
Rural		70	23	68	82	42	19	0	1	305
Remote		3	0	24	21	5	0	0	57	110
Total		155	80	157	142	73	29	0	64	700
	(%)	22.1	11.4	22.4	20.2	10.4	4.1	0.0	9.1	100.0
Area as at June 2005 ^(c)										
Urban	('000 sq km)	116.6	123.6	115.7	162.2	6.7	5.2	2.4	1.1	533.5
Rural	('000 sq km)	494.1	103.9	718.8	384.4	149.1	62.7	0.0	3.1	1 916.1
Remote	('000 sq km)	99.1	0.0	916.6	1 940.5	0.1	0.0	0.0	184.3	3 140.6
Total		709.8	227.4	1 751.1	2 487.1	155.9	68.0	2.4	188.4	5 590.1
	(%)	12.7	4.1	31.3	44.5	2.8	1.2	0.0	3.4	100.0
Population (2003-04) ^(d)										
Urban	('000)	6 106.9	4 609.8	3 368.7	1 654.2	1 243.4	338.5	324.1	133.6	17 779.2
Rural	('000)	600.5	355.7	482.9	263.3	281.6	143.7	0.0	16.0	2 143.6
Remote	('000)	7.4	0.0	34.4	60.6	8.2	0.0	0.0	48.6	159.1
Total	('000)	6 714.9	4 965.5	3 885.9	1 978.1	1 533.2	482.2	324.1	198.1	20 082.0
	(%)	33.4	24.7	19.4	9.9	7.6	2.4	1.6	1.0	100.0
Local road length as at June 2005 ^(e)										
Urban	(km)	53 717	75 085	38 082	17 225	11 793	4 126	1 837	1 145	203 010
Rural	(km)	86 788	54 086	74 734	76 273	62 523	9 953	0.0	756	365 113
Remote	(km)	3 277	0.0	34 706	29 495	994	0.0	0.0	12 207	80 679
Total	(km)	143 782	129 171	147 522	122 993	75 310	14 079	1 837	14 108	648 802
	(%)	22.2	19.9	22.7	19.0	11.6	2.2	0.3	2.2	100.0
Local road maintenance expenditure 2003-04 ^(f)										
Urban	(\$m)	376.6	266.0	218.9	142.7	101.9	21.0	10.6	4.6	1 142.3
Rural	(\$m)	160.3	93.0	107.4	80.8	66.6	18.9	0.0	3.2	530.4
Remote	(\$m)	3.2	0.0	18.6	28.1	3.8	0.0	0.0	8.3	62.0
Total	(\$m)	540.1	359.0	345.0	251.6	172.3	39.9	10.6	16.0	1 734.7
	(%)	31.1	20.7	19.9	14.5	9.9	2.3	0.6	0.9	100.0

(a) Local governing bodies are classified as urban, rural and remote according to the ACLG.

(b) The ACT is not a local governing body under the Act.

(c) This is the total area of local governing bodies. For New South Wales, South Australia and the Northern Territory, it is less than the total area of the State because large parts of these States are unincorporated. It includes estimates of the area of those local governing bodies (mainly in the Northern Territory) that have no designated area.

(d) Excludes population living in unincorporated areas.

(e) Based on figures for each local governing body, provided by local government grants commissions.

(f) Attachment C shows how the Commission calculated maintenance expenditure for each State from the available data.

Source: Estimated using data provided by DOTARS, local government grants commissions, and ACT Department of Urban Services. Population data from ABS *Regional Population Growth*, Cat. No. 3218.0.

- 6 Table 2-2 also shows that when the \$13 million of supplementary funding to South Australia is included it receives 7.8 per cent of total local road grants, compared to 5.5 per cent of the local roads financial assistance grants. With these supplementary funds, South Australia receives just above the Australian average of total grants per person in 2006-07 but still has the lowest grants per kilometre of all States.

Table 2-2 Estimated local road financial assistance grants by State, 2006-07

		NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Local road financial assistance grants										
Estimated allocations ^(a)	(\$m)	149.5	106.2	96.5	78.8	28.3	27.3	16.5	12.1	515.2
Distribution	(%)	29.0	20.6	18.7	15.3	5.5	5.3	3.2	2.3	100.0
Grants per person ^(b)	(\$/person)	22	21	24	39	18	56	51	59	25
Grants per kilometre ^(c)	(\$/km)	1 040	822	654	640	376	1 939	8 992	855	794
Supplementary funding to South Australia										
Allocation ^(a)	(\$m)	0.0	0.0	0.0	0.0	13.0	0.0	0.0	0.0	13.0
Local road grants plus South Australian supplementary funding										
Estimated allocations	(\$m)	149.5	106.2	96.5	78.8	41.3	27.3	16.5	12.1	528.2
Distribution	(%)	28.3	20.1	18.3	14.9	7.8	5.2	3.1	2.3	100.0
Grants per person ^(b)	(\$/person)	22	21	24	39	27	56	51	59	26
Grants per kilometre ^(c)	(\$/km)	1 040	822	654	640	549	1 939	8 992	855	814

Sources: (a) 2006 Budget estimate of entitlement for 2006-07.

(b) State population from ABS *Australian Demographic Statistics*, Cat. No. 3101.0, Dec 2005.

(c) Local road lengths from DOTARS based on data provided by local government grants commissions and the ACT Department of Urban Services.

HISTORY OF THE INTERSTATE DISTRIBUTION OF LOCAL ROAD GRANTS

- 7 When the Commission conducted its 2001 review of the operation of the *Local Government (Financial Assistance) Act 1995*, it was unable to obtain an explanation of the basis for the interstate distribution of the local road grants.
- 8 Subsequently, DOTARS provided the following explanation of the historical basis for their distribution²:
- the October 1990 Special Premiers' Conference, agreed that as from 1991-92 Australian Government funds for local roads that were then tied and paid through the State under the *Australian Land Transport Development Act 1988* would be paid as untied general purpose grants to local government, or to State Governments where they were responsible for local roads;

² See Appendix D of *Rates and Taxes: A fair share for responsible local government*.

- prior to 1991-92,
 - the Australian Government had provided road grants to the States including grants for urban and rural local roads³. The States passed some of those grants on to local government;
 - the basis for the distribution of the grants to the States prior to 1991-92 is now not known but appears to have been related to, amongst other things, State population and local road length;
 - road authorities in most States had responsibility for some local roads (mainly in unincorporated areas) and so kept a proportion of the local road grants. This proportion was negotiated between the State government and the local government association in each State. Therefore, national consistency in the determination of the proportion would have been lacking⁴;
- in 1991-92, \$303.2 million was provided to local government as local road grants under an amended *Local Government (Financial Assistance) Act 1986* and \$39.4 million was provided to the States for local roads maintained by them;
 - the interstate distribution of the local road grants under the amended 1986 Act was based on the shares paid to the States under the previous arrangement adjusted for the amounts paid to them for the local roads they maintained;
 - the local road grants when paid to local governing bodies were untied and did not have to be spent on local roads;
- in 1992-93, the pool of local road grants and some State shares were increased:
 - the Tasmanian Government gave to local government in Tasmania the local road grants it kept. These were added to Tasmania's share of local road grants under the local government financial assistance grants legislation; and
 - \$4.1 million of the local road grants paid to the Northern Territory Government were returned to the local road grants pool. This was the estimated expenditure by the Territory Government on local roads in unincorporated areas that then became the responsibility of community councils and associations;
- in 1993-94, the payments to the States for local roads maintained by the States were untied and included in general purpose payments to the States; and

³ The Australian Government provided funding to the States for rural local roads in 1947 and for urban local roads in 1974.

⁴ The report of the Independent Committee of Inquiry into the Distribution of Federal Road Grants (1986) states that:

The formulae have emerged from separate negotiations in each State, from starting points that were the product of State history. In two of the States there is an initial division of grants between urban and rural local roads (using definitions that are not necessarily the same as those used in road grants legislation). In all except one of the States a significant amount of local road grants is allocated to State road authorities. In two of the States this is about one-third of the total because of the many local roads that are the responsibility of State road authorities. (p27).

- from 1995-96, the ACT began receiving financial assistance grants with the introduction of the *Local Government (Financial Assistance) Act 1995*. The interstate shares of the local road grants paid to the States and the Northern Territory declined accordingly.
- 9 This brief history indicates that the existing interstate distribution of the local road financial assistance grants has evolved over time. Prior to 1991-92, Australian Government funding to States for local roads managed by the State and local governments seems to have had some relationship to State population, local road length and some other factors. However, since then the distribution of local road grants to local government has also reflected interstate differences in the arrangements, negotiated between States and their local governments prior to 1991-92, for funding local roads managed by the State.
- 10 **Conclusion.** Since the current interstate distribution of the local road grants evolved over time and has been frozen since 1995-96, despite changes in the population and circumstances of the States, it is unlikely to reflect the current relative needs of local government for maintenance expenditure on local roads.
- 11 To illustrate how the distribution would change over time Table 2-3 shows a notional distribution for 2006-07 in which we adjusted the current distribution to reflect:
- the changes in State shares of the Australian population since 1995-96; and
 - the \$13 million of supplementary funds given to South Australian councils in 2006-07, which could be interpreted as addressing part of their funding shortfall.
- 12 Allowing for only these influences, but not changes in road characteristics or relative maintenance costs, suggests that some State shares would change noticeably. This indicates that the existing distribution cannot be used as a basis against which to compare any new distribution. The status quo is not a viable option.

Table 2-3 An adjusted 2006-07 distribution

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
1995-96 grant shares	29.0	20.6	18.7	15.3	5.5	5.3	3.2	2.3	100.0
2006-07 adjusted shares ^(a)	28.3	20.3	20.3	15.8	5.1	4.8	3.0	2.4	100.0
Notional 2006-07 shares ^(b)	27.7	19.8	19.8	15.4	7.4	4.7	3.0	2.3	100.0

(a) December 1994 State populations and 1995-96 local road grants were used to calculate per person relativities, which were then applied to December 2005 State populations.

(b) Obtained using the 2006-07 population adjusted grant shares, estimated total funding for 2006-07 and including the \$13 million of supplementary funding for South Australian councils.

AUSTRALIAN GOVERNMENT FUNDING FOR LOCAL ROADS

- 13 Funding provided by the Australian Government to local government for local roads includes:
- untied financial assistance grants of which around 30 per cent is identified for local roads, but all these grants can be spent according to the priorities of each local governing body;

- supplementary funding to local governing bodies in South Australian for local roads, but this is only being paid for three years from 2004-05; and
 - specific purpose (or tied) grants for local roads under:
 - the Roads to Recovery programme;
 - the AusLink Strategic Regional programme; and
 - the National Black Spot programme.
- 14 In the 2006-07 Budget, the Australian Government announced an additional \$300 million in supplementary Roads to Recovery funding for local government to be paid in 2005-06 but able to be spent in the period to June 2009.
- 15 Details of the \$828 million in funding for 2006-07 by State under the local road grants and the Roads to Recovery programmes are shown in Table 2-4. Details of local government funding for 2006-07 under the AusLink Strategic Regional programme and the National Black Spots programme have not been determined. This Review is considering only the interstate distribution of the local road grants component of the financial assistance grants.

Table 2-4 Australian Government funding to local government for local roads, 2006-07

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m
Local road financial assistance grants ^(a)	149.5	106.2	96.5	78.8	28.3	27.3	16.5	12.1	515.2
Supplementary funding to SA councils					13.0				13.0
Roads to Recovery grants	85.0	62.5	62.5	45.0	25.0	10.0	5.0	5.0	300.0
Total	234.5	168.7	159.0	123.8	66.3	37.3	21.5	17.1	828.2

(a) 2006 Budget estimate of 2006-07 entitlements.
Source: DOTARS.

CHAPTER 3

INTERPRETING THE REFERENCE

- 1 The terms of reference ask us to recommend an interstate distribution of local road grants based on the relative needs of local government to incur maintenance expenditure for local roads and, to the extent practicable, bridges. In doing so, we are not to take account of local roads in unincorporated areas. This chapter outlines how we have interpreted important features of the reference, being:
 - assessing relative needs;
 - the expenditure to be covered by the Review;
 - the roads to be covered by the Review; and
 - the treatment of roads in unincorporated areas.

Assessing relative needs

- 2 The terms of reference do not indicate how we should interpret ‘relative needs’. It could be interpreted as requiring us to:
 - estimate the amounts local government in each State would need to spend if it were to bring the maintenance of all similar roads to a common standard — a backlog concept under which areas where roads are of a poorer standard would receive more funds; or
 - estimate how much local government in each State would spend if it were to perform the same level of maintenance work as the other States given the features of its local road network — a ‘doing the same job’ concept, which implies that the relative quality of the road networks across all States is maintained.
- 3 The first approach implies an evaluation of the condition of all roads and the work required to bring them to the chosen level. We could not do that because it would require data that are not available.
- 4 The second approach implies that differences between States in their share of the total assessed maintenance expenditure would result from differences between them in the length

of local roads, the use of those roads, the physical environment and other influences on cost levels. It is the conceptual approach we have adopted for this Review.

- 5 ***Allocating grants on a relative needs basis.*** The terms of reference ask us for advice on an allocation of the local road grants paid under the *Local Government (Financial Assistance) Act 1995* based on the relative needs of local government for expenditure on maintenance of local roads. However, the local road grants available for distribution (\$461 million in 2003-04) are much lower than the total amount of maintenance expenditure incurred by local government (\$1735 million in 2003-04 — see Table 2-1). A large part of road maintenance is funded from rate revenue, other Australian Government grants and grants from the State government.
- 6 The reference did not seek, and we have not done, a comprehensive fiscal equalisation-type review of the financial capacity of local government to provide road services. Such a review would have involved considering many aspects of local government funding, including:
 - the relative capacity of local government to raise its own revenue to fund road maintenance; and
 - the extent to which the needs for road maintenance expenditure are met from other Australian and State government payments to local government.
- 7 We have responded to the reference by estimating the maintenance expenditure each State would incur if it were to provide the same standard of maintenance services as the others given the features of its road network and other relevant circumstances.
- 8 Allocating the local road grants among all States in proportion to the level of maintenance expenditure assessed in this report would allocate them on a relative needs basis. The same proportion of each State's assessed maintenance expenditure would be met from the local road grants.
- 9 Allocating the local roads grants on a relative needs basis provides the capacity for the same level of maintenance to be performed in each State. However, the standard of maintenance actually provided depends on decisions by local government about how they choose to use the local road grants (they are 'general purpose' grants that can be used however the local governments choose) and what other funds they choose to devote to maintenance.

What expenditure should be covered by the Review?

- 10 The reference asks us to consider expenditure needs for maintenance and preservation of local roads and bridges. We are not asked to consider expenditure on, or the relative needs for, road construction and upgrading. This is consistent with the aim of the financial assistance grants to fund existing needs, not to facilitate future growth.
- 11 As far as possible, construction expenditure and the factors that affect it have been excluded from the assessments.

Should the assessments cover local roads or roads that are the responsibility of local government?

- 12 We have interpreted the terms of reference as asking us to base the allocation of local road grants on the relative needs of local government in the States for expenditure on the maintenance of local roads and, if practicable, bridges on them. This implies the assessments should reflect the roads and bridges for which local government is responsible in each State. Many parties to the May 2006 conference supported this interpretation.
- 13 In Australia, local government is generally responsible for local roads, which can be described as those roads
- whose principal function is to distribute traffic and provide access to individual land holdings or land uses¹.
- 14 However, roads that are the responsibility of local government in each State are typically affected by the outcome of negotiations between them and their State government. Those negotiations can result in local government being relieved of the responsibility for some local roads or having responsibility for some arterial roads. More importantly, the negotiations can result in the responsibilities of local government differing between States. Some of the differences are:
- the New South Wales, Victorian, South Australian and Northern Territory governments are responsible for local roads in unincorporated areas;
 - while arterial roads are generally the responsibility of State governments, in some States roads that perform an arterial function (and would be classified as arterial roads in other States) are the responsibility of local government; and
 - in some States some roads, such as access roads to Indigenous communities, which perform a local function are the responsibility of the State government.
- 15 Consequently, basing the assessments on the actual length of roads that are the responsibility of local government in each State means the assessed needs would be affected by differences between States in their policies on:
- the allocation of responsibility for roads between the State and local governments; and
 - the provision of local roads.
- 16 Allowing differences between States in those policies to influence the relative needs means the assessments for local roads grants:

¹ Austroads 1998, *Responsibilities for Local Roads*, AP-129/98, p16. This definition was proposed as part of a scheme of functional classifications for roads.

- would not be policy neutral² — policies adopted by a State could affect its grant; and
- would not complement the assessments the Commission makes of each State’s relative needs to incur expenditure on road maintenance as part of the allocation of GST revenue among the States — some roads may not be included in the determination of the allocation of the GST or the local roads grants and/or some roads may be included in determining both allocations.

Should local roads in unincorporated areas be included?

- 17 The terms of reference require us to exclude local roads in unincorporated areas³. These local roads are usually the responsibility of State governments. Consistent with the existing scope of the local road grants and the approach of local government grants commissions in allocating those grants, we were inclined to include access roads and other internal community roads maintained by Indigenous communities within unincorporated areas that are treated as local governing bodies for the purposes of the *Local Government (Financial Assistance) Act 1995*.
- 18 DOTARS has advised that:
- We agree that it would be consistent with the intent of the inquiry and the current arrangements for the terms of reference to be interpreted to include the access roads and the roads within indigenous communities located in unincorporated areas.
- 19 We also note that action by the Australian Government in 1992-93 in effect resulted in funds for these types of local roads in the Northern Territory (which are most of the roads in question) being included in the local roads grants pool⁴.
- 20 In their submissions, most parties supported that proposal. However, Victoria said there should be no expansion of the types of roads eligible for funding, such as the local roads in unincorporated areas, without an increase in funding from the Australian Government.

² Policy (or effort) neutrality is one of the pillars of the relative needs assessments made by the Commission. Relative needs should be assessed on the basis that each State applies the same policies relating to the size and standard of the service being provided. A decision by a State to provide a higher standard of service than the other States should not result in it receiving a higher share of a grant that is allocated on a needs basis. It is also one of the national principles that guide local government grants commissions in the assessments they make. The National Principles define Effort Neutrality as: ... policies of individual local governing bodies in terms of expenditure and revenue effort will not affect grant determination.

³ ‘Unincorporated areas’ are parts of States for which no incorporated body of local government has responsibility. State governments generally provide local government services in unincorporated areas. Large portions of New South Wales, South Australia and the Northern Territory are unincorporated.

⁴ In 1992-93 the Australian Government increased the local road grant pool and the amount paid to the Northern Territory for on passing to local authorities by \$4.1 million. At the same time, it reduced the amount paid to the Northern Territory Government for local roads in unincorporated areas by the estimated expenditure on local roads in areas managed by community councils and associations. Advice from the Northern Territory indicated that as a result of this decision, the Northern Territory Government implemented legislation to transfer responsibility for maintaining these roads to the respective local governing bodies.

- 21 We have accepted the advice from DOTARS that our assessments should include the access roads and other internal community roads maintained by the Indigenous communities in unincorporated areas that are treated as local governing bodies under the *Local Government (Financial Assistance) Act 1995*.

Summary

- 22 The Commission has concluded that relative needs should be interpreted in terms of comparisons of the amount local government in each State would spend if it were to perform the same level of maintenance work as the other States given the features of its local road network.
- 23 It has also concluded that this Review should cover:
- maintenance and preservation expenditure only;
 - roads (and if practicable bridges on them) that are the responsibility of local government in each State; and
 - access roads and other internal community roads maintained by the Indigenous communities in unincorporated areas that are treated as local governing bodies under the *Local Government (Financial Assistance) Act 1995*.

CHAPTER 4

ASSESSMENT METHODS

POTENTIAL ASSESSMENT MODELS

- 1 During this Review, we examined many approaches to assessing the needs of local government to incur maintenance expenditure on local roads. These included the approach the Commission uses to assess the relative needs of States for expenditure on maintaining arterial roads and approaches used by local government grants commissions to allocate local road grants to local governing bodies.
- 2 We examined each potential approach against criteria relating to its:
 - conceptual rigour;
 - data requirements and the expected comparability and reliability of those data; and
 - simplicity, clarity and transparency.
- 3 We also took careful account of the views of parties to the Review expressed in written submissions and at our conference. We were mindful of the support for an approach that:
 - is easy to understand,
 - uses data that is readily available and can be updated annually,
 - is verifiable, and
 - is transparent.

AN ASSET PRESERVATION APPROACH

- 4 This approach involves identifying and costing the work that must be done over the life of a road to maintain and preserve it to a given standard and converting those costs to equivalent annual expenses. It is used by the local government grants commissions in Victoria, Western Australia and Tasmania to allocate the local road grants between local governing bodies.
- 5 The asset preservation approach is a sophisticated one that requires comprehensive local road data, including traffic volumes, and a detailed understanding of the factors affecting local

road maintenance costs. Applying it in this Review would be complex. It would require judgments on the life cycles of local roads, the tasks required to maintain them, the normal frequency of those tasks and their benchmark costs in circumstances varying from Indigenous communities in the Northern Territory to inner city areas in Sydney.

- 6 We concluded that this approach could not be pursued in this Review because the detailed data required for each State are generally not available. Thus making it inappropriate for use in interstate comparisons.

AN INDICATOR MODEL

- 7 Under indicator models, State grant shares may be assessed using indicator variables (such as population, area or road length) which are associated with local road expenditure. Indicator models can be:
- very simple options in which grant shares are based on State shares of the Australian population or total local government road maintenance expenditure; or
 - simple combinations of State shares based on several indicators, such as road length, area or population.
- 8 Indicator models were used in the past by the Australian Government to allocate roads grants among the States. Local government grants commissions in New South Wales, Queensland, South Australia and the Northern Territory currently use them to allocate the local road grants between local governing bodies.
- 9 Indicator models received considerable support from parties to the Review, because of their simplicity. However, different parties supported different models.
- 10 We considered the options based solely on population or expenditure shares were too simplistic and could not be adopted because:
- the population share approach (which may also be called an equal per person approach) makes no allowance for any of the factors that lead to differences between States in the per person maintenance expenditures — it ignores the needs that exist; and
 - the expenditure share approach results in all differences in expenditure per person, including those that arise because of decisions to provide above or below average standards of service, being included in the grant shares — it is not policy neutral.
- 11 Approaches based on simple combinations of indicators involve calculating a weighted average of the share of road length and the share of population. Despite their simplicity, we decided against pursuing them because the resulting shares depend heavily on decisions about the weights applied to each indicator and those decisions relied too heavily on judgment.

AN AVERAGE STANDARD APPROACH

- 12 The average standard approach is used by the local government grants commissions of New South Wales and South Australia to assess expenditure on roads for the allocation of the general purpose grants among local authorities. It is also the approach used by the Commission to assess State expenses on roads as part of the distribution of the GST revenue between States.
- 13 This approach aims to estimate what each State would spend if it provided the Australian average level of service in its own circumstances. It starts from an assumption that if State circumstances were the same, they could provide the same service by spending the Australian average amount per person. It then adjusts that amount for the effects of factors that are not of a State's own making which result in above or below average amounts of service per person and costs per unit of service.
- 14 This approach would produce conceptually sound estimates of relative expenditure requirements. However, the reliability of those estimates depend on the reliability of data on the main influences on maintenance costs — road lengths, road use and the effects of climate, geography and other influences on cost levels.
- 15 The robustness and appropriateness of the results of this approach are strengthened if the influences included in the analysis cannot be influenced by the actions of individual States or local governments — that is, if they are policy neutral. Otherwise it is open for States and local governments to adopt policy positions designed to maximise their grant entitlements.
- 16 The general form of the average standard approach we examined is based on the premise that local government in each State would spend more or less than the average amount per person on local road maintenance if the length of local roads for which it was responsible and/or the use of those roads was above or below the average per person levels.
- 17 We also accepted advice that the cost of maintenance tasks would be affected by:
 - whether the roads are in urban, rural or remote locations — in general, maintenance per kilometre of urban roads is more expensive than rural and remote roads because of the higher standard of the roads and the more complex work required to maintain them and this is generally compounded by the effects of use. However, maintenance per person in urban areas is less than rural and remote areas because the costs in urban areas are spread over larger populations; and
 - the climatic and geographic environment (such as soil type, terrain, rainfall and salinity) where the roads are located — some climatic conditions lead to faster deterioration of road surfaces and some geographic conditions lead to more frequent and complex work.
- 18 Some States argued that allowances should be made for:
 - the effect of differences between States in wage levels¹; and

¹ New South Wales and the ACT argued for a wages allowance.

- the effects of population dispersion².
- 19 We decided not to make those allowances for a mix of conceptual and practical reasons. Data were not available to measure the allowances that might apply to local road maintenance. The allowances used in the State assessments would have had to be used as approximations and it is not clear that they are appropriate. For example, the wages allowance used in the arterial road assessments reflects labour price differentials for all types of labour and for all services. It is not clear that those differentials could be applied to the narrower range of labour required for local road maintenance tasks.
- 20 The dispersion assessment used in the State assessments includes allowances for cost effects (such as communication and travel between regional centres and the State capital city and costs of staff removals and locality allowances to encourage staff to work in remote areas) that may not apply in the case of local road maintenance where work is often done by contractors from the local region.
- 21 Some of the effects of wages and population dispersion would be included in the relative cost weights applied to roads in urban, rural and remote areas. Attempting to include separate wages and dispersion allowances would increase the complexity of the assessments and would be unlikely to improve their overall reliability.

Applying the average standard approach

- 22 The average standard approach could be applied in two ways.
- 23 We could examine the situation at State level and attempt to allow for differences from the all State average expenditure caused by inherent differences in State road related characteristics. This is similar to the way the Commission approaches the assessment for arterial roads in determining the distribution of GST revenue. This approach was strongly supported by many parties to the Review. We decided to examine the possibility of applying it.
- 24 As an alternative we could attempt to apply the average standard at the level of local government. Again we would attempt to explain how expenditure patterns would vary from the observed average based on the road related characteristics of local governments. Because an analysis at this level provides many more observations, we would be able to use statistical methods, such as regression, to help inform decisions on the relative importance of different road characteristics to maintenance expenditure.
- 25 During our May 2006 conference many parties said it was inappropriate to base a grant distribution on regression because it was not transparent and it provided few conceptual links between the indicators and local road expenditure. However, in subsequent submissions, some parties acknowledged the value of regression analysis for testing the relevance of different road related characteristics and explaining variations in expenditure. We considered the practical advantages were sufficient to justify detailed consideration of its use.

² Western Australia and the Northern Territory argued for the inclusion of a population dispersion factor.

- 26 The rest of this chapter provides an overview of the various specifications of the average standard approach we examined. Details of the data we collected and our evaluation of them are in Attachment C. Details of the assessments we made are in Attachments D and E.

The State level average standard approach

- 27 Implementing the State level average standard approach requires data on:
- total maintenance expenditure by all local governing bodies in each State;
 - the length of local roads in each State sub-divided into the length of local roads in urban, rural and remote areas of the State;
 - the Australian average proportion of maintenance on local roads that is attributable to their length and to their use;
 - the Australian average cost of maintaining a kilometre of road in urban and rural areas relative to the average cost of maintaining a kilometre of road in remote areas; and
 - estimates of the impact of climatic and geographic conditions in each State on road maintenance costs relative to that for Australia as a whole.
- 28 **Expenditure.** Data on expenditure by local governments on local roads were collected from the local government grants commissions and the ACT Department of Urban Services (see Attachment C). Some parties expressed concern that the data were affected by differences between local governing bodies in coverage and accounting practices. As far as possible, we adjusted the data to exclude expenditure on construction and other tasks not associated with road maintenance. Any remaining differences have little effect on State shares because the expenditure data are used only to prepare Australian average per person expenditures. We consider the resulting figures are sufficiently comparable for use in this Review.
- 29 **Local road lengths.** We collected road length data from local government grants commissions, Austroads publications and PSMA (see Attachment C).
- 30 Many parties to the Review said that the road length data provided by the local government grants commissions are the most comparable available. This confirmed the results of our analysis, although we have unresolved concerns about whether actual road length is a policy neutral indicator of the size of the maintenance task and whether the definitions of local roads are comparable across States. However, in examining this average standard approach we put those concerns aside because the reference asks for relative needs based on the responsibilities of local government in each State. We, therefore, used the road length data provided by local government grants commissions.
- 31 The average standard approach, as specified for this Review, requires the length of local roads in each State to be dissected into roads in urban, rural and remote locations. The local government grants commission data did not contain that dissection. It had to be estimated by applying proportions derived from other data sets to the grants commission's data. Those proportions could be derived on the basis of:

- the location of the road, using data provided by ARRB and sourced from Austroads publications. However, adjustments were needed to use the latest data, to exclude most roads in unincorporated areas (see Chapter 3, paragraph 21), to exclude forestry roads in Tasmania and to include local roads that are the responsibility of local governing bodies in the Northern Territory; or
 - the urban, rural or remote classification of the local authority in which the roads are located. Local governing bodies were classified using the Australian Classification of Local Governments (ACLG).
- 32 Neither approach is ideal. The data on where roads are located may understate the length of urban roads because the Austroads data define urban centres as those over 40 000, which would omit many centres where the roads have predominantly urban features. Moreover, applying this approach required many adjustments to the data. While each adjustment was plausible, the need for them and their cumulative effects substantially reduced the reliability of the data. On the other hand, the data based on the classification of local governing bodies could overstate the length of urban roads in States where local governing bodies responsible for regional cities were also responsible for surrounding rural areas.
- 33 We chose to classify roads on the basis of the urban, rural or remote classification of the local authority in which they are located³ because we considered the data were more reliable and accurate. Table 2-1 shows the length of local roads by location prepared on this basis.
- 34 **Parameters.** We contracted the ARRB to provide technical advice on:
- the relative effects of the length and use of local roads on maintenance costs;
 - the relative cost of maintaining local roads to an average national standard in urban, rural and remote areas;
 - environmental factors in each State that have a material effect on the costs of maintaining and preserving local roads; and
 - the factors that affect maintenance expenditure for bridges on local roads.
- 35 A copy of ARRB's final report, *Interstate distribution of local roads grants: advice on factors influencing local roads expenditure*, is at Attachment F. They advised that:
- about 60 per cent of maintenance expenditure could be attributed to road length and 40 per cent to use;
 - the relative costs of maintaining a kilometre of local road in urban, rural and remote areas are 4.45: 1.63: 1.00; and
 - the relative effects of the physical environment (climate and topography) on the frequency and cost of road maintenance are as shown in Table 4-1.

³ The ACLG was used to classify local governing bodies as urban, rural or remote.

Table 4-1 The relative effects of physical environment by State

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
State factors provided by ARRB	1.18	1.08	1.15	1.19	1.01	1.27	1.00	1.15	1.14
State factors relative to Australia	1.04	0.95	1.01	1.05	0.89	1.12	0.88	1.01	1.00

Source: ARRB Report *Interstate distribution of local roads grants: advice on factors influencing local roads expenditure* — see Attachment F.

- 36 We provided the ARRB report to the parties to the review. Advice from several parties reflected differing views on their advice, which is not surprising given the differing implications of the recommendations for State shares of the grants. For example:
- Western Australia and the Northern Territory argued that the proportion of maintenance costs due to length should be higher.
 - South Australia applied a much lower proportion to road length (it uses 50 per cent in metropolitan areas and 33.3 per cent in non-metropolitan areas).
 - Western Australia said that the effects of road use were double counted in the ARRB estimates of the proportion of maintenance expenses due to use and the relative cost weights for urban, rural and remote roads.
 - Western Australia and the Northern Territory said the cost weights for each type of road should not be used and if they are the ARRB figures for remote areas are too low. Both States said that the weights do not take account of the high costs of getting work gangs and equipment to the remote areas and the more frequent maintenance needed for unsealed roads in areas subject to monsoon influences.
 - Western Australia and the Northern Territory said that the environmental factors underestimate the conditions in both States. They said the factors did not allow for the intensity of rain in the wet season. Western Australia also said the ARRB index did not allow for the effects of heat and understated its length of local roads affected by salinity.
 - The ACT said that cold weather, ice and other environmental influences substantially increase the need for and cost of maintenance in the Territory and that the effects of soil instability were understated.
- 37 Since we engaged ARRB as roads experts, we have used their advice in our calculations for the State level average standard approach. Much of the advice we received from them was contested by several States, mainly because it was based on incomplete data and data whose reliability could be questioned. For example, data limitations mean the environmental factors can only be broad reflections of the major influences on road maintenance. However, ARRB did review their advice on the physical environment factors in the light of more recent data on the length of road at risk from salinity in each State. The figures in Tables 4-1 and 4-2 include those revisions.

- 38 **Local road use.** Road use is often measured in terms of annual vehicle kilometres travelled or average annual daily traffic. ARRB provided data on annual vehicle kilometres travelled on local roads. However, ARRB stated in its report that estimates at a State level ‘are not reliable’ because the samples on which they were based were designed to produce national level figures, not State level ones.
- 39 In this circumstance, we used population as a proxy for road use. Population is often used as an indicator of road use, in the absence of better data. Using population as the road use measure in the average standard approach is equivalent to providing each State with an equal per person share of the 40 per cent of expenditure assumed to be due to road use.
- 40 **Bridges on local roads.** The reference asks us to assess the relative needs of local government in each State to incur maintenance expenditure on bridges on local roads, if that is practicable. We asked the local government grants commissions for data on the expenditure by local governments on bridge maintenance. We also asked for information on the number and size of bridges on local roads in each State.
- 41 Some States were unable to provide data on bridge maintenance expenditure. The data we received indicated that on average it was less than four per cent of total road and bridge maintenance expenditure, although the percentage was noticeably higher in Tasmania and the ACT. Information on bridges was also incomplete and what we did receive was unreliable and not comparable across States — it was based on widely different definitions of a bridge.
- 42 Given the relatively small amount spent on bridge maintenance and the lack of reliable data to measure differences between States in the size of the maintenance task, we concluded it was not practicable to assess the relative needs for bridge maintenance expenditure. We decided we would include bridge maintenance expenditure with road maintenance expenditure. This is equivalent to assuming the appropriate interstate distribution of expenditure on bridges is the same as that for roads. Even if we made an extreme assumption that all the interstate differences in bridge maintenance expenditure per person were due to disabilities⁴, the effect on State shares would be small.
- 43 **The results.** The average standard approach calculates how much each State would have spent if they all provided the same standard of local road maintenance in similar circumstances. In doing so, it takes account of the main factors that affect the cost of local road maintenance. Further details about the calculations and issues involved in applying the model are in Attachment D.
- 44 Table 4-2 shows the distribution of the assessed maintenance expenditure by State under the State level average standard model.

⁴ The maximum effect of this assumption would be to increase the share of New South Wales by 0.3 percentage points and that of Queensland and Tasmania by 0.1 percentage points. Most other States would fall by 0.2 or 0.1 percentage points.

Table 4-2 Assessed local roads expenditure under the average standard approach

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Shares of assessed expenditure (2003-04)	29.0	24.6	20.5	13.4	8.0	2.6	0.8	1.1	100.0

- 45 ***Evaluation of the State level average standard approach.*** This approach allows for the major factors that lead to interstate differences in maintenance expenditure. It was strongly supported by many parties to this Review.
- 46 However, we have serious reservations about the reliability of much of the data it uses, and the extent of judgment required to improve the comparability of the data and to derive other important parameters.
- 47 Data on the length of local roads are fundamental to the assessment. Many parties to the Review considered the road length data provided by the local government grants commissions were sufficiently comparable estimates of the roads that are the responsibility of local government in each State. Even if the data were accepted as sufficiently comparable measures of the length of road maintained by local government in each State, there are serious doubts about the suitability, reliability and comparability of most other data used in the assessments. There are questions about:
- the dissection of road length into urban, rural and remote roads;
 - the relative maintenance costs per kilometre of roads in urban, rural and remote areas;
 - the relative importance of road length and use as influences on maintenance;
 - the measure of road use; and
 - the effects of the physical environment on the frequency and cost of maintenance.
- 48 External experts in the roads field provided much of the information we used, but they also faced problems in obtaining reliable data to use in preparing their advice. The comments of some States indicate that significant further work is required to develop robust measures of the important variables.
- 49 In short, the State level average standard approach is conceptually sound but its application is compromised by the poor quality of much of the data used in it. We tried to overcome those deficiencies by exercising our judgment or relying on the judgment of experts in the field. While judgment is an inevitable and appropriate feature of the Commission's work, the extent of it required in this case and the sensitivity of the results to it substantially reduces the confidence we have in the resulting State shares of the grants.
- 50 We conclude that, based on the currently available data, the interstate distribution of grants derived using the average standard approach based on road characteristics is unreliable and cannot be used.

Local government level average standard approach

- 51 In the same way as the average standard approach was applied to State governments we considered how the maintenance expenditure for local governing bodies would vary from the observed average expenditure of all local governing bodies, due to factors such as the length of roads they had to maintain, the use of those roads and environmental factors.
- 52 However, in contrast to the State level approach, we did not attempt to specify how each of these influences would affect maintenance expenditure. We let statistical analysis estimate the relative importance of these factors based on what we observed from local government level data. That analysis can also test for the existence of State specific policy influences.
- 53 *The models examined.* The models were based on indicators, which could be regarded as measures of the size and cost of the road maintenance task and which could be reliably measured. Most of the models did not use road length data or other details that were of debatable reliability.
- 54 In these models, expenditure on local road maintenance (measured using data provided by each local governing body to their local government grants commissions) was regressed against area and population using many different specifications for the relationships. Area and population were favoured as explanatory variables because consistent data are available and they are generally considered to influence road maintenance expenditure. Specifically:
- road maintenance expenditure is generally considered to be a function of the length of local roads and their use;
 - the length of local roads is broadly related to area and population (as area and population increase, the length of local roads generally increases and vice versa); and
 - the use of local roads in a local governing area is broadly determined by its population.
- 55 By avoiding the use of road length data, the State shares produced by these models are policy neutral because they are not affected by interstate differences in the allocation of responsibility for local roads between the State and local governments, definitions of local roads and past policy decisions on the length and type of roads constructed.
- 56 The model we considered the most conceptually rigorous is described in Attachment D. It includes many of the influences reflected in the State level average standard approach, although many are measured in a different way. The main features of the model are:
- it considered maintenance expenditure by local governing bodies to be related to their population and area. We expected expenditure to increase with increases in population (and area), but the rate of increase would reduce as population (and area) increase;
 - it used data for individual local governing bodies. But to minimise the effects of State decisions on the structure of local government, local governing bodies were grouped according to their ACLG category;
 - it allowed for the effects of the physical environment on maintenance expenditure;

- it allowed for the differences in maintenance costs for local roads in urban, rural and remote areas ; and
- it eliminated the effect on maintenance expenditures of possible differences between States in policy influences, such as the standard of maintenance provided.

57 **The results.** The regression equation was estimated using data for 587 local governing bodies because we did not have expenditure or area data for all local governing bodies.

58 Estimates of State local road maintenance expenditure were prepared by applying the results of the estimated model to data for all local governing bodies in each State, the ACT and the Northern Territory (grouped according to the ACLG classification). However, before we could estimate the expenditure for the Northern Territory, we had to derive a notional area for local governing bodies in unincorporated areas that do not have a designated land area (mostly Indigenous community councils). This was done by assuming that the relationship between road length and area observed in other Northern Territory remote area local governing bodies applied to these community councils.

59 The grant shares implied by this model are shown in Table 4-3.

Table 4-3 Assessed local roads expenditure under the local government level approach

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Shares of assessed expenditure (2003-04)	29.0	18.2	22.5	14.0	8.8	4.5	1.2	1.8	100.0

60 **Evaluation of the local government level approach.** The model indicates that population is important in explaining expenditure in all locations but its impact appears to be less important in remote areas. Area is less important in explaining expenditure in urban areas but is important in rural areas and most important in remote areas.

61 However, our analysis of the results suggested that at least one other significant influence had not been taken into account. Our approach appeared to under-estimate expenditure for ACLG categories with high maintenance expenditure. Similar results were obtained when we estimated the regression model using individual local governing bodies rather than ACLG categories. The under-estimation mainly occurred for local governing bodies in New South Wales, Victoria and Queensland.

62 These results suggest that factors other than area and population significantly influence expenditure. In many cases, the resident population appeared to underestimate the need for local road maintenance — possibly because it did not adequately capture the nature of the activities in the area (for instance, capital city councils, regional centres and tourist destinations) but in other cases the reasons were less clear. Grouping local governing bodies according to ACLG reduced but did not completely overcome the problem. We tried many alternative models, including ones that used the value of commercial and industrial land as an

indicator of the extent of non-resident road use, but were unable to develop a satisfactory specification.

- 63 If we had used these results, we would have under-estimated the expenditure needs for those States with many local governing bodies with high expenditure and over-estimated the expenditure needs for those States with few high expenditure local governing bodies.
- 64 We have concluded, as with the State level approach, that the results from the local government level approach should not be used to distribute local roads funds.

A simple average standard approach

- 65 We have concluded that we could not produce sufficiently reliable State grant shares using the proposed average standard approaches at State or local government level. We therefore examined a simple average standard approach that uses a limited range of reliable data.
- 66 There are large differences in the maintenance expenditure per person in urban, rural and remote areas. Maintenance expenditure per person is much higher in rural and remote areas than it is in urban areas because of the smaller population, greater length of local roads, higher costs and diseconomies of small scale in urban and remote areas. Based on expenditure data for 2003-04, the Australian average expenditure per person was:
- \$ 64.25 per person in urban areas;
 - \$247.43 per person in rural areas;
 - \$389.72 per person in remote areas; and
 - \$ 86.38 per person in all areas.
- 67 Under this approach we applied the Australian average maintenance expenditure per person in urban, rural and remote areas to the population of each State resident in those areas.
- 68 This approach is based on the premise that by spending the average amounts per person in its urban, rural and remote areas each State would be able to provide maintenance services of a standard equivalent to the average for each of those areas. The relative needs, therefore, reflect differences between States in the proportion of their population who live in urban, rural and remote areas.
- 69 In applying this approach we classified local governing bodies as urban, rural and remote using the ACLG classification. All ACLG classifications for developed urban centres, regional urban centres and fringe urban centres were treated as urban.
- 70 We then calculated the Australian average expenditure per person using expenditure and population data provided by the local government grants commissions. This was applied to State populations in each area, which were again based on local government grants commission data classified using the ACLG.
- 71 The assessed expenditure for a State is the sum of the amounts assessed for its urban, rural and remote areas. See Attachment E for further details on this approach.

72 To make sure the results were not affected by large one-off events, we did the calculations using data for three years (2002-03 to 2004-05) and averaged the resulting States shares. The State shares of maintenance expenditure assessed by this method are shown in Table 4-4.

Table 4-4 Assessed local roads expenditure under the simple average standard approach

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Shares of assessed expenditure based on 2002-03 to 2004-05 data ^(a)	31.3	22.0	20.2	11.3	8.9	3.3	1.2	1.8	100.0

(a) An average of calculations that used data for 2002-03, 2003-04 and 2004-05.

73 The model is conceptually sound in that its use of average per person expenditure in the different locations captures the main differences in the average maintenance tasks in those locations. It does so in a simple way and requires limited amounts of data. It is not affected by the unreliability and lack of comparability of data on road length and location, road use and the other parameters in the model based on road length. Since the expenditure data of all local authorities are only used to derive the Australian average expenses in each area, the effects of any differences between local authorities in their accounting practices are minimised by the averaging processes.

74 However, the approach:

- implies that the urban, rural or remote areas of each State are broadly similar to the average for those areas. This may not always be the case. There may be different levels of road use, different physical environments and different wage levels. As we have noted previously, data deficiencies mean that any such differences cannot be measured in a reliable way. We consider, however, that the approach does reflect the most important difference — the effect of differences in where people live (or State settlement patterns) as measured by differences in the proportion of population living in those areas; and
- allocates population to urban, rural and remote areas on the basis of the ACLG. Consequently, it could be affected by differences between States in their policies on the size of local authorities, such that States with small rural authorities surrounding urban centres may be interpreted as having greater needs than States where such areas are included in a larger authority responsible for the urban centre and its surrounding regions. However, given the general features of those localities, it is unlikely that many people would be incorrectly classified.

75 Overall, we conclude that this approach captures important and relevant causes of differences between the States in their need to incur maintenance expenditure for local roads. The simplicity and robustness of the model mean that the grant shares it produces are reliable and robust. It is a reasonable and reliable interim distribution that could be used to allocate grants until such time as the data needed to undertake more comprehensive assessments are of an acceptable quality.

THE RECOMMENDED GRANT DISTRIBUTION

- 76 In summary, our conclusions on the alternative approaches to deriving grant distributions are:
- The average standard approach at both the State and local government levels has conceptual merit but there are considerable problems with the data and the ability to include all important influences. Much of the available data are not comparable across States and are unreliable. Consequently, grant distributions produced by this approach cannot be considered sufficiently reliable or appropriate for use at this time.
 - The simple average standard approach has conceptual merit. It may omit some influences that affect the relative need to incur maintenance expenditure, but it requires fewer assumptions than the other approaches and it uses data that are reliable and robust. It produces an objective grant distribution.
- 77 Table 4-5 shows the State population shares, the current distribution adjusted to 2006-07 and the distribution derived from the simple average standard approach adjusted to 2006-07.
- 78 We acknowledge that the simple average standard approach provides an approximation only of the needs of local government in each State to incur expenditure on the maintenance of local roads and the bridges on them. However, insufficient reliable and comparable data are available to warrant more sophistication. We consider the grant distribution produced by this approach better reflects relative maintenance needs than the current distribution, even after it is updated for population changes and the supplementary assistance given to South Australia.
- 79 In each case, the grant distributions shown in Table 4-5 have been adjusted to reflect the projected population shares as at December 2005⁵.

Table 4-5 Distribution of actual expenditure, population, adjusted current shares and assessed local road expenditure

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Actual expenditure ^(a)	31.1	20.7	19.9	14.5	9.9	2.3	0.6	0.9	100.0
Population shares ^(b)	33.3	24.7	19.6	9.9	7.6	2.4	1.6	1.0	100.0
Nominal 2006-07 shares ^(c)	27.7	19.8	19.8	15.4	7.4	4.7	3.0	2.3	100.0
Average standard approach based on population location using 2002-03 to 2004-05 data and adjusted to 2006-07	31.1	22.0	20.5	11.3	8.8	3.3	1.2	1.8	100.0

(a) Estimated expenditure on local road maintenance 2003-04.

(b) Estimated resident population as at December 2005.

(c) Current distribution adjusted to include \$13 million in supplementary funding paid to South Australian councils in 2006-07 and for population changes between 1995-96 and December 2005.

⁵ In each case, this was done by applying the per person relativities implied by the calculated grant shares to the estimated State populations as at December 2005. In the *Local Government (Financial Assistance) Act 1995*, the State population used for a grant year is the population as at December in the calendar year immediately preceding the grant year. This differs from the State population used for the purpose of the GST distribution — the population at the midpoint of the grant year.

Recommendation

The Commission recommends that as an interim measure, until reliable and comparable data on road characteristics are available for all States, the local roads grants be distributed among the States on the basis of average expenditure per person in urban, rural and remote areas and the population of each State resident in those areas.

CHAPTER 5

UPDATING STATE SHARES

- 1 The terms of reference ask us to recommend how the interstate distribution of the local road grants could be updated in future years.
- 2 Under the current arrangements for local road grants, the State shares have been held constant. This contrasts with the arrangements for the general purpose grants where the State shares are updated annually on the basis of State shares of Australia's population¹.
- 3 In the issues paper, the Commission suggested that updating occur to ensure that the interstate allocation of the grants reflects the most recent conditions in the States.
- 4 Submissions to the Review provided a range of views on updating. For instance:
 - the Local Government Association of Queensland said that the assessment model should use readily available information such as population, road length and road use. It said that these variables are likely to be the main drivers of change in relativities and using them would allow the distribution to be updated annually which would smooth out significant changes in State shares over time;
 - Western Australia said that updates to the data every three to five years would provide greater certainty of State shares and give local governing bodies greater certainty of local road funding; and
 - the Northern Territory suggested that key drivers such as population and road length could be updated annually and disabilities reviewed every five years.
- 5 The data deficiencies faced in this Review have led to an interim assessment being recommended. Until such time as reliable and comparable data are available for all States to allow more targeted assessments to be made, updating the interim assessment to incorporate new data should not be done. It is possible that updating could create incentives to change

¹ Under the Act, the State population used for a particular financial year is the ABS estimate of the population as at 31 December of the previous calendar year.

definitions or data collection methods in an attempt to affect State grant shares. Retaining the historical data would avoid this possibility.

- 6 However, to make the grant distribution more relevant to the year in which it is applied, it should be adjusted annually to reflect changes in State shares of the Australian population. This could be done by applying the per person relativities derived from the relative maintenance expenditures calculated by the approach recommended in this report to the estimated State populations as at 31 December of the calendar year immediately prior to the financial year when the distribution will be applied. This would be consistent with the approach for allocating the general purpose funds among the States for local government.

FUTURE WORK

- 7 The State shares of maintenance expenditure recommended in this report are interim ones only. More work needs to be done to allow more of the influences that affect local road maintenance expenditure to be taken into account.
- 8 This Review has been hampered by the lack of reliable and consistent local road data across States. If governments want local road grants to be allocated across States in a more rigorous way, which better reflects differences in State relative needs, substantial improvements in data related to roads are essential. Resources will need to be committed to ensuring that consistent and comparable national data are available on:
 - the length of local roads for each State, with ‘a local road’ defined consistently across States;
 - the number and deck area of bridges on local roads with ‘a bridge’ defined consistently across States;
 - estimates of local road use in each State; and
 - the maintenance expenditure by local governing bodies on local roads and bridges on local roads in each State.
- 9 The Commission notes that a National Transport Data Framework was developed as a partnership between DOTARS and the ABS to support AusLink and is being reviewed by State transport ministers. We also note that the ALGA has two data improvement projects in progress (the National Local Road Data System and the National Local Roads Information Project). These initiatives may provide a starting point for the necessary improvements. However, we consider that a comprehensive approach covering all roads and involving all stakeholders is necessary.
- 10 We recommend that a further review be undertaken to assess relative needs for maintenance expenditure on local roads in each State once reliable data for all States become available. If possible that review should complement the Commission’s 2010 review of how GST revenue should be distributed between the States so that there can be a consistent treatment of maintenance needs on local and arterial roads.

ATTACHMENT A

SUBMISSIONS RECEIVED BY THE COMMISSION

- 1 The Commission circulated an issues paper, *CGC 2005/2 Review of the Interstate Distribution of Local Road Grants*, in November 2005 to relevant Australian and State government departments, the local government grants commission in each State, the Australian Local Government Association and each State local government association. The local government associations were asked to co-ordinate contributions on behalf of their members. It also circulated the *Draft report for the review of the interstate distribution of local road grants* in May 2006 to the same agencies and associations.
- 2 The issues paper and draft report were also placed on the Commission's web site www.cgc.gov.au.
- 3 A total of 17 submissions were received in response to the issues report and 12 submissions were received in response to the draft report. Those submissions were placed on the Commission's web site. The submissions are listed below.

SUBMISSIONS RECEIVED IN RESPONSE TO ISSUES PAPER CGC 2005/2

- LRG/SUB/01 Victoria Grants Commission/Victorian Government — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/02 Western Australian Local Government Grants Commission/Western Australian Government — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/03 Tasmanian Treasury — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/04 Queensland Government — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/05 South Australian Government — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006

- LRG/SUB/06 Local Government and Shires Associations of New South Wales — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/07 Local Government Association of South Australia — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/08 Local Government Association of Tasmania — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/09 Municipal Association of Victoria — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/10 Withdrawn
- LRG/SUB/11 Department of Transport and Regional Services — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/12 Local Government Association of Queensland — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/13 Western Australian Local Government Association — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/14 Local Government Association of the Northern Territory — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/15 City of Boroondara Council — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/16 Northern Territory Government — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/17 New South Wales Treasury — Review of the Interstate Distribution of Local Road Grants 2006 — January 2006
- LRG/SUB/18 ACT Treasury — Review of the Interstate Distribution of Local Road Grants 2006 — February 2006

SUBMISSIONS RECEIVED IN RESPONSE TO THE DRAFT REPORT

- LRG/SUB/19 Municipal Association of Victoria — Review of the Interstate Distribution of Local Roads Grants — May 2006
- LRG/SUB/20 ACT Treasury — Draft report for the review of the interstate distribution of local road grants — May 2006
- LRG/SUB/21 Local Government and Shires Associations of New South Wales — Draft report for the review of the interstate distribution of local road grants — May 2006
- LRG/SUB/22 Queensland Treasury and the Local Government Association of Queensland (Joint Submission) — Draft report for the review of the interstate distribution of local road grants — May 2006
- LRG/SUB/23 Northern Territory Treasury — Draft report for the review of the interstate distribution of local road grants — May 2006
- LRG/SUB/24 Municipal Association of Victoria — Supplementary submission — Analysis of the regression models outlined in the draft report — Draft report for the review of the interstate distribution of local road grants — May 2006

- LRG/SUB/25 Local Government Association of South Australia — Identified local road grants — SA position —Draft report for the review of the interstate distribution of local road grants — June 2006
- LRG/SUB/26 Western Australia Treasury — Draft report for the review of the interstate distribution of local road grants — June 2006
- LRG/SUB/27 Western Australia Treasury — Draft report for the review of the interstate distribution of local road grants — Supplementary submission relating to the regression models — June 2006
- LRG/SUB/28 Northern Territory Treasury — Draft report for the review of the interstate distribution of local road grants — Supplementary submission on ARRB Report — June 2006
- LRG/SUB/29 Western Australia Treasury — Draft report for the review of the interstate distribution of local road grants — Comments on the ARRB Report — June 2006
- LRG/SUB/30 Municipal Association of Victoria — Future local road data improvement strategy — June 2006

ATTACHMENT B

REPRESENTATION AT THE CONFERENCE

- 1 The Commission held a conference on 18 May 2006 in its offices in Braddon, ACT, to discuss the draft report for the Review. Representatives of the parties to the Review who attended the conference are listed below.

Name	Organisation
Karl Cloos	ACT Department of Urban Services (Roads ACT)
Roger Broughton	ACT Treasury
John Purcell	ACT Treasury
Andrew Phillip	ACT Treasury
John Pritchard	Australian Local Government Association
Barry O'Neill	Department of Transport and Regional Services
Roger Gottlob	Department of Transport and Regional Services
Prue Digby	Department of Victorian Communities, Victoria
Richard Connors	Local Government and Shires Associations of New South Wales
Alan Morton	Local Government Association of Queensland
Chris Russell	Local Government Association of South Australia
Bev Barber	Local Government Association of South Australia
Allan Garcia	Local Government Association of Tasmania
Peter McLinden	Local Government Association of the Northern Territory
John Hennessy	Municipal Association of Victoria
Owen Harvey-Beavis	Municipal Association of Victoria
Bruce Wright	New South Wales Local Government Grants Commission
Tim North	New South Wales Treasury
Anhi Vong	Northern Territory Treasury

Lynn Sawtell	Queensland Local Government Grants Commission
Laurie Ehrenberg	Queensland Treasury
Jane Gascoigne	South Australian Local Government Grants Commission
Kim Besharati	Tasmanian Treasury
Colin Morrison	Victoria Grants Commission
Debbie Terelinck	Western Australian Local Government Association
Alex Scherini	Western Australian Treasury
Keith Wignall	Western Australian Treasury

ATTACHMENT C

OBTAINING CONSISTENT AND RELIABLE DATA

INTRODUCTION

- 1 To assess expenditure on local road maintenance, the Commission required data that allow the important causes of needs to be measured in a comparable and reliable way for all States.
- 2 The data required include:
 - expenditure on maintenance of local roads and bridges;
 - total length of local road along with length of local road by the type of local road or location of the local road;
 - measures of road use;
 - bridge data; and
 - other indicators, such as population and area of States and local governing bodies.
- 3 Data were collected from many sources including local government grants commissions, the ACT Department of Urban Services, DOTARS, Austroads, ARRB, PSMA and ABS.

LOCAL ROAD MAINTENANCE EXPENDITURE

- 4 Estimates of expenditure by local governing bodies in each State on the maintenance of local roads are needed to:
 - put the total grant amounts in the context of actual expenditure;
 - put components of the expenditure (for example, expenditure on bridges) into context;
 - provide average per person figures for use in the State level average standard approach;
 - use as the variable to be explained in the regression analysis; and
 - allow actual and assessed expenditure for each State to be compared.

- 5 The data required were expenditure by local governing bodies on the maintenance of local roads and bridges. Therefore, it should exclude expenditure by local governing bodies on new construction or upgrading of existing roads and on ancillary work.
- 6 There are two sources of expenditure data:
- local government grants commissions, which collect data annually from local governing bodies; and
 - the ABS Government Finance Statistics (GFS) collection.

Local Government Grants Commissions — reported expenditure

- 7 Local government grants commissions provided the Commission with details of expenditure by local governing bodies on local roads and bridges for 2002-03, 2003-04 and 2004-05.
- 8 The data were generally consistent and comparable for local authorities in each State. But, there were some inconsistencies across the States in how the data were categorised, collated and reported, such as:
- possible inconsistencies between States in the definition of a local road were likely to be reflected in expenditure on local road maintenance;
 - the scope and definition of ‘maintenance’ was not fully consistent across States, and there was not always a clear and consistent distinction between maintenance and renewal, upgrading and other capital expenditure;
 - the scope and definition of ‘road expenditure’ was not fully consistent across States, with some variation in the scope of ancillary work (such as kerbing, drainage, lighting, footpaths, and traffic control and road safety measures) included; and
 - the method of allocating administrative and overhead expenses to maintenance tasks was not explicitly revealed in the data definitions, but most States said those expenses were included.
- 9 Consequently, some adjustments were made to the data to improve the consistency across States. The adjustments made are outlined below.
- 10 **New South Wales.** Expenditure was provided by local governing bodies as a single figure for each road type and described as ‘Operating Expenses’. It was not dissected into maintenance, ancillary work, upgrading and new capital expenditure.
- Based on the information for Victoria, Western Australia and South Australia that provided sufficient data to measure the relative size of maintenance to operating expenses, 75 per cent of the total expenditure was considered to have been due to road and bridge maintenance or renewal.
- 11 **Victoria.** Data reported by council were dissected into expenditure on:
- existing assets:
 - maintenance;

- capital renewal; and
- capital upgrade;
- new assets:
 - capital expansion.

Only expenditure classified as maintenance and capital renewal for existing assets was included in estimated expenditure.

12 **Queensland.** Local roads expenditure data were classified as maintenance, renewal and capital for sealed and unsealed roads. Only expenditure classified as maintenance and renewal was included.

13 **Western Australia.** Local road expenditure data was classified as:

- existing (maintenance and renewal); and
- new roads (capital upgrade and capital expansion).

Only expenditure classified as 'existing' was included.

14 **South Australia.** Expenditure data were classified as:

- sealed roads:
 - maintenance;
 - capital renewal;
 - upgrade; and
 - capital expansion;
- unsealed roads:
 - existing assets; and
 - new assets.

Only expenditure on maintenance and capital renewal for sealed roads and expenditure on existing assets for unsealed roads was included.

15 **Tasmania.** Maintenance expenditure data were provided by the Tasmanian Treasury and classified as:

- operating expenses — material and contracts;
- wages and salaries, superannuation, other employee expenses;
- depreciation; and
- other expenses.

Expenses classified as depreciation were excluded.

Expenditure on bridge maintenance was said to be included in the total figures, but it could not be separately identified.

To help overcome that deficiency, the Local Government Association of Tasmania provided data on bridge expenditure for 15 Tasmanian local governing bodies.

- 16 **Australian Capital Territory.** Data were provided by the ACT Department of Urban Services for a number of road related categories, including separately identified Local Road Maintenance, and Bridge and Culvert Maintenance. Administration overhead costs were provided separately and allocated to categories on the basis of direct expenditure.
- 17 **Northern Territory.** The data provided were labelled as either ‘Total road expenditure’ or ‘Total maintenance costs’. In some cases there were obvious discrepancies in the allocations between maintenance and total expenditure. Expenditure on bridge maintenance was understood to be included in the total figures, but it could not be separately identified. Data were provided for 2003-04 only.
- 18 **State Expenditure Summary.** Not all local governing bodies provided data for maintenance expenditure. Total expenditure was estimated for these local governing bodies. We first obtained the average expenditure per person for the location (that is, urban, rural and remote) within the State for the council¹. This average expenditure per person was multiplied by the population of the council.
- 19 A summary of the 2003-04 data is in Table C-1. A comparison of total maintenance expenditure by local government in each State on local roads and bridges in 2002-03, 2003-04 and 2004-05 is in Table C-2.

Table C-1 Local government grants commission estimates of local road maintenance expenditure, by State, 2003-04

		NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Maintenance expenditure ^(a)										
Local roads	(\$m)	515.7	344.2	328.5	246.5	170.1	na	9.6	na	na
Bridges	(\$m)	24.4	14.9	16.5	5.1	2.2	na	1.0	na	na
Total	(\$m)	540.1	359.0	345.0	251.6	172.3	39.9	10.6	16.0	1 734.7
Bridges as a proportion of total expenditure	(%)	4.5	4.1	4.8	2.0	1.3	na	9.3	na	3.8 ^(b)
Total expenditure per km	(\$/km)	3 756	2 780	2 338	2 046	2 289	2 837	5 779	1 137	2 674
Total expenditure per person	(\$/person)	80	72	89	127	112	83	33	81	86

(a) Expenditure data for some States were adjusted by the Commission to improve consistency.

(b) National average excludes Tasmania and the Northern Territory.

Source: Expenditure data from local government grants commissions; Tasmanian Department of Treasury and Finance; and the ACT Department of Urban Services. Road length data provided by DOTARS and the ACT Department of Urban Services. State population from ABS *Australian Demographic Statistics*, Cat. No. 3101.0, Dec 2003.

¹ This could not be calculated for the Indigenous local governing bodies in South Australia as they are the only local governing bodies in South Australia to be classified as remote. For these local governing bodies, the average expenditure per person for remote local governing bodies in Western Australia was used.

- 20 Expenditure on bridges could not be fully separated from expenditure on local roads for Tasmania and the Northern Territory. Expenditure on bridges for some local governing bodies in Tasmania suggested that bridges account for about 10 per cent of total maintenance expenditure in Tasmania.
- 21 In terms of simple indicators, the data for 2003-04 show a range across the States:
- total expenditure per kilometre ranges from \$1 137 (Northern Territory) to \$5 779 (ACT); and
 - total expenditure per person ranges from \$33 (ACT) to \$127 (Western Australia).
- 22 Maintenance expenditure for each State for 2002-03 to 2004-05 is shown in Table C-2.

Table C-2 Total road maintenance expenditure 2002-03 to 2004-05

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT ^(a)	Aust
	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m
2002-03	541.2	364.3	315.2	251.8	167.9	40.5	8.1	16.0	1 705.1
2003-04	540.1	359.0	345.0	251.6	172.3	39.9	10.6	16.0	1 734.7
2004-05	547.6	392.1	412.9	262.5	196.7	44.0	12.0	16.0	1 883.8

(a) Maintenance expenditure for the Northern Territory is constant for the three years because data were available only for 2003-04.

Source: Local government grants commissions; Tasmanian Department of Treasury and Finance; and the ACT Department of Urban Services.

Australian Bureau of Statistics (Government Finance Statistics)

- 23 The ABS provides estimates of expenditure and revenue, classified by level of government and the purpose of the expenditure in its Government Finance Statistics².
- 24 The ABS provided the Commission with unpublished data on expenditure by local governments in each State on 'road maintenance' and 'road transport nec' for the six years to 2003-04.
- 25 The Commission uses ABS GFS expenditure data in its assessments of State expenditure for the distribution of GST revenue. However, after examining the data from the ABS and the local government grants commissions, the Commission decided to use the local government grants commission data for this Review because:
- in recent years, the ABS has relied heavily on the local government grants commissions for data on the local government sector in each State;
 - the ABS data appear to include capital expenditure and expenditure on work done on behalf of the State, which was not relevant to this Review — total expenditure for all States identified by ABS for 2003-04 was much larger than estimates based on local government grants commission data (\$4 432 million compared with \$2 513 million for

² ABS *Government Finance Statistics*, Cat. No. 5512.0

total expenditure on local roads and \$1 735 million for expenditure on local road maintenance); and

- the local government grants commission data could be dissected by individual local governing bodies and by groups of local governing bodies in each State.

LOCAL ROAD LENGTH

- 26 Under many of the models examined, the length of local roads is an important determinant of the expenditure each State might incur in providing a standard level of local road maintenance services.
- 27 Potential sources of data on road length include:
- local government grants commissions;
 - Austroads; and
 - the graphical information systems held by PSMA.

Local government grants commissions

- 28 Local government grants commissions collect local road length data from local governing bodies for use in distributing the local road and the general purpose components of the financial assistance grants between local governing bodies in their State.
- 29 The level of detail collected varies, with some grants commissions obtaining detailed data on local road length by traffic volume and by road surface type. Some grants commissions check their information by undertaking on-site audits of road length or by interrogating data from graphical information systems showing roads in the State.
- 30 While each local government grants commission appears to apply a consistent definition of local roads in their State, a consistent definition is not applied across States. It appears that the data reflects each State's policies on the allocation of responsibility for roads between the State and local government.
- 31 There is also uncertainty as to whether grants commissions have information on all local roads in their State. For example, the Western Australian Local Government Grants Commission advised the Commission of an extra 2 900 km of local roads which it wanted included in the length of local roads. These local roads were described as 'Aboriginal access roads. Local governments have not accepted responsibility for them because they do not have the resources to maintain them'³.

³ Letter from Chairman, WA Local Government Grants Commission to Secretary, Commonwealth Grants Commission, 20 March 2006.

State Road Authorities as reported by Austroads

- 32 Austroads collates road length data for each State and publishes them in its *RoadFacts* publication⁴. Austroads relies on data from State Road Authorities, which in turn often rely on local government grants commissions for data on local roads.
- 33 The Commission has used Austroads data in its assessment of State expenditure on arterial roads. However, the Commission has concerns about the interstate comparability of the data and decided to hold arterial road lengths constant using data for 2001 until those concerns are overcome.
- 34 One way of estimating the local road length for each State would be to start with the total road length figures for each State from Austroads' *RoadFacts 2005* (which reflect road lengths in 2003) and subtract the length of national highways and State arterials used in the 2006 Update (which reflects road lengths in 2001). This should give estimates that include all identified roads and avoid double-counting by treating them as either State or local roads.
- 35 Table C-3 provides an estimate of 'local road length' using this approach.

Table C-3 Estimating local road length using Austroads data

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	km	km	km	km	km	km	km	Km	km
Total road length ^(a)	182 007	153 010	181 304	148 851	96 574	24 596	2 645	23 985	812 974
LESS									
National highways ^(b)	3 105	1 004	4 188	4 648	2 750	320	20	2 670	18 705
State arterials ^(b)	33 558	21 230	21 246	20 334	9 557	2 884	765	4 128	113 682
State managed local roads ^(c)	2 962	66			10 221			15 416	28 665
Estimated local road length	142 382	130 710	155 870	123 869	74 046	21 392	1 860	1 771	651 902

(a) Austroads *RoadFacts 2005*, Table 2.3.

(b) Figures used by the Commonwealth Grants Commission in 2006 Update based on Austroads *RoadFacts 2000* (including 2002 updates).

(c) Local roads in unincorporated areas in New South Wales, Victoria, South Australia and the Northern Territory managed by the State. The Northern Territory estimate includes approximately 1 425 km in National Parks.

Source: Austroads *RoadFacts 2005*, Table 2.3; Commonwealth Grants Commission 2006 Update, State Road Authority Annual Reports, Victoria Grants Commission, Northern Territory Treasury.

- 36 However, those estimates have shortcomings and would need further adjustments before they could be used for this Review. Specifically:
- the approach attributes all changes in road length to local roads;
 - local roads in unincorporated areas that are the responsibility of States need to be identified and classified as State roads; and

⁴ Austroads *RoadFacts 2005* is available from www.austroads.com.au

- the figures for total road length in the Northern Territory are inappropriate because a footnote to the relevant table in *RoadFacts 2005* states:
The data as supplied above are for roads managed by the Northern Territory Government and exclude roads owned or managed by other authorities, that is, Private, Aboriginal, Local Government and Parks Australia North.

37 This last issue suggests that the Austroads data in *RoadFacts 2005* may not be consistently defined across States.

Public Sector Mapping Agencies (PSMA)

38 The Commission sought data from the PSMA on road length by type of road by State. It understood that a uniform set of definitions of road types was applied across graphical information systems and that these systems contained information about roads provided by the States. The Commission expected to obtain consistent estimates of local road length for all States using this approach.

39 However, there were some substantial differences between the road lengths for States and individual local governing authorities obtained from PSMA and those provided by Austroads and the local government grants commissions.

40 There appear to be differences in the scope of roads included in each set of data, but there was not a consistent pattern in the differences — in some States the total length of roads provided by PSMA was higher than that from the other sources but in others it was lower. Those differences could not be explained without extensive investigations of the detail in each data set. The Commission concluded that the PSMA data could not be used in assessments for this Review.

The preferred measure of local road length

41 Table C-4 compares the three sets of figures for the length of local roads in each State (those based on local government grants commission, Austroads and PSMA data).

42 The table shows discrepancies between the local government grants commission data and the estimates derived from Austroads data for Queensland, Tasmania and the Northern Territory.

- The difference for Queensland may be because the figure derived from Austroads data includes some district roads for which the State government is financially responsible but which would be treated as local roads in other States. The PSMA figure may include some gazetted local roads that have not been constructed.
- The difference for Tasmania may be the inclusion of State forestry roads in the Austroads and PSMA estimates.
- The difference for the Northern Territory may be because the Austroads data cover only roads managed by the Northern Territory Government — they omit roads managed by local authorities.

Table C-4 Estimates of local road length by State by source

Source	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	km	km	km	km	km	km	km	km	km
Local government grants commissions ^(a)	143 782	129 171	147 522	122 993	74 316	14 079	1 837	14 108	647 808
Derived from Austroads ^(b)	142 382	130 710	155 870	123 869	74 046	21 392	1 860	1 771	651 902
PSMA ^(c)	107 483	107 826	222 100	143 515	63 332	21 426	2 239	1 758	669 679

- (a) DOTARS estimates based on information provided by local government grants commissions and the ACT Department of Urban Services.
- (b) See Table C-3.
- (c) Total of road lengths for PSMA road types 304 (collector roads) and 305 (local roads) and excluding local roads in unincorporated areas, State forests, national parks and reserves. For South Australia and the Northern Territory, the PSMA figure does not include the lengths of local roads in unincorporated areas that are the responsibility of local governing bodies.

- 43 The Commission concluded that the data reported by local government grants commissions are the most reliable measure available for the length of roads that are the responsibility of local government in each State.
- 44 Many participants in the 18 May 2006 Conference supported this conclusion. For example, the representative of the Queensland Local Government Association said that the local government grants commission data were a sufficiently accurate reflection of the roads for which local governments are responsible in each State to be used in our assessments.
- 45 Accepting that local road lengths reported by local government grants commissions are the most reliable data on the roads which are the responsibility of local government in each State does not necessarily mean that they are appropriate for policy neutral interstate comparisons.
- 46 Policy neutrality implies the roads are defined and measured in the same way in all States. It appears that there are differences across States in the roads for which local government is responsible and in the definition of local roads. The full extent of differences is not known.
- 47 However, if a policy neutral measure of local roads were required, estimates could be made by adjusting the local government grants commission data to overcome the larger interstate differences in the definition of local roads. Some of the adjustments that could be made are:
- include district roads in Queensland for which the State government is responsible but which would be treated as local roads in other States;
 - exclude roads in Queensland which are the responsibility of the Brisbane City Council but which would be treated as State arterials in other States;
 - include access roads to Indigenous communities in Western Australia for which local governing bodies in Western Australia have not accepted responsibility; and
 - exclude State forestry roads⁵.

⁵ At the Commission's Conference on the draft report for the Review, Tasmania argued that State forestry roads should be included in the length of local roads for this Review.

DEFINING CATEGORIES OF LOCAL ROADS

- 48 The work of local government grants commissions indicates that the type of road can have significant effects on the relative maintenance expenditures incurred. For instance, unformed or natural surface roads are an important component of local roads for some States but are given a relatively low per kilometre cost in asset preservation models⁶.
- Victoria has 21 378 km of natural surfaced roads⁷ — 16.6 per cent of total local road length for the State. In the Victoria Grants Commission asset preservation model, base funding of \$300 per km is provided for natural surfaced roads whereas \$2 000 per km is provided for unkerbed roads with less than 100 vehicles per day; and
 - Western Australia has 14 109 km of non-built-up unformed roads — 10.8 per cent of total local road length for the State. In the Western Australian Grants Commission asset preservation model, base funding of \$143 per km is provided for non-built-up unformed local roads, whereas \$929 per km is provided for non-built-up formed local roads and \$1 786 per km for non-built-up gravel roads.
- 49 When the definitions of the types of local roads are compared across States, it is apparent that local government grants commissions define the categories differently. Some make distinctions between roads in urban and rural areas, some between built-up and non-built-up areas, some between kerbed and unkerbed roads, some include categories based on traffic levels and there is usually a disaggregation by road surface type.
- 50 There is no direct compatibility between any two States. While several States include rural and urban or built-up and non-built-up categories, it cannot be assumed that they are defined the same way in each State.
- 51 If possible, account should be taken of the effects on maintenance expenditure of differences across the States in the types of local roads. Collecting data from all States according to one or other of the classifications used by local government grants commissions was not feasible. Therefore the Commission decided to categorise roads as local roads in urban, rural and remote areas.
- 52 Local roads could be categorised as urban, rural and remote in one of two ways:
- classify each length of local road as urban, rural or remote using criteria relating to the location of the road; and
 - classify each local governing body as urban, rural or remote using criteria relating to the characteristics of the local governing body and classify all local roads in each local governing body as urban, rural or remote according to the classification of the local body.

⁶ Note that in any assessment model based on (unweighted) actual local road length such as the indicator model, a kilometre of natural surfaced or unformed local roads is treated the same as a kilometre of sealed local roads.

⁷ The term ‘natural surfaced roads’ used by the Victoria Grants Commission includes unformed (not graded) as well as formed (periodically graded) local roads.

- 53 It was not feasible to obtain sufficient reliable data to classify roads on the basis of their location. Therefore local roads have been classified on the basis of the urban, rural or remote classification given to the local authority where they are located.
- 54 The Australian Classification of Local Governments (ACLG) has been used to classify local governing bodies. The ACLG allocates them to one of 22 categories using population, population density and the proportion of its area that is classified as urban⁸. The 22 ACLG categories are collapsed into three categories — urban, rural and remote. This involved treating local governing bodies:
- classified as Urban under the ACLG (13 categories) as urban;
 - classified as Rural Remote under the ACLG as remote (4 categories); and
 - the remaining local governing bodies (5 ACLG categories) as rural.
- 55 The advantage of using the ACLG to classify local governing bodies is that it facilitates analysis of links between local road expenditure and local road length, population and area using local government grants commission data for each local governing body.
- 56 Table C-5 shows the estimated length of roads that are the responsibility of local government in urban, rural and remote areas on this basis. Table C-6 shows the same information in proportional terms.

Table C-5 Local roads in urban, rural and remote locations, by State, 2003-04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	kms	kms	kms	kms	kms	kms	kms	kms	kms
Urban	53 717	75 085	38 082	17 225	11 793	4 126	1 837	1 145	203 010
Rural	86 788	54 086	74 734	76 273	62 523	9 953	0	756	365 113
Remote	3 277	0	34 706	29 495	994	0	0	12 207	80 679
Total	143 782	129 171	147 522	122 993	75 310	14 079	1 837	14 108	648 802

Source: Local road length data using the ACLG classifications and local government grants commission road length data.

Table C-6 Distribution of local roads across urban, rural and remote locations by State, 2003-04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Urban	37.4	58.1	25.8	14.0	15.7	29.3	100.0	8.1	31.3
Rural	60.4	41.9	50.7	62.0	83.0	70.7	0.0	5.4	56.3
Remote	2.3	0.0	23.5	24.0	1.3	0.0	0.0	86.5	12.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Local road length data using the ACLG classifications and local government grants commission road length data.

⁸ See Appendix F of DOTARS 2006, *Local Government National Report 2004-05* for a description of the ACLG and the classifications for all local governing bodies.

57 However, the data may not be policy neutral. For instance, differences between States in their policy on the size of local governing bodies could affect the comparisons of roads by location. That is, a State that has rural cities that cover a large area including some of the surrounding rural area would have all the local roads of those cities treated as urban, whereas a State with smaller local governing bodies or separate local authorities for the rural city and its surrounding area would have some roads treated as urban and some as rural. However, this is not expected to be an issue when using the ACLG categories to obtain State population by urban, rural and remote locations.

ROAD USE

58 The indicators of road use generally used in studies include numbers of vehicles travelling on roads and total vehicle kilometres travelled on roads. In many studies the number of vehicles and kilometres travelled are classified and weighted by vehicle type, because larger heavier vehicles cause more damage to roads (and hence lead to higher costs) than light vehicles. If road use measures are not available, population is often used as a proxy for road use.

59 In Australia, there is no comprehensive measurement of road use for local roads.

- The ABS annual *Survey of Motor Vehicles* estimates total vehicle kilometres travelled by State, for capital cities versus the rest of State, and for various vehicle types. But the survey report contains no information specifically for local roads.
- Local governing bodies may conduct traffic counts for their own requirements. While some local government grants commissions classify local roads by road use (based on traffic volume), others do not because of concerns about the reliability of the data.
- Austroads publishes data for total vehicle kilometres travelled by State and road type (highway, arterial and local). However, when local road use data from *RoadFacts 2005* were compared to road length, the results were hard to reconcile across States.

60 The other data on road use are from a project conducted in 2004 by ARRB in which it sampled 46 local governing bodies across Australia⁹. The ARRB study provided estimates of the proportion of travel on local roads by particular vehicle classes. The key findings from this study were:

- 39 per cent of travel for light vehicles was on local roads;
- 31 per cent of travel for medium vehicles was on local roads;
- 15 per cent of travel for heavy vehicles was on local roads; and
- 37 per cent of travel for all vehicles was on local roads.

61 The ARRB data can be used to make estimates of the use of local roads in each State by:

⁹ *Estimation Of Vehicle Kilometres Travelled On Arterial And Local Roads*, June 2004. ARRB report prepared for the National Transport Commission.

- expanding the road use observed in the local authorities sampled in each State to produce State level estimates of road use on local roads. For this to be appropriate, the local authorities sampled in each State need to be representative of that State; or
- apportioning the total kilometres travelled in each State by each type of vehicle from the ABS Survey of Motor Vehicles to local and other roads using the national level data on travel by vehicle class on local roads from the ARRB study. Such estimates assume that the proportion of travel on local roads is constant for all States, which is unlikely.

62 Table C-7 compares the three possible measures of local road use:

- vehicle kilometres travelled from the expanded results of the ARRB 2004 survey;
- vehicle kilometres travelled estimated by apportioning data from the ABS Survey of Motor Vehicles using ARRB data; and
- population;

63 In their report to the Commission, ARRB said that it had reservations about the road use measures it determined from its 2004 survey. This indicated that neither estimate of vehicle kilometres travelled would be sufficiently reliable to use in this Review. Therefore population has been used as a proxy for road use in our assessments.

Table C-7 Comparison of alternative measures of road use, 2003-04

		NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
ARRB survey estimates of local road usage ^(a)										
Estimated	(mvkt)	28 063	17 930	16 552	10 441	6 917	2 583	1 278	1 175	84 939
Distribution	(%)	33.0	21.1	19.5	12.3	8.1	3.0	1.5	1.4	100.0
Local road use using ABS survey and ARRB data ^(b)										
Estimated	(mvkt)	22 376	19 910	15 707	8 082	5 757	1 727	1 247	597	75 402
Distribution	(%)	29.7	26.4	20.8	10.7	7.6	2.3	1.7	0.8	100.0
Population ^(c)										
Estimated	('000)	6 803.0	5 052.4	4 001.0	2 028.7	1 546.3	487.2	326.7	204.5	20 449.8
Distribution	(%)	33.3	24.7	19.6	9.9	7.6	2.4	1.6	1.0	100.0

(a) Estimates provided by ARRB using survey results from *Estimation Of Vehicle Kilometres Travelled On Arterial And Local Roads*, June 2004.

(b) Based on *ABS Survey of Motor Vehicle Use*, Cat. No. 9208.0 for 12 months to 31 October 2004 and NTC report *Estimation of vehicle kilometres travelled on arterial and local roads*.

(c) State population from *ABS Australian Demographic Statistics*, Cat. No. 3101.0, Dec 2005.

BRIDGES ON LOCAL ROADS

64 The reference asks the Commission to assess the relative needs of local government for expenditure on local road maintenance and, to the extent practicable, bridges on local roads. The Commission asked local government grants commissions for details of expenditure on bridge maintenance by local governing bodies and the number of bridges on local roads.

- 65 Tasmania and the Northern Territory did not separate bridge maintenance expenditure from local road maintenance expenditure. The data on maintenance expenditure (see Table C-1) reveal that, on average, bridge maintenance was 3.8 per cent of the total road maintenance expenditure across the States that provided complete data. However, expenditure in the ACT was 9.3 per cent and data for some Tasmanian local governing bodies suggested that bridge maintenance could be about 10 per cent of maintenance expenditure in Tasmania.
- 66 All States, except the Northern Territory, provided the number of bridges. Some States also collected extra detail, such as bridge deck area, bridge length and construction material (timber, concrete or steel) for use in their assessments.
- 67 The Commission also obtained unpublished data on local bridges from Austroads and, as part of its consultancy, ARRB provided estimates of the number of bridges from its sources.
- 68 Data from the three sources are shown in Table C-8.

Table C-8 Bridges on local roads by State from different data sources

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	no.	no.	no.	no.	no.	no.	no.	no.	no.
Local government grants commissions	7 682 ^(a)	4 292 ^(a)	18 228 ^(b)	1 009 ^(c)	719 ^(a)	2 750 ^(d)	428 ^(e)	na	35 108
Austroads ^(f)	7 555	7 666	3 357	1 359	1 023	1 954	274	33	23 220
ARRB ^(g)	14 778	2 802	1 659	2 068	520	620	0	97	22 544

(a) Bridges and major culverts of six metres and over in length.

(b) Bridges and major culverts of six metres and over in length. There are 3 316 bridges.

(c) Includes footbridges but excludes culverts.

(d) Excludes bridges and precast pipe culverts less than 3 metres in length.

(e) Includes structures with a single span of diameter 1.8 metres or more or have a waterway area of 3 sq metres or more.

(f) Bridge data are unpublished and may reflect the responsibility in each State.

(g) ARRB said that these figures are for bridges only.

Source: Local government grants commissions, ACT Department of Urban Services, and Austroads unpublished data. ARRB report to the Commission at Attachment F.

- 69 There is a lack of consistency across the data sources and also between the States. This is due in part to inconsistency in the definition of bridges. The distinction between bridges and culverts is not applied consistently across States or collection agencies.

POPULATION

- 70 Population estimates for local governing bodies were obtained from DOTARS, which in turn obtained them from the local government grants commissions. Most local government grants commissions use ABS estimates of estimated resident population in their assessment models.
- 71 Estimates of State population were obtained from the ABS publications *Australian Demographic Statistics* (Cat. No. 3101.0) and *Regional Population Growth* (Cat. No. 3218.0).

72 Population data were used in all the assessment models examined for this Review. In some cases it was used as a proxy for road use and in other cases it provided a proxy for local road length when combined with a measure of area.

73 Table C-9 shows the various population estimates for each State used in this report.

Table C-9 State population^(a)

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	'000	'000	'000	'000	'000	'000	'000	'000	'000
Population in 2002-03	6 676.1	4 911.0	3 798.9	1 949.9	1 526.3	477.3	323.4	199.5	19 862.4
Population in 2003-04	6 714.9	4 965.5	3 885.9	1 978.1	1 533.2	482.2	324.1	198.1	20 082.0
Population in 2004-05	6 773.1	5 024.9	3 961.7	2 010.1	1 542.6	485.3	325.2	199.8	20 322.6

(a) Excludes population in the unincorporated areas of New South Wales, South Australia and the Northern Territory.
Source: Local government grants commissions and ABS *Regional Population Growth* Cat. No. 3218.0.

AREA

74 Area estimates for local governing bodies were obtained from DOTARS which in turn obtained them from the local government grants commissions. As indicated above, population and area are used as proxies of local road length in some assessment models.

ATTACHMENT D

ASSESSMENT METHODS CONSIDERED

- 1 The Commission considered assessing local government expenditure on local road maintenance using the following approaches:
 - indicator models;
 - the average standard State level approach; and
 - the average standard local government level (regression) approach.
- 2 This attachment describes the application of these methods and the results obtained using approaches the Commission did not recommend.

INDICATOR MODELS

- 3 An indicator model combining State population and local road length was supported by several submissions to the Review. The New South Wales and Queensland submissions supported an equal per person model, which is equivalent to a 100 per cent weight being given to population. The Victorian submission proposed that 20 per cent be given to local road lengths and 80 per cent to population. The South Australian submission proposed an equal weighting for State shares of population and local road length.
- 4 The Queensland Local Government Grants Commission uses an indicator model based on 62.85 per cent for road length and 37.15 per cent for population to allocate local roads grants among local authorities. Indicator models were also used in previous years by the Australian Government to allocate roads funds among States.
- 5 An indicator model may be appropriate when the indicators that are chosen have material effects on interstate differences in maintenance expenditure, they can be measured with an acceptable level of reliability and the quality of data for other indicators does not justify more sophisticated models.
- 6 Implicitly, the indicator models assume that:

- one of the following is true:
 - the cost of maintenance tasks is not materially affected by the type of local road — a local road in an urban area carrying a high traffic volume costs the same to maintain per kilometre as a local road in a remote area carrying irregular traffic; or
 - each State has approximately the same proportions of local roads in urban, rural and remote locations; or
 - the choice of type of road is a council decision and should not affect grant allocations;
 - road use depends primarily on the size of the local population — the impact of through traffic and freight transport on maintenance expenditure can be ignored;
 - there are no factors beyond the control of local governing bodies that have a materially different influence on local road expenditure between States (that is, disabilities such as climate, terrain, sub-soil condition have no material influence on expenditure); and
 - maintenance costs for bridges on local roads do not have a materially different effect on expenditure between States.
- 7 For this type of model, the choice of weights to attach to population and road length is important. Advice from ARRB on the relative importance of length and use on maintenance costs suggested weights of around 60 per cent for road length and 40 per cent for road use¹. These are the same as the weights used in the Commission’s assessment of maintenance costs for arterial roads. They also approximate the weights applied to road length and population by the Queensland Local Government Grants Commission².
- 8 The simplicity of these indicator models might have particular effects on the extreme case of the ACT. Almost all local roads in the ACT are urban local roads, which are more expensive to maintain than other roads. In other States, urban local roads make up less than 60 per cent of all local roads. This may lead to some underestimation of the ACT’s share³. The use of cost weighted local road lengths, obtained using the weights suggested by ARRB (see Attachments D and F), may be a preferable approach to the use of unweighted road length.
- 9 Table D-1 shows the State expenditure shares using an indicator model and applying the ARRB weights — that is, giving road length a 60 per cent weight and population a 40 per cent weight. Two models were estimated using:
- local road lengths and population; and
 - cost weighted local road lengths developed for the average standard model using the ARRB cost weight factors and population.

¹ See ARRB report at Attachment F.

² The Queensland Local Government Grants Commission provides 62.85 per cent of the local road grants according to local road length and 37.15 per cent according to population.

³ The Northern Territory is at the other extreme with 8.1 per cent of urban local roads.

Table D-1 Assessed local road expenditure under the indicator approach, 2003-04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Local road length shares	22.2	19.9	22.7	19.0	11.6	2.2	0.3	2.2	100.0
Cost weighted local road length shares	24.3	26.7	20.6	14.6	9.8	2.2	0.5	1.2	100.0
Population shares 2003-04	33.4	24.7	19.4	9.9	7.6	2.4	1.6	1.0	100.0
Maintenance expenditure shares	31.1	20.7	19.9	14.5	9.9	2.3	0.6	0.9	100.0
Assessed expenditure									
Local road length and population	26.7	21.8	21.4	15.3	10.0	2.3	0.8	1.7	100.0
Cost weighted local road length and population	28.0	25.9	20.1	12.7	9.0	2.3	1.0	1.1	100.0

Source: Population from local government grants commission data for 2003-04.

Local road length from DOTARS as advised by local government grants commissions and the ACT Department of Urban Services.

- 10 The indicator model is sensitive to the choice of cost weights for urban, rural and remote local roads and by implication the allocation of roads between urban, rural and remote. For instance, Victoria's share is increased by 4.1 percentage points by cost weighting and Western Australia's share is reduced by 2.6 percentage points. A one percentage point change in a State's share is equivalent to a change of \$5 million in local road grants.
- 11 An alternative to using the ARRB weights of 60 per cent for road length and 40 per cent for population is to estimate the weights using actual data. If expenditure on local road maintenance is assumed to be a good indicator of local road need, a regression model with maintenance expenditure regressed against road length and population can be estimated to find the weights that give the best fit to the data.
- 12 **Model I.** The regression model would have the following form:
- $$\text{ExpendS} = \alpha \times \text{RLengS} + (1 - \alpha) \times \text{PopS}$$
- or
- $$(\text{ExpendS} - \text{PopS}) = \alpha \times (\text{RLengS} - \text{PopS}) \quad (\text{I})$$
- where
- ExpendS = share of total expenditure on the maintenance of local roads
- RLengS = share of the total length of local road
- PopS = share of total population
- α is the parameter to be estimated and is the weight for local road length.
- 13 Three regression models were estimated:
- I1: using individual council data and regressing local road maintenance as a function of local road length and population;

- I2: using data for each State and regressing local road maintenance expenditure as a function of local road length and population; and
- I3: using data for each State and regressing local road maintenance expenditure as a function of cost weighted local road length and population.

14 Results of these regressions are shown in Table D-2.

Table D-2 Indicator models: estimating weights for road length and population using regression

Regression models	Weight for road length	Weight for population	Number of observations	R ² (a)
	%	%		
I1: Local governing bodies data	41	59	587	0.75
I2: State data using local road length and population	38	62	8	0.94
I3: State data using cost weighted local road lengths and population	36	64	8	0.95

(a) R² is calculated as the correlation between the share of expenditure and the estimated share of expenditure and then squared.

15 The weights for population in Table D-2 are the reverse of those recommended by ARRB.

16 The interstate distribution of grants implied for regression model I3 are given in Table D-3.

Table D-3 Assessed expenditure using an indicator model with weights estimated for regression model I3

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Assessed expenditure:									
Model I3	30.2	25.4	19.8	11.5	8.4	2.3	1.2	1.1	100.0

STATE LEVEL AVERAGE STANDARD APPROACH

17 The State level average standard approach is the approach the Commission uses for assessing State expenses on roads as part of the distribution of the GST revenue between States. A similar approach is used by the local government grants commissions of New South Wales and South Australia when assessing expenditure on roads for the allocation of the general purpose grants among local governing bodies.

18 The process for estimating shares using an average standard approach would be:

- Estimate the cost of an average level of maintenance services. This is done by estimating the average national expense per person, or per kilometre of local road⁴, incurred on

⁴ In the Commission's usual formulation of an average standard approach, the average would be an average per person.

- maintenance (that is, total maintenance expenses incurred by all local authorities divided by their total population or the total length of local roads). This average expense, called the ‘average standard’, implies the standard level of maintenance is an average of what is actually done in all local authorities.
- The assessments then proceed on the basis that spending the average amount would deliver the average road maintenance task in all States, unless there are identifiable factors (called disabilities) that cause:
 - more (or less) road maintenance work to be required in one State compared with the average; and
 - given tasks to cost more (or less) than the average amount.
 - Measure the disabilities that are conceptually relevant and material. The links between the disability and its impact on average expenses must also be determined. For instance, if terrain is a disability, measures of how terrain affects average expenses and measures of differences between States in their terrain are required.
 - Finally, determine the interstate distribution of local road expenses implied by the model.
- 19 The average standard approach assumes each local governing body makes a maintenance effort equal to the average of the work done by all local authorities. This approach avoids the need for judgments about the tasks to be performed, their desirable frequency and the standards to which they should be performed. The assessment task involves identifying and measuring the influences that affect the level, frequency and unit costs of maintenance tasks and determining how they affect expenses.
- 20 Box 1 shows the general form of the model used by the Commission to derive notional maintenance expenditure for local roads based on road characteristics. It assumes that the amount of maintenance work required results from two main causes:
- the length of the road, which affects the amount of routine work required to keep it in a serviceable condition regardless of the amount of use; and
 - the level of use of the road, which affects the wear and tear on the road.
- 21 Under this model, the cost of the maintenance tasks is affected by:
- whether the roads are in urban, rural or remote locations — in general, routine maintenance per kilometre on urban roads is more expensive than on rural and remote roads because of the higher quality of the roads and the more complex work required to maintain them and this is generally compounded by the effects of use; and
 - the climatic and geographic environment (such as soil type, terrain, rainfall and salinity) where the roads are located — some climatic conditions lead to faster deterioration of road surfaces and some geographic conditions lead to more frequent and complex work.

Box 1 Average standard approach: General form of model for local roads

Assessed expenditure per person for State i is assumed to be of the form⁵

$$= Epp \times [\delta \times RL_i + (1 - \delta) \times RU_i] \times PE_i$$

where

- Epp = total expenditure per person across all States
 δ = the proportion of expenditure due to road length
 $1 - \delta$ = the proportion of expenditure due to road use
 RL_i = the cost weighted road length for State i
 $= (URL_i \times URC + RUL_i \times RUC + REL_i \times REC)$
 URL_i = length of urban road in State i
 RUL_i = length of rural road in State i
 REL_i = length of remote roads in State i
URC = relative cost of maintaining a km of urban roads
RUC = relative cost of maintaining a km of rural roads
REC = relative cost of maintaining a km of remote roads
 RU_i = road usage for State i
 PE_i = physical environment factor for State i

22 The distribution of local roads by location used in the average standard model is in Table D-4.

Table D-4 Distribution of local roads across urban, rural and remote locations by State, 2003-04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
Urban	37.4	58.1	25.8	14.0	15.7	29.3	100.0	8.1	31.3
Rural	60.4	41.9	50.7	62.0	83.0	70.7	0.0	5.4	56.3
Remote	2.3	0.0	23.5	24.0	1.3	0.0	0.0	86.5	12.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Local road length data using the ACLG classifications and local government grants commission road length data.

23 **Parameters.** The following values for the parameters, recommended by ARRB⁶, were used:

- proportion of maintenance expenditure due to length (δ) = 0.60; and
- relative costs for urban: rural: remote roads (URC: RUC: REC) = 4.45: 1.63: 1.00.

24 **Local road use.** ARRB provided the Commission with estimates of local road use but said they were unreliable. For this assessment, population figures provided by local government grants commissions were used as the road use measure.

⁵ This is a simplified version of the equation for obtaining shares using the average standard approach. This equation shows the basic components of the model that we use.

⁶ Details of the parameters and factors recommended by ARRB are at Attachment F.

- 25 **Physical environment.** Physical environment factors were provided by ARRB for urban, rural and remote areas in each State. They reflect the influences on maintenance costs of:
- terrain;
 - soils;
 - climate; and
 - salinity.
- 26 The physical environment factors by urban, rural and remote location are in Table D-5. The State physical environment factor is a road length weighted average of the factors for the urban, rural and remote locations of the State. The road length weights used are in Table D-4.

Table D-5 Estimates of the relative effects of physical environment by State

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Urban	1.16	1.00	1.16	1.00	1.13	1.16	1.00	1.05	1.08
Rural	1.19	1.18	1.17	1.29	0.99	1.32	1.00	1.16	1.17
Remote	1.10	1.00	1.10	1.05	0.90	1.00	1.00	1.16	1.09
State ^(a)	1.18	1.08	1.15	1.19	1.01	1.27	1.00	1.15	1.14
State relative to Australia	1.04	0.95	1.01	1.05	0.89	1.12	0.88	1.01	1.00

(a) The State estimate is a weighted average based on the local road length for each location.

Source: ARRB — see Attachment F.

- 27 **Cost weighted road length.** Because there are differences in the costs of maintaining roads in urban, rural and remote areas, the relative need to incur maintenance expenditure is affected by the differences between States in the proportion of their road networks located in those areas. To allow for those needs, the first step in applying the State level average standard model was to calculate cost weighted road length for each State. This was calculated using the length of local roads in each State obtained from local government grants commissions, the distribution of local roads by region in Table D-4 and the relative costs per kilometre for urban, rural and remote roads.
- 28 Table D-6 provides the distribution across States and the per person relativities for local road length and cost weighted local road length. It shows that generally the more sparsely settled States (Northern Territory, Western Australia, Queensland and South Australia) have above average road lengths per person (a relativity greater than 1). Conversely, more densely settled States have below average road lengths (a relativity less than 1). The same pattern of outcomes arises for the cost weighted local road lengths, which allow for the higher per kilometre costs of maintaining roads in urban areas, although the range from the highest to the lowest relativity is reduced.

Table D-6 Distribution and per person relativities of local road length and cost weighted local road length by States, 2003-04

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Local road length									
Distribution (%)	22.2	19.9	22.7	19.0	11.6	2.2	0.3	2.2	100.0
Per person relativities ^(a)	0.6628	0.8052	1.1751	1.9245	1.5204	0.9037	0.1754	2.2043	1.0000
Cost weighted road length									
Distribution (%)	24.3	26.7	20.6	14.6	9.8	2.2	0.5	1.2	100.0
Per person relativities ^(a)	0.7268	1.0815	1.0668	1.4816	1.2888	0.9120	0.3207	1.1898	1.0000

(a) Population from local government grants commission data for 2003-04.

- 29 **Applying the average standard approach.** The model takes the total actual maintenance expenditure by all States (estimated as \$1 734.7 million in 2003-04) and calculates how much each State would have spent if they all provided the same standard of local road maintenance. It does so by combining the average maintenance expenditure per person, the cost weighted road length per person, road use per person, the proportions of maintenance costs attributable to road length and road use (60 per cent and 40 per cent respectively), and the physical environment factors using the formula in Box 1.
- 30 In this way, the model has taken into account the main factors that affect the cost of local road maintenance and which are beyond the control of States and local governing bodies.
- 31 Table D-7 provides the distribution of the assessed maintenance expenditure by State under this form of the average standard model. It also provides per person relativities that could be used to distribute a grant on the basis of the assessed expenditure.

Table D-7 Assessed local roads expenditure under the average standard approach

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Shares of assessed expenditure 2003-04	29.0	24.6	20.5	13.4	8.0	2.6	0.8	1.1	100.0
Per person relativities ^(a)	0.8685	0.9960	1.0570	1.3569	1.0473	1.0647	0.5227	1.1323	1.0000

(a) Population from local government grants commissions for 2003-04 data.

THE LOCAL GOVERNMENT LEVEL APPROACH USING REGRESSION

- 32 In these models, expenditure on local road maintenance, provided by each local governing body to their local government grants commissions, was regressed against variables such as area and population⁷.
- 33 These models were generally built on the hypothesis that:
- local road maintenance expenditure is a function of the length of local roads and their use;

⁷ In the regression models, expenditure is measured in dollars, area in square kilometres and population in number of people.

- the length of local roads needed by a local governing body is broadly determined by the size of the task which would be related to its area and population; and
- the use of local roads for a local governing body is broadly determined by its population.

34 Area and population were favoured as explanatory variables in these models because consistent estimates of these variables are available.

35 **Model R.** The regression models estimated had the following general form:

$$\text{Expend/PE} = \alpha \times \text{Pop}^{\beta} \times \text{Area}^{\gamma} \quad (\text{R})$$

where

Expend = local road maintenance expenditure

PE = physical environment factor

Pop = population

Area = area

α , β and γ are parameters to be estimated.

36 This multiplicative model was chosen because expenditure is not expected to be a linear function of area. Estimates of β and γ in this model are expected to be positive with a value less than 1. Under this assumption, a 1 per cent increase in population while holding area constant, increases expenditure by γ per cent. This would mean that expenditure would increase with increases in population but the rate of increase would reduce as population increases which is in line with expectations about the impacts of economies of scale.

37 In this model, the physical environment factor is used to remove the effects of the physical environment from expenditure before it is regressed against area and population. The physical environment factors used are those determined by ARRB and applied for the urban, rural and remote locations in a State.

38 Model R is estimated using linear regression by transforming both sides of the equation using natural logarithms. That is:

$$\text{Ln}(\text{Expend/PE}) = \text{Ln}(\alpha) + \beta \times \text{Ln}(\text{Pop}) + \gamma \times \text{Ln}(\text{Area})$$

39 This relationship was estimated using data for:

- individual local governing bodies;
- local governing bodies grouped within a State according to their ACLG classification⁸ — resulting in up to 22 groups per State; and
- local governing bodies grouped into urban, rural and remote locations within a State based on their ACLG classifications⁹ — resulting in up to 3 groups per State.

⁸ The ACLG is described in Appendix F of the *2004-05 Local Government National Report*.

⁹ To convert the ACLG categories to urban, rural and remote, local governing bodies classified under ACLG as 'rural remote' were treated as remote and the remainder of those classified as 'rural' were treated as rural. Those classified as 'urban' were treated as urban.

- 40 Grouping of local governing bodies was done to reduce the impact State decisions on the structure of local government would have on the estimates. However, by grouping local governing bodies some of the ‘richness’ that was available in the data was lost. From our analysis, using the local governing bodies grouped according to their ACLG categories provided a reasonable compromise that removes much of the effect of differences in policy on the structure of local authorities but retains some of the data qualities. Grouping local governing bodies into urban, rural and remote locations within a State was not preferred because it severely reduced the number of observations available for estimation.
- 41 Attachment C explains the adjustments the Commission made to local government grants commission data to obtain more consistent estimates of local road maintenance expenditure. Data were not available for some local governing bodies — for instance, where local road expenditure was not available or where local governing bodies had no defined area. Data for individual local governing bodies were combined to obtain the grouped data.
- 42 Estimation of this equation using data for individual local governing bodies showed that the model under-estimated expenditure for local governing bodies that had high maintenance expenditure. The under-estimation occurred for about 80 local governing bodies with local road maintenance expenditure greater than \$5 million. They were predominantly in New South Wales, Victoria and Queensland. This indicated that factors other than area and population were influencing expenditure for these local governing bodies.
- 43 For many of the local governing bodies with high maintenance expenditure, their resident population appeared to underestimate their need for local road maintenance — possibly because it does not adequately capture the effects of an important influence on road use. In some cases, this could be put down to the nature of the activities in the local governing body (for instance, capital city councils, regional centres and tourist destinations) but in other cases the reasons were less clear.
- 44 Alternative specifications of the model were applied in an attempt to overcome the underestimation. For instance, rate revenue and the value of commercial and industrial properties for local governing bodies were used as additional explanatory variables without addressing the under-estimation.
- 45 Using these results would have under-estimated the expenditure needs for those States with many of these local governing bodies with high expenditure and over-estimated the expenditure needs for those States with few high expenditure local governing bodies.
- 46 We estimated regressions with local governing bodies within a State grouped by their ACLG classification. In the preferred equation we allowed the coefficients to vary according to whether the grouped local authorities were urban, rural or remote.

47 The preferred regression model had the following form:

$$\begin{aligned} \text{Ln}(\text{Expend}/\text{PE}) = & \alpha_0 + \beta_0 \times \text{Ln}(\text{Pop}) + \gamma_0 \times \text{Ln}(\text{Area}) + \\ & \alpha_1 \times \text{Ru_D} + \beta_1 \times \text{Ru_Ln}(\text{Pop}) + \gamma_1 \times \text{Ru_Ln}(\text{Area}) + \\ & \alpha_2 \times \text{Re_D} + \beta_2 \times \text{Re_Ln}(\text{Pop}) + \gamma_2 \times \text{Re_Ln}(\text{Area}) + \\ & \delta_1 \times \text{Vic_D} + \delta_2 \times \text{Qld_D} + \delta_3 \times \text{WA_D} + \delta_4 \times \text{SA_D} + \\ & \delta_5 \times \text{Tas_D} \end{aligned}$$

where

Ru_D is 1 for rural councils and 0 otherwise;

Re_D is 1 for remote councils and 0 otherwise;

Ru_Ln(Pop) is Ln(Pop) for rural councils and 0 otherwise;

Ru_Ln(Area) is Ln(Area) for rural councils and 0 otherwise;

Re_Ln(Pop) and Re_Ln(Area) are defined similarly for remote councils;

Vic_D is -1 for NSW councils, +1 for Victorian councils and 0 otherwise;

Qld_D, WA_D, SA_D and Tas_D are defined similarly; and

α_i , β_i , γ_i and δ_i are parameters to be estimated.

48 Based on the model for the average standard approach, the relationship between expenditure, area and population using the grouped data was expected to vary according to location. For this reason, different regression coefficients were assumed to apply for urban, rural and remote locations. In the model above, for rural councils α_1 is the intercept shift, β_1 is the slope shift for Ln(Pop) and γ_1 is the slope shift for Ln(Area). This means, for instance, that the coefficient for Ln(Pop) for urban councils is β_0 but for rural councils is $(\beta_0 + \beta_1)$.

49 To allow for potential State specific effects in the regression model, such as the differential effects of service standards, special State dummy variables were included which were specified in such a way that the intercept α_0 can be regarded as a 'national intercept' for urban councils. For instance, δ_1 is the shift away from the national intercept for Victorian councils in the model above. The value of the intercept for New South Wales urban councils is

$$(\alpha_0 - \delta_1 - \delta_2 - \delta_3 - \delta_4 - \delta_5)$$

50 Using 2003-04 data, the estimated regression model was:

Coefficient		Coefficient estimate	t Statistic
α_0	National intercept	8.10	10.42
α_1	Intercept shift for rural	-1.40	-1.08
α_2	Intercept shift for remote	-2.37	-0.97
β_0	Slope of Ln(Pop) for urban	0.63	9.22
β_1	Ln(Pop) slope shift for rural	-0.05	-0.43
β_2	Ln(Pop) slope shift for remote	-0.24	-1.30
γ_0	Slope of Ln(Area) for urban	0.07	1.93
γ_1	Ln(Area) slope shift for rural	0.23	2.11
γ_2	Ln(Area) slope shift for remote	0.41	1.95
δ_1	Intercept shift for Victoria	0.14	1.14
δ_2	Intercept shift for Queensland	0.01	0.05
δ_3	Intercept shift for Western Australia	0.16	1.38
δ_4	Intercept shift for South Australia	0.23	1.66
δ_5	Intercept shift for Tasmania	-0.63	-3.66

Number of observations = 88

$R^2 = 0.83$

51 These results suggest:

- population and area are both significant explanatory variables;
- there is a significant positive shift in the coefficient of area for rural and remote locations;
and
- there is only a significant State effect for Tasmania (lower than the national average) — that is, the national intercept is appropriate for all States except Tasmania.

52 The coefficients for Ln(Pop) and Ln(Area) in all locations are positive and less than 1. Based on the size of the parameter estimates, the regression indicates that population is important in explaining expenditure in all locations, that its effect in urban and rural are almost the same but its impact appears less important in remote areas. As expected, area is less important in explaining expenditure in urban locations but is important in rural locations and more important in remote locations.

53 Although the estimated model sought to explain actual expenditure, the primary aim of the regression analysis was to estimate State shares of expenditure under an equalisation framework. The model is intended to approximate the expenditure for each group of local governing bodies if they provided an average level of local road maintenance services. That is, State differences in service standards should be ignored and assessed expenditure should relate to the current circumstances of States. The use of the 'national intercept' permits

estimates of expenditure to be calculated that are free from the State policy differences assumed to be captured by the special State dummies, that is, the estimated State effects can be suppressed in deriving assessed expenditure based on ‘average policy’.

- 54 These estimates of assessed expenditure were obtained using grouped data based on ACLG for all local governing bodies in each State, the ACT and the Northern Territory.
- 55 Before estimates of expenditure could be obtained for ACLG categories in the Northern Territory, a notional area had to be assigned to local governing bodies in unincorporated areas which do not have a designated land area (mostly Indigenous community councils). This was done by assuming that the relationship between road length and area observed in other Northern Territory remote area councils applied to these community councils¹⁰.
- 56 The estimated expenditure shares using this model are in Table D-8.

Table D-8 Assessed local roads expenditure under the indicators approach using regression

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Assessed expenditure shares 2003-04	29.0	18.2	22.5	14.0	8.8	4.5	1.2	1.8	100.0
Per person relativities ^(a)	0.8670	0.7381	1.1610	1.4252	1.1486	1.8542	0.7621	1.8293	1.0000

(a) Population from local government grants commission data for 2003-04.

¹⁰ For the 26 remote Northern Territory local governing bodies with no reported area, we multiplied their local road length by 15.1 to obtain a notional area. The Local Government Association Trust Account also has no population. We calculated a notional population by multiplying its local road length by 4.15.

ATTACHMENT E

THE PREFERRED ASSESSMENT APPROACH

AN AVERAGE STANDARD APPROACH BASED ON POPULATION LOCATION

- 1 The Commission's preferred assessment is the average standard approach applied to location. It is simpler, requires fewer assumptions and uses more reliable data than the State level average standard approach.
- 2 Local governing bodies were classified as urban, rural and remote according to their ACLG (see Attachment C). A national average expenditure per person (an average standard) was assessed for each location. These average standards recognise the different maintenance needs of urban, rural and remote local governing bodies. A State's requirement for local road funding is based on the average expenditures and the number of people it has in urban, rural and remote areas.
- 3 The average standards were calculated using local road maintenance expenditure and population data collected by the local government grants commissions. Table E-1 shows the average standards for urban, rural and local councils for three years: 2002-03, 2003-04 and 2004-05. For the same period, Table E-2 shows the number of people in each location in each State.
- 4 An alternative to using population as the basis of assessment is to use local road length. Local road length was considered but not adopted because of concerns about the appropriateness of the ACLG classification for calculating local road length by location and State particularly for urban locations.
- 5 To provide the average level of road maintenance services in each location, each State is assessed to need to spend the same amount per person for each resident in that location. The calculation applies the relevant average standard (from Table E-1) to the number of residents in each location (from Table E-2). A State's assessed expenditure is the sum of these amounts. Table E-3 shows States' assessed expenditure for each year and their share of total assessed expenditures. A State's requirement for local roads funding is proportional to its share of total assessed expenditure.

Table E-1 National averages of expenditure on local road maintenance per person by location for 2002-03, 2003-04 and 2004-05

Location	2002-03	2003-04	2004-05
	\$ per person	\$ per person	\$ per person
Urban	65.45	64.25	68.90
Rural	241.63	247.43	276.42
Remote	356.26	389.72	390.51

Source: Unpublished local government grants commission data and ABS *Regional Population Growth*, Cat. No. 3218.0.

Table E-2 Population by location by State for 2002-03, 2003-04 and 2004-05

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	'000	'000	'000	'000	'000	'000	'000	'000	'000
2002-03									
Urban	6 067.5	4 650.4	3 286.1	1 628.5	1 238.8	334.7	323.4	136.2	17 665.6
Rural	601.2	260.5	478.2	261.7	279.8	142.6	-	16.1	2 040.1
Remote	7.5	-	34.5	59.8	7.7	-	-	47.2	156.8
Total	6 676.1	4 911.0	3 798.9	1 949.9	1 526.3	477.3	323.4	199.5	19 862.4
2003-04									
Urban	6 106.9	4 609.8	3 368.7	1 654.2	1 243.4	338.5	324.1	133.6	17 779.2
Rural	600.5	355.7	482.9	263.3	281.6	143.7	-	16.0	2 143.6
Remote	7.4	-	34.4	60.6	8.2	-	-	48.6	159.1
Total	6 714.9	4 965.5	3 885.9	1 978.1	1 533.2	482.2	324.1	198.1	20 082.0
2004-05									
Urban	6 244.6	4 665.4	3 439.2	1 680.8	1 250.2	341.0	325.2	134.5	18 080.9
Rural	521.1	359.4	488.5	267.9	284.1	144.3	-	16.2	2 081.5
Remote	7.4	-	34.0	61.4	8.2	-	-	49.2	160.2
Total	6 773.1	5 024.9	3 961.7	2 010.1	1 542.6	485.3	325.2	199.8	20 322.6

Source: Unpublished local government grants commission data and ABS *Regional Population Growth*, Cat. No. 3218.0.

Table E-3 Distribution of assessed local road maintenance expenditure across States for 2002-03, 2003-04 and 2004-05

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
	%	%	%	%	%	%	%	%	%
2002-03	32.0	21.5	20.1	11.2	8.9	3.3	1.2	1.7	100.0
2003-04	31.4	22.1	20.1	11.2	8.8	3.3	1.2	1.8	100.0
2004-05	30.6	22.3	20.5	11.4	8.9	3.4	1.2	1.7	100.0
Average share	31.3	22.0	20.2	11.3	8.9	3.3	1.2	1.8	100.0

Source: Commonwealth Grants Commission.

- 6 Per person relativities can be calculated by comparing States' assessed expenditure shares (from Table E-3) with their population shares. Table E-4 provides the per person relativities for each year and an average for the three years.

Table E-4 Per person relativities implied by the distribution of assessed local road maintenance expenditure across States for 2002-03, 2003-04 and 2004-05

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
2002-03	0.9511	0.8713	1.0516	1.1417	1.1558	1.3756	0.7625	1.7299	1.0000
2003-04	0.9376	0.8957	1.0406	1.1414	1.1533	1.3759	0.7438	1.8383	1.0000
2004-05	0.9194	0.9035	1.0492	1.1477	1.1741	1.4088	0.7433	1.7787	1.0000
Average relativity	0.9360	0.8902	1.0471	1.1436	1.1611	1.3868	0.7499	1.7823	1.0000

Source: Commonwealth Grants Commission.

ATTACHMENT F

INTERSTATE DISTRIBUTION OF LOCAL ROADS GRANTS: ADVICE ON FACTORS INFLUENCING LOCAL ROADS EXPENDITURE (ARRB GROUP LTD)

AND ADDENDUM

by Tim Martin and George Giummarra

for Commonwealth Grants Commission

VC72147 - June 2006

Interstate distribution of local roads grants: advice on factors influencing local roads expenditure

for Commonwealth Grants Commission

	Reviewed
Project Leader	Tim Martin
Quality Manager	George Giummarra

VC72147 - June 2006

Summary

Scope

The Commonwealth Grants Commission (CGC) sought expert advice covering all States regarding the relationships that apply on average to the following tasks:

1. the relative effects of local road length and local road use on maintenance costs
2. the relative cost of maintaining local roads to an average standard in urban, rural and remote areas
3. identifying the environmental factors that impact on maintaining local roads, providing a means of measuring these factors and quantitatively assessing how much these factors impact on maintenance costs across States
4. the costs of maintaining bridges on local roads.

The above advice was required to be fully documented and supported, including any relevant data sources.

Advice

Task 1: relative effects of road length and road use on maintenance costs

Analytical

Analysis indicated that the estimates for the relative effects of road length and road use on maintenance costs vary depending on the underlying assumptions used for the estimating the base maintenance costs, road use factors and the relationship adopted between the state maintenance expenditure and the relative effects of road length and road use.

The base maintenance costs supplied by the local government grants commissions were particularly high for urban roads, while the cost relativities between the remote and rural roads were almost the same as those found for the Victorian base maintenance costs. Consequently, in terms of reliability and acceptability, the Victorian base cost maintenance costs were considered to be a better estimate of maintenance costs because they were subject to an extensive review within Victoria. Provided the cost relativities for national highway maintenance between States for local roads are reliable, these Victorian estimates are currently the best available and should therefore be used as the basis for the estimates of the relative effects of road length and road use on maintenance costs.

The adjustments to allow for relative road use suggest that the VKT/day estimates at a State level are not reliable and there are some concerns generally about the road length estimates of the local road types in the States/Territories. The use of relative road use adjustments with respect to State/Territory road use is preferable because it appears to provide plausible results notwithstanding concern about the road use data.

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Consequently, estimates of these effects using the Victorian base maintenance costs as related by an equation with independent parameters for relative road length and relative road use (adjusted with respect to State/Territory road use) is preferred. This equation has the best fit (r^2) to the maintenance expenditure data and has relatively high statistical significance compared to the CGC's equation, although neither equation is statistically significant because the data is limited to the actual number of States/Territories. The preferred equation estimates that 0.55 is the relative effect of road length and 0.34 is the relative effect of road use influencing maintenance expenditure to the States.

Engineering assessment of the relative effect of road use on maintenance costs

A review of the variation of the base rural and urban maintenance costs with traffic levels and load using an engineering approach to quantify their variation was undertaken to compare the outcome with the analytical approach. This approach estimated that some 33% of the base rural and urban maintenance costs vary with traffic. This outcome compares with the factor of 0.34 for the relative effect of road use on the maintenance of roads in the equation with independent parameters for relative road length and relative road use.

Assessment of CGC equation for maintenance expenditure

The CGC equation coefficients, α , for relative road length effects and $(1 - \alpha)$ for relative road use effects were calculated from estimates of maintenance for each State/Territory. This approach, as noted earlier, has the limitation of having only 8 samples because this is the total of the State/Territories. The equation with independent parameters for relative road length and relative road use is preferable to the CGC equation because it has higher 't' test and 'F' test values, although neither equations are statistically significant because of the limited number of samples.

The actual maintenance expenditure relationships developed for each State/Territory are a reasonable approach to estimating expenditure because they cover the variables likely to change from State to State. However, the major limitation of the preferred maintenance expenditure equation is the reliability of the input data needed for each State/Territory. Provided concerns about the reliability of these input variables (the road lengths for each road type, the base expenditure (\$/km) on these roads and the variations of local road use) are addressed, this maintenance expenditure equation for each State/Territory is sound from an engineering viewpoint.

Task 2: relative costs of maintaining local roads in urban, rural and remote areas

The Victorian base cost maintenance costs are a better estimate of maintenance costs, in terms of reliability, and were therefore used the basis for estimating the relative base cost of maintaining road in urban, rural and remote areas. The relativities for urban, rural and remote roads are 4.45: 1.63: 1.00, respectively. The main uncertainty is the relativity of the urban local road maintenance costs which would be nearly double the estimated relativity to remote roads if the maintenance cost data from the local government grants commissions was used.

Task 3: relative effects of environmental factors on the costs of maintaining local roads

Environmental factors were assigned to the urban, rural and remote roads in each State based on consideration of the separate impacts of terrain, soil stability, wet/dry effects and salinity factors. A table in the report summarises all these factors and provides an overall length weighted estimate for each State. The States with most adverse environmental effects are Tasmania and New South Wales followed equally by Queensland and the Northern Territory. The State with the least environmental effect is South Australia.

Task 4: costs of maintaining bridges on local roads

It is considered that the model for determining the relativities of bridge expenditure between States/Territories should take into account the following factors:

- bridge deck areas
- bridge types (concrete/steel and timber)
- applying a weighting factor (suggested 2) for timber bridges
- average bridge maintenance expenditure/state.

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Introduction

ARRB Group (ARRB) were invited by the Commonwealth Grants Commission (CGC) on the 13 February 2006 to submit a proposal outlining how ARRB would provide independent advice on the various factors that influence local roads maintenance expenditure across Australia. This report documents that advice.

Background

The Australian Government provides local road grants to local governments as part of the financial assistance grants program. The local road grants are initially allocated between States on the basis of fixed shares inherited from an earlier program. The Australia Government has asked the CGC to recommend an interstate distribution of local roads grants and to advise on how the interstate distribution might be updated for future years.

The CGC is required to base its recommended interstate distribution on the relative needs of local government to incur maintenance and preservation expenditure for local roads and, to the extent practicable, bridges. Local roads in unincorporated areas are to be excluded from the assessment.

The CGC's proposed approach in undertaking the review is documented in an Issues Paper released in November 2005 (CGC 2005). In assessing relative needs, the Commission takes into account those factors beyond the control of the States that cause it to spend more or less than the average to provide a similar level of service.

The Issues Paper outlined three possible approaches to assessing relative needs.

- an asset preservation or whole of life approach where the life-cycle cost for maintaining a range of road categories at set levels of service is estimated with the costs for each road type varying because of its traffic load, function, climate, terrain, subsoil conditions and length
- an average standard approach in which the nature of the tasks performed is implied by an average across all States of what is actually done in a year
- a notional service provision approach (NIEIR 2001) that weights the population in urban, rural and remote areas of each State by factors that allow for the level of road service provided (measured by road density) and the relative costs of road preservation costs in each area.

The above approaches have their relative merits and corresponding greater or lesser demands on data and other assumptions that are needed to reach a practical estimate of relative need.

The CGC assesses State expenditure on arterial roads as part of its analysis when it recommends the distribution of the GST revenue between States. For this assessment, it uses an average standard approach. The CGC is considering modifying this assessment model so that the model can be applied to an assessment of local roads needs at a State level.

2.1 CGC Brief

The CGC seeks expert advice covering all States regarding the relationships that apply on average to the following tasks:

1. the relative effects of local road length and local road use on maintenance costs
2. the relative cost of maintaining local roads to an average standard in urban, rural and remote areas

3. identifying the environmental factors that impact on maintaining local roads, providing a means of measuring these factors and quantitatively assessing how much these factors impact on maintenance costs across States
4. the costs of maintaining bridges on local roads

The above advice was required to be fully documented and supported, including any relevant data sources.

The Brief suggests that the CGC is keen to maintain its average standard approach, or relative needs approach, but is aware that the approach may need some modification to reflect the reality of how actual maintenance costs vary on local roads and bridges across Australia. It would be fair to say that any modifications need to be substantially supported, as best they can, but these modifications also need to be practical and robust for their implementation.

3 Approach to providing advice

3.1 General

The initial data collection involved estimation of the following from the statistical data available and other documented sources of information for the local urban, rural and remote roads in each State/Territory:

- the lengths (km) of these roads, further disaggregated into sealed and unsealed surfaces
- the basic cost of maintaining and preserving these roads (\$/km), accounting for the sealed and unsealed lengths of road
- the road usage, in terms of vehicle kilometres travelled (VKT/day), on these roads.

Further information was sought regarding climate effects through the use of various environmental factors for each State/Territory to allow for adjustment of the basic cost of maintaining and preserving the local urban, rural and remote roads.

Once the above information was assembled it was possible to estimate the total cost of maintaining the local roads in each State/Territory. This cost was then related to the CGC's process of allocating these costs to each State/Territory which allowed for the estimation of the relative effects of the length and usage of roads on the cost of maintaining and preserving them (Task 1).

3.2 Local road length estimation

The initial source used for estimates of the local rural and urban road lengths was Austroads (2000) and the initial source used for estimates of the local unsealed road lengths was the National Road Transport Commission (NRTC 1996). It was assumed that all the local urban roads were sealed in all States/Territories. According to the NRTC (1996), the ACT has approximately 60% of its local roads unsealed and these were assumed to be local rural unsealed roads, although the Austroads (2000) data suggests that most of these unsealed local roads are urban. It is likely that these local unsealed roads in the ACT were classified by Austroads as urban rather than rural because virtually all urban local roads in the ACT are sealed.

Table 1(a) shows the break up of the estimation of road lengths into sealed urban, unsealed rural/remote and sealed rural/remote roads. Table 1(b) shows the estimation of rural and remote sealed and unsealed road lengths. The unsealed lengths of the local rural/remote roads were taken as the sum of the various forms of unsealed road in Table 1.1 of NRTC (1996). This assumed that all unsealed roads are local roads. The separate lengths of rural and remote roads were estimated based on achieving the overall ratios of unsealed to sealed roads shown in Table 1(b), although

individual States/Territories have specific variations such as Victoria, ACT and Tasmania which were considered not to have any remote roads on the basis of their States' relative compactness. These overall ratios of unsealed to sealed roads were based on the unsealed to sealed road ratios found by sampling for local roads VKT (NTC 2004) which was appropriate at a broad national level.

The split between unsealed and sealed for rural and remote roads in Table 1(b) was based on the hypothesis that less than 33% of the length of rural roads would be sealed while less than 25% of the length of remote roads would be sealed. It was considered important to disaggregate these roads into sealed and unsealed length because of the significant difference in the costs of maintaining these different surfaces. The unsealed lengths were further split into unformed, formed and paved (gravel) surfaces to allow for the different costs of maintaining them.

The CGC also provided estimates of length for rural, remote and urban local roads from the local government grants commissions (LGGCs). These estimates are shown in Table 1(c) which is further split into sealed and unsealed portions for the rural and remote roads in Table 1(d) using the same disaggregating approach applied in Table 1(b).

There are substantial differences in the overall local road lengths provided by Austroads (2000) and NRTC (1996) and those provided by the LGGCs. This is particularly the case for the Northern Territory where the Austroads (2000) length of 24,462 km (Table 1(a)) is significantly higher than the 14,108 km (Table 1(c)) provided by the LGGCs. The overall Australian local road length provided by Austroads (2000) of 685,658 km (Table 1(a)) is also much higher than the 648,796 km (Table 1((c)) given by the LGGCs. These differences are most likely due to Austroads (2000) having included local road lengths in unincorporated areas, such as forest roads, that are the responsibility of State Governments.

There are also significant differences between the local road lengths of Austroads (2000) and the LGGCs with local roads classified as urban, rural and remote in all States. These differences are likely to be because the National Office of Local Government (NOLG 2003) categorises local governments into typical zones, such as urban, rural and remote, based on population, densities and the percentage of the local government area that is urban. In view of the discrepancies between the Austroads (2000) and the LGGCs estimates, it was decided to use the LGGCs estimates of local road length and their classification into as urban, rural and remote roads for overall consistency with CGC approaches. In addition, the local roads vehicle kilometres travelled (VKT) survey (NTC 2004) used the same classification approach to local government zones as NOLG.

Table 1(a): Urban, rural and remote local road lengths (Source: Austroads (2000), NRTC (1996))

Road type	NSW (km)	VIC. (km)	QLD (km)	WA (km)	SA (km)	TAS (km)	NT (km)	ACT (km)	Total (km)
Unsealed rural/remote	98200	90000	96500	95700	70100	8200	15310	1090	
Sealed rural/remote	25316	16100	42679	22115	6746	4740	9093	40	
Total Rural/Remote	123516	106100	139179	117815	76846	12940	24403	1130	600824
Urban local	21103	26400	14814	10469	7431	2728	59	725	(1030 u/s)
Total Rural/Remote/Urban	144619	132500	153993	128284	84277	15668	24462	1855	685658

Table 1(b): Urban, rural and remote local roads (sealed and unsealed lengths)

Road type	NSW (km)	VIC. (km)	QLD (km)	WA (km)	SA (km)	TAS (km)	NT (km)	ACT (km)	Total (km)
Rural local (average overall 0.797)	114016	106100	107869	80634	55346	12940	1903	1130	383914
Remote local (average overall 0.203)	9500	0	31310	37181	21500	0	22500	0	97845
Total Rural/Remote	123516	106100	139179	117815	76846	12940	24403	1130	600824
Rural local unsealed (average>0.67)	89650	90000	66755	60378	49675	8200	235	1090	
Rural local sealed (average<0.33)	24366	16100	41113	20256	5671	4740	1668	40	
Total Rural (sealed/unsealed)	114016	106100	107869	80634	55346	12940	1903	1130	
Remote local unsealed (>0.75)	8550	0	29745	35322	20425	0	15075	0	
Remote local sealed (<0.25)	950	0	1566	1859	1075	0	7425	0	
Total Remote (sealed/unsealed)	9500	0	31310	37181	21500	0	22500	0	
Urban local	21103	26400	14814	10469	7431	2728	59	725	(1030 u/s)
Total Rural/Remote/Urban	144619	132500	153993	128284	84277	15668	24462	1855	685658

Table 1(c): Urban, rural and remote local road lengths (Source: LGGCs)

Road type	NSW (km)	VIC. (km)	QLD (km)	WA (km)	SA (km)	TAS (km)	NT (km)	ACT (km)	Total (km)
Rural local (sealed/unsealed)	86788	54086	74731	76273	62523	9953	756	0	365110
Remote local (sealed/unsealed)	3277	0	34705	29495	994	0	12207	0	80678
Total Rural/Remote	90065	54086	109436	105768	63517	9953	12963	0	445788
Urban local (sealed)	53717	75085	38080	17225	11793	4126	1145	1837	203008
Total Rural/Remote/Urban	143782	129171	147516	122993	75310	14079	14108	1837	648796

Table 1(d): Rural and remote local road lengths (sealed and unsealed)

Road type	NSW (km)	VIC. (km)	QLD (km)	WA (km)	SA (km)	TAS (km)	NT (km)	ACT (km)	Total (km)
Rural local unsealed (average>0.67)	58148	36238	50070	51103	41890	6669	507	0	
Rural local sealed (average<0.33))	28640	17848	24661	25170	20633	3284	249	0	
Total Rural (sealed/unsealed)	86788	54086	74731	76273	62523	9953	756	0	365110
Remote local unsealed (>0.75)	2458	0	26029	22121	746	0	9155	0	
Remote local sealed (<0.25)	819	0	8676	7374	248	0	3052	0	
Total Remote (sealed/unsealed)	3277	0	34705	29495	994	0	12207	0	80678

3.3 Cost of maintenance and preservation

Two approaches were used to estimate the cost of maintaining and preserving local urban, rural and remote roads. These approaches were as follows:

- the well established and documented base costs of maintaining and preserving a range of local urban and rural roads in Victoria (Martin et al. 2003) and factor these costs by the relativities between Victoria and the other States that were found to occur for maintaining and rehabilitating the national highways (Martin and Michel 2003) to estimate the maintenance and preservation costs for all States/Territories other than Victoria
- accept the base costs for maintaining and preserving a range of road types provided by local government grants commissions.

In addition, the base costs for maintaining and preserving the various forms of unsealed roads provided by local government grants commissions were included in both the above approaches because the maintenance relativities between Victoria and the other States were only relevant for the sealed national highways. It was accepted that the maintenance of unsealed roads is relatively more influenced by local factors than those of sealed roads and the application of relativities to these roads would be difficult and inappropriate.

3.3.1 Using relativities to Victorian base costs (sealed roads)

Table 2 shows the conversion of the base cost rates for a range of traffic levels for Victorian local urban (see Figure 1) and rural roads (see Figure 2) into those for sealed urban, rural and remote roads that form the base for the relativities to be applied to the other States. This conversion involved the initial assumption that sealed remote roads annual average daily traffic (AADT) levels are less than or equal to 500, while sealed rural roads AADT levels range from 500 to greater than 1000. Other assumptions were used about the ratios between the maintenance rates for various traffic levels for the sealed local urban, rural and remote roads and are shown in Table 2. These ratios are based on the presumed distribution of traffic levels on these local roads. By implication, these distributions of traffic levels are regarded to hold for local roads in other States. Table 2 and Figure 1 and 2 also show that as the traffic levels increase so do the base maintenance costs.

Table 2: Sealed road maintenance rates derived from Victorian data

Road type & base rate AADT weighting	AADT Range	Road Type	Base Rate \$/km (Vic.)	Road Type (for relativities)	Base Rate \$/km (Vic.)
Remote length 3 × (i)	(i) < 100	Rural	2,000	Remote sealed	2,500
Remote length 1 × (ii)	(ii) 100 - 500	Rural	4,000		
Rural length 3 × (i), 2 × (ii), 1 × (iii)	(iii) 500 - 1000	Rural	4,900	Rural sealed	3,471
Rural length 1 × (iv)	(iv) > 1000	Rural	5,400		
Urban length 3 × (v)	(v) < 500	Urban	2,700	Urban sealed	4,371
Urban length 2 × (vi)	(vi) 500 - 1000	Urban	4,000		
Urban length 1 × (vii)	(vii) 1000 - 5000	Urban	5,500		
Urban length 1 × (viii)	(viii) > 5000	Urban	9,000		

The National Highways maintenance and rehabilitation cost relativities to other States/Territories was applied to the Victorian base maintenance rates for each range of traffic by assuming a typical rehabilitation treatment and thickness for that range of traffic for the rural and urban road types. The resulting relativities were then weighted or adjusted in the same way as the above conversion of the Victorian base rates into cost rates for sealed urban, rural and remote roads to give the relativities that apply for these road types in other States/Territories. Table 3(a) summarises the relativities for each sealed road type and traffic range for each State/Territory. Table 3(a) also shows the resulting weighted relativities for the sealed rural, remote and urban roads.

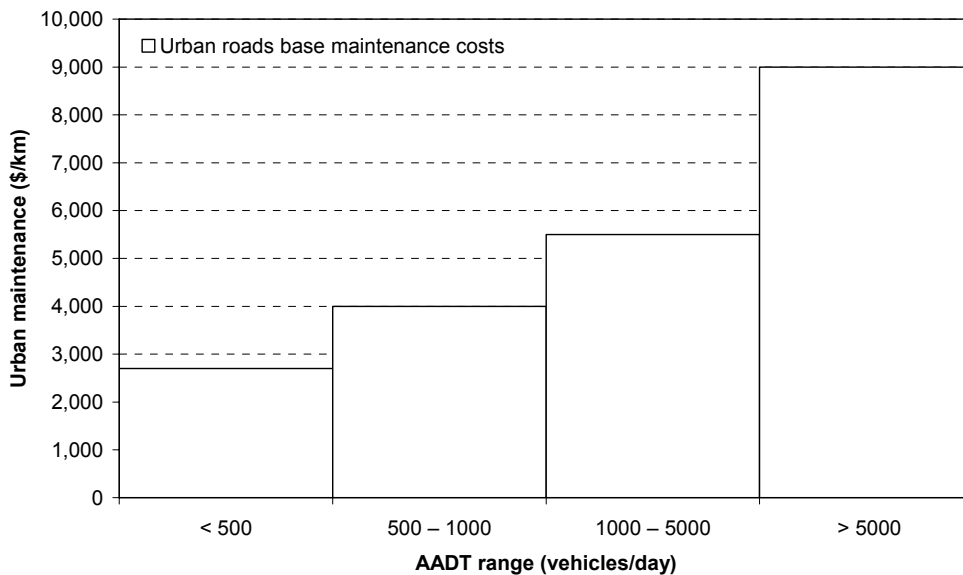


Figure 1: Urban local roads base maintenance costs (Victoria)

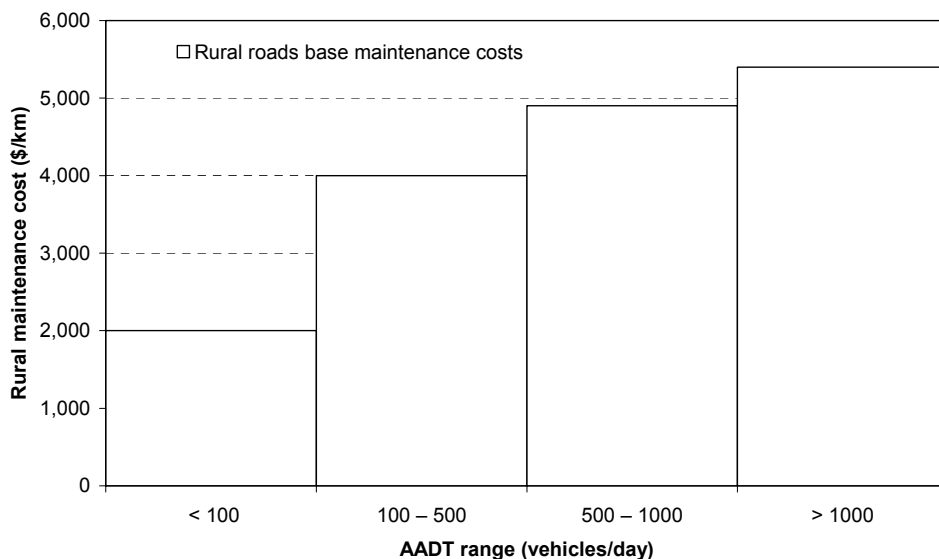


Figure 2: Rural local roads base maintenance costs (Victoria)

Cost of maintaining unsealed roads

The Grants Commissions from Queensland, Western Australia and South Australia provided the base costs of maintaining unformed, formed and gravel surfaced unsealed roads in their respective States. The Grants Commissions from New South Wales, Tasmania and Victoria provided the generic base costs of maintaining unsealed rural roads in their respective States without specific reference to the type of surface being maintained. These rates were accepted on their face value for unsealed rural roads in these States due to the lack of any other information. Table 4 shows the estimated rates for maintaining unsealed rural and remote roads in each State/Territory using this approach.

As a consequence of the above, Table 4 shows that the same base rate of maintenance for unsealed roads applied in New South Wales regardless of whether it was a rural or remote unsealed local road. The same rates used for the South Australian unsealed roads was applied to the Northern Territories unsealed roads because of the relative similarities in the rural and remote areas of these States.

Cost of maintaining rural, remote and urban roads (using relativities)

Using the maintenance costs estimated for rural, remote and urban sealed roads (Table 3(b)) combined with the maintenance costs estimated for the rural and remote unsealed roads (Table 4), the costs of maintaining rural and remote and urban roads were calculated by using the appropriate cost rate for the sealed and unsealed lengths of road in the rural and remote road categories (as provided in Table 1). Table 5 summarises these estimates for each State/Territory. Table 5 also provides an estimate of the relative cost of maintaining local roads in remote, rural and urban areas based on using a length weighted average of the costs for each State/Territory (Task 2).

Table 3(a): Estimated relativities from Victorian base (sealed roads)

Road types	AADT Range	Road Location	Base Rate \$/km (Vic)	Treat. (mm)	NSW		QLD		WA		SA		NT		TAS		ACT	
					Rel.	Wght Rel.	Rel.	WghtRel.	Rel.	Wght Rel.	Rel.	Wght Rel.	Rel.	Wght Rel.	Rel.	Wght Rel.		
Remote	< 100	Rural	2,000	100 rs ¹	0.79		0.84		0.84		0.79		0.66		0.78		0.79	
	100 - 500	Rural	4,000	135 rs	0.73		0.79		0.78		0.78		0.66		0.74		0.73	
	500 - 1000	Rural	4,900	165 rs	0.96	0.83	0.66	0.77	0.75	0.79	0.75	0.78	0.66	0.66	0.71	0.74	0.96	0.83
Rural	> 1000	Rural	5,400	200 rs	1.01	0.78	0.66	0.83	0.72	0.82	0.76	0.79	0.66	0.66	0.68	0.77	1.01	0.78
	< 500	Urban	2,700	135 rs	0.73		0.79		0.78		0.78		0.66		0.74		0.99	
				(or 35 as ²)														
Urban	500 - 1000	Urban	4,000	35 as	0.59	0.65	0.41	0.72	0.41	0.72	1.48	1.18	0.51	0.58	0.51	0.61	0.99	0.99
	1000 - 5000	Urban	5,500	35 as	0.59		0.92		0.92		1.48		0.51		0.51		0.99	
	> 5000	Urban	9,000	35 as	0.59		0.92		0.92		1.48		0.51		0.51		0.99	

Note: 1 rs = resheet (granular)
2 as = asphalt overlay or remove and replace

Table 3(b): Maintenance cost rates (based on relativities to Victorian sealed roads)

Maintenance rates (\$/km)	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban (sealed)	2841	4371	3147	3147	5158	2667	2535	2653
Rural (sealed)	2881	3471	2673	2742	2708	2569	2291	0
Remote (sealed)	1950	2500	2075	2050	1975	1850	1650	0

Table 4: Maintenance cost rates for unsealed roads

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Rural unsealed roads ¹	1349	300	1145	1036	535	480	535	0
Remote unsealed roads ²	1349	0	735	707	400	0	400	0

- Note: 1. Assuming 30% unformed (0.3), 30% formed (0.3) 40% paved (0.4), except for NSW, Vic., ACT and Tas.
2. Assuming 50% unformed (0.5), 30% formed (0.3) 20% paved (0.2), except for NSW, Vic., ACT and Tas.

Table 5: Maintenance costs for remote, rural and urban local roads (relative to Victorian base rates)

Road type (\$/km)	NSW	VIC	QLD	WA	SA	TAS	NT	ACT	Length Wght. ¹	Cost ratio ²
Urban	2,841	4,371	3,147	3,147	5,158	2,667	2,535	2,653	3618	4.45
Rural	1,672	779	1,725	1,377	768	1,241	2,106	2,881	1323	1.63
Remote	1,404	0	803	777	475	0	798	0	813	1.00

- Note: 1. Length weighted average of all States.
2. Cost ratio for relative effects of maintaining remote, rural and urban roads.

3.3.2 Using base costs from local government grants commissions (LGGCs)

Table 6 summarises the base maintenance costs supplied by the LGGCs after they were adjusted for the lengths of unsealed road in the remote and rural road categories in the same manner as that used for the maintenance costs in Table 5. In both cases the maintenance cost rates used for unsealed roads were the same.

Table 6: Maintenance costs for remote, rural and urban local roads (from LGGCs)

Road type (\$/km)	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT	Length Wght. ¹	Cost ratio ²
Urban	11219	4371	11177	7065	11605	21000	11605	5633	8499	8.09
Rural	1866	779	1971	1820	1032	5770	4687	0	1686	1.61
Remote	1572	0	823	915	627	0	1920	0	1050	1.00

- Note: 1. Length weighted average of all States.
2. Cost ratio for relative effects of maintaining remote, rural and urban roads.

Table 6 also provides an estimate of the relative cost of maintaining local roads in remote, rural and urban areas based on using a length weighted average of the costs for each State/Territory (Task 2). It should be noted that the length weighted average costs for maintaining urban roads, based on the maintenance costs supplied by the local government grants commissions, were nearly double those estimated relative to the Victorian cost rates (Table 5). In order to account for this disparity it is suspected that these urban local road cost rates may include the costs of maintaining features

other than pavement related costs. However, the cost relativities between remote and rural local roads appear to be virtually the same as shown when comparing the cost ratios in Tables 5 and 6.

In view of the above concern about the high relative cost of maintaining urban roads based on the rates supplied by the LGGCs, it was decided to use the sealed road base rates derived from Victoria and their relativities to the other States/Territories in assessing the relative effect of road length and road use on maintenance costs.

3.4 Usage of local roads

ARRB estimated for the National Transport Commission (NTC) the amount of vehicle kilometres travelled on both arterial and local roads in all States and Territories (NTC 2004). This estimation was made using a statistical sample (7%) of roads across Australia and included estimates of the proportions of light, medium and heavy vehicles on these roads.

3.4.1 State/Territory VKT/day estimates

Table A2 in the NTC (2004) report was used to estimate the VKT/day on each of the local road types in each State/Territory by factoring up the estimates given by the samples within each local government area category within each State/Territory. Table 7 summarises these results. The sampling and factoring process was considered appropriate for providing national level estimates of VKT/day on the types of local roads; however, it relied on gaining reasonably representative samples for each area and State/Territory which may not be adequate at a State/Territory level. Nevertheless the VKT/day estimates in Table 7 overall appear to reflect some of differences in local road use between the States and Territories.

Table 7 shows that on average urban local roads have nearly 60 times the levels of use (VKT/day) of remote local roads, while on average rural roads have over 13 times the levels of use of remote local roads. These are significantly different levels of use which could be expected to impact to some extent on the base maintenance costs.

3.4.2 Adjustment for relative road use

An adjustment for the relative usage on the costs of maintaining the various local road types in each State/Territory, based on the relativity to national averages, was proposed by using the following relationship:

$$\text{Relative usage factor, } r_{ij}, \text{ for road type, } i, \text{ in State, } j = \frac{\text{VKT/day for road type, } i, \text{ in State, } j / \text{road length road type, } i, \text{ in State, } j}{\frac{\sum \text{VKT/day for all road types, } i, \text{ in all States, } j}{\sum \text{length all road types, } i, \text{ in all States, } j}} \quad (1)$$

The above relationship was considered to reflect the relativities of local road use in each State/Territory when compared with total local road use. The VKT/day estimates for each road type in each State/Territory were divided by the road type road length in the numerator in equation (1) to effectively estimate the overall AADT for the road type in each State/Territory.

The AADT estimates based on this approach are shown in Table 8(a) and demonstrate the range of AADT relativities between the road types in each State/Territory. It should be noted that the Northern Territory AADT estimate for urban roads appears to be significantly higher than that for urban roads in other States/Territories. This is probably due to the relatively short length (1145 km) of Northern Territory urban local roads estimated in Table 1(c) and the probable lack of accuracy in the VKT/day estimates for each State/Territory. It is possible that the VKT/day estimate for the

Northern Territory is an overestimate because the VKT/day sampling for individual States was not extensive.

The factors estimated by equation (1) are shown in Table 8(b) and could be applied to the maintenance cost rates for each road type for each State/Territory to account for the impact of road use. The usage factors shown in Table 8(b) also demonstrate the range of the relativities that could be attributed to road use.

However, these factors also show that the use factor estimate for local urban roads in the Northern Territory to be significantly higher than that for the other urban local roads and as a consequence may lack credibility. Similarly, the use factor estimate for urban roads in the ACT is significantly higher than those in the other States for urban local roads. This may also be due to the relatively short length of urban roads (1837 km, see Table 1(c)) estimated for the ACT.

3.4.3 Alternative adjustment for relative road use

An alternative adjustment for the relative usage on the costs of maintaining the various local road types in each State/Territory, based on the relativity to road types across the States, was proposed by the following relationship:

$$\text{Relative usage factor, } r_{ij}, \text{ for road type, } i, \text{ in State, } j = \frac{\text{VKT/day for road type, } i, \text{ in State, } j / \text{road length road type, } i, \text{ in State, } j}{\sum \text{VKT/day for road type, } i, \text{ in all States, } j / \sum \text{length road type, } i, \text{ in all States, } j} \quad (2)$$

The above relationship was considered to reflect the relativities of local road use in each State/Territory when compared with local road use at a State/Territory level rather than total road use. Table 8(c) shows these use factors estimated by equation (2) for each State/Territory and road type. These factors also show the disparity of the Northern Territory's and the ACT's urban local roads use compared with the urban local roads in other States/Territories. The outcomes shown in Tables 8(a), 8(b) and 8(c) strongly suggest that the VKT/day estimates for each road type and State/Territory are not reliable along with the estimates of urban road length in the Northern Territory and the ACT.

Table 7: VKT/day estimates for each State/Territory

VKT/day	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT	Total	Aust. (wghtd) ¹	Use ratio ²
Urban	61370914	45341543	33513204	20935649	12972000	3877978	2353753	3467958	183832998	39149708	58.8
Rural	15376789	3780448	10887125	6824608	5839775	3198624	161741	34339	46103450	8862987	13.3
Remote	137892	0	947300	845918	139017	0	702431	0	2772558	665752	1.0
Total =	76885594	49121991	45347629	28606175	18950792	7076603	3217925	3502297	232709006	48678447	

- Note: 1. Length weighted average VKT/day of all States.
 2. Usage ratio for relative effects of road use on remote, rural and urban roads

Table 8(a): Overall AADT estimates for road types in each State

Road type	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT	Total
Urban	1142	604	880	1215	1100	940	2056	1888	906
Rural	177	70	146	89	93	321	214	0	126
Remote	42	0	27	29	140	0	58	0	34
Total	535	380	307	233	252	503	228	1907	359

Table 8(b): Relative usage factor, r_{ui} , for road types and States (relative to national average, equation (1))

Road type	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT	Total
Urban	3.19	1.68	2.45	3.39	3.07	2.62	5.73	5.26	2.53
Rural	0.49	0.19	0.41	0.25	0.26	0.90	0.60	0.00	0.35
Remote	0.12	0.00	0.08	0.08	0.39	0.00	0.16	0.00	0.10
Total	1.49	1.06	0.86	0.65	0.70	1.40	0.64	5.26	1.00

Table 8(c): Relative usage factor, ru_{ij} , for road types across States (equation (2))

Road type	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT	Total
Urban	0.69	0.37	0.53	0.74	0.67	0.57	1.24	1.14	1.00
Rural	0.90	0.36	0.74	0.46	0.48	1.64	1.09	0.00	1.00
Remote	0.51	0.00	0.33	0.35	1.70	0.00	0.70	0.00	1.00
Total	0.84	0.60	0.48	0.36	0.39	0.79	0.36	2.96	1.00

3.5 Environmental effects

Climatic and environmental effects were broadly considered in developing appropriate environmental factors for local roads in this context. The following factors influencing road maintenance costs were taken into account in developing environmental factors for each road type in each State/Territory.

- terrain factor (= 1.0 for flat and 1.1 for hilly)
- soil stability factor (= 1.0 for stable and 1.1 for unstable)
- wet/dry factor (= 0.9 for dry and 1.25 for wet)
- salinity factor (= 1.0 for non-saline and 1.33 for saline).

A broad assessment for each of the above factors was made on a State by State basis having regard to the location of the local roads in each State (Auslig 1992) and the location and distribution of the urban, rural and remote roads within each State.

3.5.1 Terrain factor

The general terrain for local urban rural and remote roads in each State/Territory was assessed from a broad perspective using Auslig (1992) and some local knowledge of local features, particularly those in the rural environment where the effect of terrain is significant over long lengths of road. The range adopted for the terrain factor (1.0 to 1.1) was similar to that used by the local government grants commissions (QLGGC 2005).

3.5.2 Soil stability factor

In some States/Territories, moisture sensitive subgrade soils beneath the pavement can be a significant cause of continual maintenance because of their alternate swelling and shrinking with changes in moisture content arising from seasonal variations in rainfall and sunshine. The States/Territories particularly susceptible to unstable subgrade soils (Robinson et al. 1999) are South Australia (Adelaide area), Northern Territory (Katherine area), Queensland (western regions), New South Wales (west of the dividing ranges) and Victoria (western plains). The assessment of the soil stability factor and its range (1.0 to 1.1) for the local road types in each State/Territory was made in conjunction with the advice from (Robinson et al. 1999) and Auslig (1992) for the location of the local roads and some local knowledge.

3.5.3 Wet/dry factor

This factor is essentially a combined climate index, based on rainfall, evaporation and soil suction, called the Thornthwaite Index (Thornthwaite 1948). It was estimated for Australia by the CSIRO (Aitchison and Richards 1965). High values (100+) of the Thornthwaite Index usually cause a relative increase in maintenance costs, while low values (-50) of the Thornthwaite Index usually cause a relative reduction in maintenance costs. The assessment of the wet/dry factor for the local road types in each State/Territory was made with reference to the Aitchison and Richards (1965) maps of Thornthwaite Index contours for Australia and Auslig (1992) for the location of the local roads. The range adopted for the wet/dry factor (0.9 to 1.25) was similar to that used by the local government grants commissions (QLGGC 2005).

3.5.4 Salinity

High levels of salinity in the subgrade are known to cause an increase in road maintenance costs (McRobert and Foley 1999). In order of increasing impact and extent of salinity on local roads are the following States: South Australia (irrigation areas), Victoria (irrigation areas), Western Australia

(irrigation areas) and New South Wales (irrigation areas). The assessment of the salinity factor for the local road types in each State was made with reference to Auslig (1992) for the location of the salinity affected areas and the local roads. The range adopted for the salinity factor (1.0 to 1.33) was similar to that used by the local government grants commissions (DLGRD 2005).

3.5.5 Outcomes

Table 9 summarises the environmental factors found for each road type in each State/Territory based on the factors found for terrain, soil stability, wet/dry and salinity. The factor for each road type was based on multiplying each of the individual factors. Table 9 also shows the overall environmental factor found for each State/Territory based on a length weighted average of the factors for each of the different road types in each State/Territory.

Table 9: Summary of environmental factors

Road Type	E, Environ.Factor	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT
Urban	terrain	1.10	1.00	1.05	1.00	1.03	1.05	1.00	1.00
	soil	1.00	1.00	1.00	1.00	1.10	1.00	1.00	1.00
	wet/dry	1.05	1.00	1.10	1.00	1.00	1.10	1.05	1.00
	salinity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	E_{urb}	1.16	1.00	1.16	1.00	1.13	1.16	1.05	1.00
Rural	terrain	1.05	1.02	1.01	1.00	1.00	1.10	1.00	1.00
	soil	1.03	1.05	1.05	1.02	1.00	1.00	1.05	1.00
	wet/dry	1.05	1.00	1.10	0.95	0.90	1.20	1.10	1.00
	salinity	1.15	1.05	1.00	1.10	1.00	1.00	1.00	1.00
	E_{rur}	1.31	1.12	1.17	1.07	0.90	1.32	1.16	1.00
Remote	terrain	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	soil	1.05	1.00	1.05	1.00	1.00	1.00	1.05	1.00
	wet/dry	1.00	1.00	1.05	1.00	0.90	1.00	1.10	1.00
	salinity	1.05	1.00	1.00	1.05	1.00	1.00	1.00	1.00
	E_{rem}	1.10	1.00	1.10	1.05	0.90	1.00	1.16	1.00
	E_{state}	1.24	1.05	1.15	1.05	0.94	1.27	1.15	1.00

3.6 Estimating maintenance costs per State/Territory

In order to estimate the relative effect of local road length and road use on the maintenance of roads, the maintenance cost of each road type in each State/Territory was initially estimated and summed to give the total maintenance cost for each State/Territory. This was undertaken as follows using several options:

$$M_{\text{state}i} = \sum_{\text{road type}_i} \text{road length type}_i \times \text{base rate (\$/km)} \text{ road type}_i \times r_{u_i} \text{ (road use factor)} \times E \quad (3a)$$

Equation (3a) uses a base rate for sealed road maintenance costs from Victoria, which are related to other States/Territories to form their base rates (see Table 5), and the unsealed maintenance costs supplied from the LGGCs (see Table 4). These base rates do not directly account for the separate impact of the environment, however, they do indirectly account for road use in that the increase in traffic levels is reflected by increased maintenance costs when the local roads range from remote to urban. This feature of these base costs may tend to mask the relative impact that road use has on maintenance costs. The road use factor, ru_i , in equation (3a) is based on equation (1) and implies that individual road types, particularly the urban roads, could be expected to have high increases in their base costs because of traffic effects (see Table 8(b)).

Alternatively, the other road use factor, ru_{ij} , from equation (2) can be used in place of ru_i , as follows:

$$M_{statei} = \sum_{\text{road type}_i} \text{road length type}_i \times \text{base rate (\$/km) road type}_i \times ru_{ij} \text{ (road use factor)} \times E \quad (3b)$$

Both equations (3a) and (3b) are based on using the Victorian base maintenance cost relativities and the LGGCs unsealed road maintenance costs, as noted above. The road use factor, ru_{ij} , in equation (3b) usually does not exceed unity, except for a few cases (see Table 8(c)), because the relativities are based on individual State/Territories and are not national. However, the actual variations in maintenance costs with traffic may not be well represented by using this road use factor.

If it is considered that the road use effects are not well quantified by using either equation (3a) or equation (3b), the following option, which excludes roads use effects for estimating the total maintenance cost for each State/Territory, is proposed:

$$M_{statei} = \sum_i \text{road length type}_i \times \text{base rate (\$/km) road type}_i \times E \text{ road type}_i \quad (3c)$$

where:

M_{statei}	=	total maintenance cost for each State/Territory, 'i'
road length type _i	=	road length, l_i of road type 'i'
base rate (\\$/km) road type _i	=	maintenance base rates for road type 'i' using Victorian base maintenance cost relativities (Table 5), C_{vici}
ru_i (road use factor)	=	road use factor defined by equation (1)
ru_{ij} (road use factor)	=	road use factor defined by equation (2)
E road type _i	=	environmental factor for road type 'i'.

3.7 Estimating relative effect of road length and road use on maintenance of local roads

3.7.1 Using a relationship between maintenance expenditures

As shown in Section 3.6, in order to estimate the relative effect of local road length and road use on the maintenance of roads, the total maintenance cost for each State/Territory, M_{statei} , was initially estimated by means of equations (3a), (3b) and (3c). These alternative estimates of the maintenance costs per State/Territory were then equated to the CGC's assessment model for each State's/Territories' assessed maintenance expenditure. The relative effect of local road length and road use was then estimated as follows based on the maintenance expenditure relationship supplied by the CGC (2006):

$$M_{statei} = \frac{\text{pop}_{statei}}{\sum \text{pop}_{statei}} \times E_{statei} \times \sum M_{statei} \times \left[\alpha \left(\frac{\sum l_i \times C_i}{\sum \text{pop}_{statei}} \right) / \left\{ \frac{\sum l_i \times C_i}{\sum \text{pop}_{statei (all)}} \right\} \right] + (1 - \alpha) \left(\frac{\sum \text{VKT}_{statei}}{\sum \text{pop}_{statei}} \right) / \left\{ \frac{\sum \text{VKT}_{statei (all)}}{\sum \text{pop}_{statei}} \right\} \quad (4)$$

where:

$$\begin{aligned}
 \alpha &= \text{portion of maintenance expenditure due to road length} \\
 (1 - \alpha) &= \text{assumed portion of maintenance expenditure due to road use} \\
 \text{pop}_{\text{state}i} &= \text{population of State 'i'}^1 \\
 \sum \text{pop}_{\text{state}i} &= \text{sum of population from all States 'i'} \\
 \sum l_i \times C_i &= \text{sum of expenditure on road lengths, 'l}_i\text{' , at expenditure rate } C_i \text{ for State 'i'} \\
 \sum l_i \times C_i \text{ (all)} &= \text{sum of expenditure on road lengths, 'l}_i\text{' , at expenditure rate } C_i \text{ for all States 'i'} \\
 \sum \text{VKT}_{\text{state}i} &= \text{sum of VKT/day on road types State 'i'} \\
 \sum \text{VKT}_{\text{state}i} \text{ (all)} &= \text{sum of VKT/day on road types for all States 'i'} \\
 E_{\text{state}i} &= \text{environmental factor for State 'i'} \\
 \sum M_{\text{state}i} &= \text{sum of maintenance expenditures for all States 'i'}
 \end{aligned}$$

other terms in equation (4) are as defined previously.

The following terms are grouped and redefined as follows:

$$\begin{aligned}
 M_{\text{ip}E} &= \text{pop}_{\text{state}i} / \sum \text{pop}_{\text{state}i} \times E_{\text{state}i} \times \sum M_{\text{state}i} \\
 \text{Rel. length} &= (\{ \sum l_i \times C_i / \sum \text{pop}_{\text{state}i} \} / \{ \sum l_i \times C_i \text{ (all)} / \sum \text{pop}_{\text{state}i} \}) \\
 \text{Rel. use} &= (\{ \sum \text{VKT}_{\text{state}i} / \sum \text{pop}_{\text{state}i} \} / \{ \sum \text{VKT}_{\text{state}i} \text{ (all)} / \sum \text{pop}_{\text{state}i} \})
 \end{aligned}$$

Equation (4) can therefore be simplified as follows and equated to equations 3(a), 3(b) and 3(c):

$$M_{\text{state}i} = M_{\text{ip}E} (\alpha \times \text{Rel. length} + (1 - \alpha) \times \text{Rel. use}) \quad (5)$$

In more general terms equation (5) can be expressed as:

$$M_{\text{state}i} = M_{\text{ip}E} (A \times \text{Rel. length} + B \times \text{Rel. use}) \quad (6)$$

where:

$$\begin{aligned}
 A &= \text{portion of maintenance expenditure due to road length} \\
 B &= \text{portion of maintenance expenditure due to road use}
 \end{aligned}$$

Equation (6) does not assume a connection between the coefficient, α , for the portion of expenditure due to road length and the coefficient for the portion of expenditure due to road use, $(1 - \alpha)$, as considered by equation (5). As noted in Section 3.6, there is a connection or correlation between road length and road use effects because road use effects are reflected in the base maintenance rates.

Estimates of the maintenance expenditure for each State/Territory, $M_{\text{state}i}$, were made based on equations (3a), (3b) and (3c) while corresponding estimates for each of these estimates of $M_{\text{state}i}$ were made for $M_{\text{ip}E}$, Rel. length and Rel. use for each State/Territory which are independent of equations (3a), (3b) and (3c). Once these terms were assembled it was possible to estimate the coefficients A, B and α in equations (5) and (6) by regression analyses (SPSS 2003) using the 8 individual samples of the estimates of $M_{\text{state}i}$, based on the various assumptions represented by equations (3a), (3b) and (3c). As a result there were some six estimates available for the relative effects of road length and road use using the three different approaches for estimating the maintenance expenditure for each State/Territory, $M_{\text{state}i}$, combined with the two different forms of expenditure relationship with road length and road use (equations (5) and (6)).

Table 10 summarises the results of the above analyses and Appendix A details the three different estimates of maintenance expenditure for each State/Territory, $M_{\text{state}i}$, and the corresponding three

¹ Population estimates based on Australian Bureau Statistics (2003) estimates.

estimates of M_{ipE} , Rel. length and Rel. use for each State/Territory. The six estimates for the relative effects of road length and road use range from -0.03 to 0.99 for road length and 0.01 to 0.90 for road use. Statistically significant independent variables are found for equations (5) and (6) based on the maintenance expenditure per State, M_{statei} , (equation (3b)) using the road use factor, ru_{ij} , from equation (2). Both equations (5) and (6) estimate that the relative effect of road use on maintenance expenditure is 0.34, while the relative effect of road length is estimated to vary from 0.55 to 0.66. This outcome suggests that despite the slightly different forms for the maintenance expenditure relationship (equations (5) and (6)), the relative effects of road use are estimated to be the same (0.34) while the relative effects of road length only vary from 0.55 to 0.66.

The advice to be adopted is discussed in Section 4.1.

3.7.2 Review of maintenance expenditure relationship for estimating relative effect of road length and road use

As equations (5) and (6) are based on the estimates of maintenance, M_{statei} , for each State/Territory, there can only be a total of 8 samples for developing either of these relationships. This is a limitation of this approach because the sampling is relatively small. Although the independent variables are significant ('t' test values > 2.2 and $p < 0.05$) where the road factor, ru_{ij} , from equation (2) is used in equation (3b), the limitation on the sample numbers means that neither of the two preferred relationships shown in bold in Table 10 is statistically significant ('F' < 4.5 and $p > 0.05$) despite their high goodness of fit (r^2) to the data. On the basis of having higher 't' test and 'F' test values, the equation (6) relationship is preferred. This equation, as noted earlier, does not assume a connection between the coefficient, α , for the portion of expenditure due to road length and the coefficient for the portion of expenditure due to road use ($1 - \alpha$) as used in equation (5).

There is also a theoretical concern with the use of equations (5) and (6). This concern is based on the fact that the estimates of maintenance, M_{statei} , for each State/Territory involve multiplying road, road use and environmental factors while equations (5) and (5) attempt to explain the State/Territory maintenance expenditure by a linear addition of relative road length and relative road use.

The actual maintenance expenditure relationships, M_{statei} , (equations (3a), (3b) and 3(c)) developed for each State/Territory are a reasonable approach to the estimate of the expenditure because they cover the variables likely to change from State to State. The major limitation of the preferred equation (3b) is the reliability of the input data needed for each State/Territory. However, provided concerns about the reliability of these input variables, that is, the road lengths for each road type, the base expenditure (\$/km) on these roads and the variations of local road use on these roads are addressed, the equation (3b) approach to estimating the expected maintenance expenditure for each State/Territory is sound from an engineering viewpoint.

Table 10: Summary of estimates for the relative effects of road length and road use

Case	Equation (5)				Equation (6)			
	$M_{statei} = M_{ipE} (\alpha \times \text{Rel. length} + (1 - \alpha) \times \text{Rel. use})$				$M_{statei} = M_{ipE} (A \times \text{Rel. length} + B \times \text{Rel. use})$			
	r^2	α	(1- α)	Comment	r^2	A	B	Comment
Victorian base & ru _j road use	0.92	0.11	0.89	α is <u>not</u> stat. signif.	0.97	-0.03	0.90	A is <u>not</u> stat. signif.
Victorian base & ru _{ij} road use	0.93	0.66	0.34	α is stat. signif.	0.97	0.55	0.34	A & B are stat. signif.
Victorian base	0.96	0.99	0.01	α is stat. signif.	0.99	0.88	0.014	B is <u>not</u> stat. signif.

3.7.3 Variation of maintenance cost with traffic

Another way of examining the impact of road use on maintenance costs is to review the variation of the base rural and urban maintenance with traffic levels, as noted in Sections 3.6 and 3.7.1 (see Figures 1 and 2). This approach is more based on engineering judgement than any relationship that can be established statistically between the various estimates of maintenance expenditure used in Section 3.7.1.

For rural local roads the base maintenance costs vary from \$2000/km to \$5400/km while the traffic varies from < 100 to > 1000 AADT (see Table 2) which suggests that typically \$3400/km varies with traffic or use. This is a maximum variation of 170% relative to the base maintenance cost of \$2000/km. Similarly for urban roads the base maintenance costs vary from \$2700/km to \$9000/km while the traffic varies from < 500 to > 5000 AADT (see Table 2) which suggests that typically \$4500/km varies with traffic or use. This is also a maximum variation of around 170% relative to the base maintenance cost of \$2700/km.

However, some of this variation should be treated as an increase in the fixed base maintenance cost with traffic. Table 11 (Martin and Michel 2003) shows that for sealed arterial roads the routine pavement related maintenance costs increase with traffic load and the increased maintenance standards associated with an increased traffic load range. When the routine maintenance costs are converted into \$/km they vary from a minimum value of \$2000/km to a maximum of \$6000/km and typically comprise 50% of the total maintenance costs as shown in Table 11. Routine maintenance costs are regarded as the absolute minimum expenditure required to maintain pavements and should be treated as a fixed cost for a given range of traffic load. The maximum traffic load that typically occurs on local roads is around 0.02 MESA/lane/year which implies that the maximum maintenance cost, including routine maintenance cost, is \$2500/lane-km/year (= \$5000/km) from Table 11. The local roads base maintenance costs (Table 2) also include an annual allowance for rehabilitation costs which typically occur every 30 to 40 years for a given road and range from 20% to 50% of the annualised maintenance costs with an average being 33% of the annualised maintenance costs in Table 2.

If \$5000/km is the maximum annualised maintenance cost for routine and periodic maintenance, then the maximum annualised total maintenance cost, including rehabilitation, is around \$7500/km. This value is above the maximum value for base maintenance cost on rural roads, but is lower than that for the base maintenance cost on urban roads. This suggests that these estimates are within the expected values.

The above analysis estimates that 33% of the total base maintenance costs (routine + periodic + rehabilitation costs) are rehabilitation costs and 50% of the remaining costs (33% of the total cost) are routine maintenance costs, leaving around 33% of the remainder being periodic maintenance costs which can be regarded as variable with traffic load.

Table 11: Variation of maintenance costs with traffic load (National Highways/Arterial Roads)

Maintenance Strategy	Traffic Load Range (MESA/lane/year ²)	Nominal Climate Range (I)	ME ¹ (\$/lane-km/year)
Full routine maintenance (R) & periodic maintenance (reseal) (P)	< 0.01	-40 to 80	1000 (R) + 1000 (P) = 2000
	0.01 to 0.1	-40 to 80	1200 (R) + 1300 (P) = 2500
	0.1 to 0.4	-40 to 80	1700 (R) + 1500 (P) = 3200
	0.4 to 2.0	-40 to 80	2300 (R) + 1900 (P) = 4200
	2.0 to 4.0	-40 to 80	3000 (R) + 2500 (P) = 5500
	> 4.0	-40 to 80	3000 (R) + 3500 (P) = 6500

Note: 1. Annual average maintenance expenditure is the sum of the routine maintenance (R) and the periodic maintenance (P).
2. Millions of equivalent standard axles (ESAs) per lane per year.

In summary, it is estimated on the basis of the variation of the base rural and urban maintenance and rehabilitation with traffic levels that some 33% of these maintenance costs vary with traffic. This is an alternative estimate of the relative effect of road use on the maintenance of roads.

3.8 Costs of maintaining bridges on local roads

It is considered that bridge maintenance expenditure for Local Government Authorities (LGAs) across the States/Territories is influenced by various factors including:

- size of the task (number of bridges or deck areas)
- type of bridge structure (main material components, that is, concrete, steel and timber)
- condition of the structure (rating score Good, Fair or Poor)
- average maintenance expenditure (possibly a reflection of environmental factors).

Each of the above factors can influence the size of the maintenance task and reflect State differences in bridge expenditure. The following discussion provides general comments on each factor and how they may influence a maintenance expenditure model. Based on the limited available bridge maintenance data, some cost rates and relativity effects for each of the above factors are provided.

The following sections outline several possible reasons to explain why maintenance expenditure per bridge varies between States, taking into account the effort neutrality principle. It is hoped that the information provided will aid the CGC in understanding the costs of maintaining bridges on local roads.

3.8.1 Size of bridge maintenance task

While total bridge numbers per State/Territory can offer a basis for expenditure differences, it is considered that bridges numbers alone would be misleading as the size of the task should be based more on the overall bridge size as it accounts for deck length and width. Table 12 shows the bridge numbers and relativities between States. The numbers, as far is known, do not include culverts.

Table 12: Number of bridges by SRA/LGA and State

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Number of bridges									
SRA									
Total SRA	1,117	1,594	880	1,015	754	971	531	72	6,934
LGA									
Conc/steel	10,345	2,241	1,161	721	428	155	-	87	15,138
Timber	4,433	560	498	1,347	52	465	-	10	7,365
Total LGA	14,778	2,801	1,659	2,068	480	620	-	97	22,503
Total State/Territory	15,895	4,395	2,539	3,083	1,234	1,591	531	169	29,437
Distribution of bridges									
LGA									
Conc/steel (%)	45.97	9.96	5.16	3.20	1.90	0.69	0.00	0.39	67.27
Timber (%)	19.70	2.49	2.21	5.99	0.23	2.07	0.00	0.04	32.73
Total LGA (%)	65.67	12.45	7.37	9.19	2.13	2.76	0.00	0.43	100.00

The bridge data on which Table 12 is based have relied on various past reports as listed in the references. Each of the reports has incomplete information, but collectively it has been possible to compile the information provided. It is difficult to be sure that the data is correct due to various jurisdictions being used.

In the case of bridge numbers the question of whether culverts are included is unclear. The NRTC surveys, while being comprehensive, it is known that some States were not as diligent in providing the information requested and to the same detail so as to provide a fair comparison. Nevertheless with a range of surveys the order of bridge numbers has been verified. In many cases the data is over 5 years old. While there is no doubt that some changes have occurred in the last few years, the relativities should not have changed too much to that previously given.

The above numbers differ considerably from those previously used by the Commission, particularly in New South Wales (7,682) and Queensland (18,228). The lower figures for New South Wales (NSW) come from the Grants Commission of NSW. These numbers appear to conflict with other studies by NRTC and ALGA which have much higher numbers for NSW and considerably lower numbers for Queensland. Some of the higher numbers for Queensland may be due to the inclusion of culverts (length > 6 m).

Bridge deck areas are considered to provide a more representative way to measure the relativities of the maintenance task. Reasonable data on bridge type is available from the NRTC survey which is based on the similar technical assessment across the various States/Territories. By applying this information to the bridge numbers in Table 12, the estimated bridge deck areas for the various States are given in Table 13.

Although the interstate distributions, in percentage (%) terms, do not differ markedly between bridge numbers and deck areas, deck areas are considered more appropriate and become more relevant when bridge types are used.

Table 13: Estimates of bridge deck areas (m²)

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Bridge deck area									
Conc/steel	1,655,200	399,638	275,553	67,596	68,480	24,800	-	13,920	2,505,187
Timber	527,527	107,109	102,294	126,286	6,188	55,335	-	1,190	925,929
Total LGA	2,182,727	506,747	377,847	193,882	74,668	80,135	-	15,110	3,431,116
Distribution of bridge deck area									
Conc/steel (%)	48.24	11.65	8.03	1.97	2.00	0.72	-	0.41	73.01
Timber (%)	15.37	3.12	2.98	3.68	0.18	1.61	-	0.03	26.99
Total LGA (%)	63.62	14.77	11.01	5.65	2.18	2.34	-	0.44	100.00

3.8.2 Bridge types

The size and nature of a bridge maintenance task is very dependent on the bridge type or more importantly the structural material. Bridges are made predominately for either reinforced concrete or steel, or a combination of each to better withstand the traffic loads being carried and the environmental effects of climate changes than can timber.

It is estimated (ALGA 1997) that the bulk of the bridges owned by LGA are timber structures with a large number (36%) more than 50 years old and thought to be beyond their useful life.

Studies undertaken by ARRB for the Victorian Grants Commission in 2002 (Martin et al 2003) established that the average maintenance cost for timber bridges was about double that for concrete or steel structures. Therefore bridge type as well as deck area are a better indication of the relative

maintenance task faced by a State. Concrete and steel structures are considered to be of a similar maintenance cost.

Applying a suggested weighting factor of 2 for timber structures can provide a more realistic basis of representing the size of the maintenance task faced by the respective States/Territories.

Again applying a weighting factor of 2 to timber structures, rather than just using deck area, has not markedly changed the interstate distributions as shown in Table 14, but is considered to better reflect the size of the task.

Table 14: Distributions of bridge deck areas by type between States weighted by concrete/steel (= 1) and timber (= 2)

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Conc/steel (%)	37.99	9.17	6.32	1.55	1.57	0.57	-	0.32	57.50
Timber (%)	24.21	4.92	4.70	5.80	0.28	2.54	-	0.05	42.50
Total LGA (%)	62.20	14.09	11.02	7.35	1.86	3.11	-	0.37	100.00

3.8.3 Bridge conditions

The nature of any maintenance expenditure is generally based on the condition of the various bridge members. Bridges condition inspections are generally conducted every 2 - 5 years rating the condition of the various structural members. The bridge is normally given an overall rating ranging from Good, Fair and Poor.

Bridges that fall into the Poor condition will need greater attention and higher maintenance to ensure the safety of passing traffic. Therefore the size of the maintenance task is highly influenced on the number of bridges that fall into each category.

As a way to account for bridge condition a suggested weighting factor of 1, 2 and 5 could be applied to Good, Fair and Poor bridges, respectively. A high weighting factor of 5 is given to poor bridges given the severe consequences of any bridge failure. A high value of 5 (instead of say 3) has been suggested as maintenance work associated with bridge members in a Poor condition often require major repairs or replacement compared to bridges rated as Fair. This is a judgement weighting and can be varied if necessary.

3.8.4 Maintenance expenditure

Maintenance expenditure data has been collected by the ALGA (1997) to provide a unit cost the average annual maintenance per bridge by State and a national average determined. This information may be a reflection on possible environmental factors such as climatic conditions, location of bridges, materials used etc.

Table 15 provides the average annual maintenance cost per bridge per State. No maintenance data is available to our knowledge that provides for variations with a State. The unit rates per State have been compared to the average annual maintenance per bridge across Australia to provide relativities between States.

In the case of the ACT the ALGA data does not include bridge maintenance expenditure. In this case a figure of \$1,000 has been assumed on the basis that it should be less than the national average given the relativity newer state of road infrastructure assets in the ACT.

Table 15: Bridge maintenance expenditure on LGA bridges/State/Territories

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
ALGA average annual maintenance cost	1320	800	2370	1444	1230	1710	1000	1230	1850
Relativities	0.71	0.43	1.28	0.78	0.66	0.92	0.54	0.66	1.00

3.8.5 Discussion

As mentioned earlier, the key variables that should be considered in explaining why expenditure differences per bridge varies per State/Territory should be based not on bridge numbers alone but on deck area as it provides a better basis to the maintenance task in that it covers both length and width of bridges.

Bridge type in terms of concrete/steel structures compared to timber structures is a major influencing factor when it comes to the maintenance task. Timber structures on the whole are older, designed to a lower load carrying capacity standard and most often in greater need of repair. Therefore States with a higher percentage of timber structures are expected to incur a higher maintenance cost. A suggested weighting factor of 2 could be applied to timber deck areas to reflect this higher cost.

The condition of existing structures in terms of Good, Fair or Poor could be a consideration, but this may be double counting when bridge type is taken into account as many poor structures are of timber construction. Also, bridge maintenance with respect to poor structures can be highly influenced by Council policies in that a Council may elect to place a load limit, or close a poor structure rather than spend large amounts to repair the structure.

Maintenance expenditure/bridge/State is an indication of the bridge task, but can also be seen as double counting in that it would encompass bridge deck areas, bridge type and condition. If bridge condition is not included as a relativity factor then applying a unit maintenance rate may be suitable.

The effort neutrality principle that requires the Council's grant be independent of its policies should be true for deck area and to a large extent bridge type. While many Councils are trying to replace timber structures because of their higher maintenance costs and overall poor structural condition, there appears to be limited scope at present for this to change significantly in the short term.

It is considered that the model for determining the relativities of bridge expenditure between States/Territories should take into account for the following:

- bridge deck areas
- bridge types (concrete/steel and timber)
- applying a weighting factor (suggested 2) for timber bridges
- average bridge maintenance expenditure/state.

4 Advice

4.1 Task 1: relative effects of road length and road use on maintenance costs

Analytical outcome

The analysis (see Table 10) indicates that the estimates for the relative effects of road length and road use on maintenance costs vary depending on the underlying assumptions used for the

estimating the base maintenance costs, road use factors and the relationship adopted between the state maintenance expenditure, M_{statei} , and the relative effects of road length and road use.

As noted in Section 3.3.2, the base maintenance costs supplied by the local government grants commissions were particularly high with respect to the urban roads, while the cost relativities between the remote and rural roads were almost the same as those found for the Victorian base maintenance costs. Consequently, in terms of reliability and acceptability, the Victorian base cost maintenance costs are a better estimate of maintenance costs because they were subject to an extensive review within Victoria. Provided the cost relativities for national highway maintenance between States holds for local roads are reliable, these Victorian estimates are currently the best available and should therefore be used as the basis for the estimates of the relative effects of road length and road use on maintenance costs.

The adjustments to allow for relative road use in Sections 3.4.2 and 3.4.3 as a result of outcomes in Tables 8(a), 8(b) and 8(c) suggest that the VKT/day estimates at a State level are not reliable and there are some obvious concerns generally about the road length estimates of the local road types in the States/Territories. It is considered that overall the relative road use adjustments with respect to total road use (equation (1)) are not reliable and should therefore not be included in any final analysis of relative road length and road use effects. The use of relative road use adjustments with respect to State/Territory road use (equation (2)) is preferable because it appears to provide plausible results notwithstanding the concern about the road use data.

As a consequence, estimates of these effects using the Victorian base maintenance costs as related by equation (6), with relative road use effects estimated by equation (2), are preferred. Equation (6) has the best fit (r^2) to the maintenance expenditure data and has relatively high statistical significance compared to equation (5), although neither equation is statistically significant because the data is limited to the actual number of States/Territories. The equation (6) relationship estimates that 0.55 is the relative effect of road length and 0.34 is the relative effect of road use influencing maintenance expenditure to the States.

Engineering assessment of the relative effect of road use on maintenance costs

A review of the variation of the base rural and urban maintenance costs with traffic levels and load using an engineering approach to quantify their variation was undertaken to compare the outcome with the analytical approach taken in Section 3.7.1. This approach estimated that some 33% of the base rural and urban maintenance costs vary with traffic. This outcome compares with the factor of 0.34 for the relative effect of road use on the maintenance of roads in equation (6).

Assessment of GCG equation (5) for maintenance expenditure

Equation (5) coefficients, α , for relative road length effects and $(1 - \alpha)$ for relative road use effects were calculated from estimates of maintenance for each State/Territory. This approach, as noted earlier, has the limitation of having only 8 samples because it is the total of the State/Territories. Equation (6) is preferable to equation (5) because it has higher 't' test and 'F' test values, although neither equation (5) nor (6) is statistically significant because of the limited number of samples.

The actual maintenance expenditure relationships developed for each State/Territory are a reasonable approach to estimating expenditure because they cover the variables likely to change from State to State. The major limitation of the preferred equation (3b) is the reliability of the input data needed for each State/Territory. Provided concerns about the reliability of these input variables (the road lengths for each road type, the base expenditure (\$/km) on these roads and the variations of local road use) are addressed, the equation (3b) approach to estimating the expected maintenance expenditure for each State/Territory is sound from an engineering viewpoint.

4.2 Task 2: relative costs of maintaining local roads in urban, rural and remote areas

As discussed in Section 4.1, the Victorian base cost maintenance costs are a better estimate of maintenance costs, in terms of reliability, and should therefore be used as the basis for estimating the relative base cost of maintaining road in urban, rural and remote areas. As Table 5 shows, these relativities for urban, rural and remote roads are 4.45: 1.63: 1.00, respectively. The main uncertainty is the relativity of the urban local road maintenance costs which would be nearly double the estimated relativity to remote road if the maintenance cost data from the local government grants commissions was used (see Table 6). There could be significant differences in the maintenance costs included in these estimates across States that could account for this significant variation.

4.3 Task 3: relative effects of environmental factors on the costs of maintaining local roads

As noted in Section 3.5, environmental factors were assigned to the urban, rural and remote roads in each State based on consideration of the separate impacts of terrain, soil stability, wet/dry effects and salinity factors. Table 9 summarises all these factors and provides an overall length weighted estimate for each State. The States with most adverse environmental effects are Tasmania and New South Wales followed equally by Queensland and the Northern Territory. The State with the least environmental effect is South Australia.

4.4 Task 4: costs of maintaining bridges on local roads

It is considered that the model for determining the relativities of bridge expenditure between States/Territories should take into account the following factors:

- bridge deck areas
- bridge types (concrete/steel and timber)
- applying a weighting factor (suggested 2) for timber bridges
- average bridge maintenance expenditure/state.

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APPENDIX A: ESTIMATES OF MAINTENANCE EXPENDITURE FOR STATES

A.1 Maintenance expenditure estimates, M_{statei} , based on Victorian base rates and road use factor, ru_i (equation (3a))

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban	121838132	119900666	73698005	39860636	45861066	7225077	3790562	5566612
Rural	171037091	16868553	111636569	51050543	20557139	26699974	2004921	0
Remote	2591645	0	10183639	8376841	721784	0	7860383	0
M_{statei}	295466868	136769219	195518213	99288019	67139990	33925051	13655865	5566612
% Total	34.9	16.1	23.1	11.7	7.9	4.0	1.6	0.7

A.2 Maintenance expenditure estimates, M_{statei} , based on Victorian base rates and road use factor, ru_{ij} (equation (3b))

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban	561617174	552686355	339713557	183739009	211398205	33304249	17472728	25659494
Rural	93598140	9231128	52604695	27936840	11249665	14611263	1097171	0
Remote	595019	0	2338075	1923250	165715	0	1804675	0
$M_{statei} =$	655810333	561917483	394656327	213599099	222813586	47915512	20374574	25659494
% Total	30.6	26.2	18.4	10.0	10.4	2.2	1.0	1.2

A.3 Maintenance expenditure estimates, M_{statei} , based on Victorian base rates and no road use factor (equation (3c))

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban	176291136	328228714	138431462	54214457	68922275	12707626	3048219	4874436
Rural	189453307	47362789	150387555	111972489	43194078	16304950	1839148	0
Remote	5071187	0	30718785	24048976	424935	0	11247225	0
$M_{statei} =$	370815630	375591503	319537803	190235923	112541288	29012577	16134592	4874436
% Total	26.1	26.5	22.5	13.4	7.9	2.0	1.1	0.3

A.4 Estimates of M_{ipE} , Rel. length and Rel. use for all cases (A1, A2 and A3)

Case	Variable	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT
Victorian base & ru _j road use	M_{ipE}	354744432	220355829	186168123	87554974	60944198	25867875	9729609	13774601
Victorian base & ru _j road use	M_{ipE}	897085554	557240686	470786061	221410953	154117033	65415254	24604450	34833514
Victorian base	M_{ipE}	593973472	368957213	311714340	146599432	102043143	43312397	16290966	23063779
Victorian base	Rel. length	0.701	1.168	1.127	1.446	1.109	0.758	1.107	0.234
All cases	Rel. use	0.982	0.854	1.019	1.253	1.060	1.267	1.381	0.926

ADDENDUM

Interstate distribution of local roads grants: advice on factors influencing local road expenditure

Revised Environmental Factors

The Western Australian Government advised:

A national survey of soil salinity was completed in 2000. This survey was part of the National Dryland Salinity Program, which has the cooperation of the Commonwealth Government as well as those of all affected States. The data from this survey are more recent, more comprehensive and more consistent across the States than the Auslig data, and do include a measure of the length of roads within affected areas.

Using the more recent advice on salinity impacts, Tables 9, 10, A.1, A.2, A.3 and A.4 were updated.

The overall impact on the environmental factor has rearranged the order of the most adversely affected States with Tasmania still being the worst, followed by WA (due to salinity), then NSW, and then the NT and QLD at the same level with Vic, SA and the ACT last.

As far as allocations to the individual States goes there is little change if Table A.2 is any guide (these are my preferred adjustments for rates and use using Victorian base rate costs and use in equation(3b)). Tables A.1 and A.3 are more volatile to the environmental factor change, however.

Table 10 shows the revised relationships between expenditure to States and the relative length and use factors.

Relative effects of road length and road use on maintenance costs

The analytical approach estimates that the road use effect can vary from 0.34 to 0.47 depending on the supporting data. This estimate on face value appears to have varied a lot with what appears to be small changes in the underlying data as a result of updating the environmental factor. The standard error around the coefficient is 0.22, so the variation in the estimated coefficient indicates the lack of precision with the analytical approach. If a medium point was sought, an estimate of 0.4 for road use effects is not unreasonable, but the approach nevertheless shows a lot of fragility.

As noted in the report, even though the relationships had high goodness of fit values, the statistical significance of the relationships (as measured by the 'F' test) was not high mainly because of the limited samples (number of States/Territories).

From previous research, road use effects typically vary from 50 to 65% in causing road wear (maintenance) costs due to heavy vehicle use on arterial roads based on deterioration (roughness) models. It is important to stress that apart from climatic factors, heavy vehicles and not cars are the cause of road wear with use and therefore increase maintenance cost with use. Local roads have in general a lower level of heavy vehicle use than arterials and it could be argued that local roads are designed for these lower levels of use and so the amount of road wear due to heavy vehicles is much the same as for arterials, all things being equal.

However, as implied by the range of AADT levels in this project, a large proportion of local roads have very low levels of use (and proportionally lower levels of heavy vehicle use) so that overall the wear due to heavy vehicles is expected to be less than 50%. This is because there are minimum requirements on pavement thickness (for construction) regardless of the low levels of traffic so that there can be lower levels of heavy vehicle wear because the pavement is theoretically thicker (and stronger) than required for the levels of heavy vehicles. Obviously there is a lot of variation of road wear on local roads across Australia with this because there will be some roads that are not strong

enough to support the higher levels of heavy vehicle traffic and other roads that are so strong that there is virtually no wear due to heavy vehicles.

In summary a range of road use effects for local roads can vary in general from 30% to 50%, depending on specific conditions. In fact the actual variation probably ranges from 0% to 100%. If a single value needs to be chosen then a value of 0.4 for road use effects does not seem unreasonable.

Table 9: Summary of environmental factors (revised salinity)

Road Type	E, Environ. Factor	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT
Urban	terrain	1.1	1	1.05	1	1.03	1.05	1	1
	soil	1	1	1	1	1.1	1	1	1
	wet/dry	1.05	1	1.1	1	1	1.1	1.05	1
	salinity	1	1	1	1	1	1	1	1
	E_{urb}	1.16	1.00	1.16	1.00	1.13	1.16	1.05	1.00
Rural	terrain	1.05	1.02	1.01	1	1	1.1	1	1
	soil	1.03	1.05	1.05	1.02	1	1	1.05	1
	wet/dry	1.05	1	1.1	0.95	0.9	1.2	1.1	1
	salinity	1.05	1.1	1	1.33	1.1	1	1	1
	E_{rur}	1.19	1.18	1.17	1.29	0.99	1.32	1.16	1.00
Remote	terrain	1	1	1	1	1	1	1	1
	soil	1.05	1	1.05	1	1	1	1.05	1
	wet/dry	1	1	1.05	1	0.9	1	1.1	1
	salinity	1.05	1	1	1.05	1	1	1	1
	E_{rem}	1.10	1.00	1.10	1.05	0.90	1.00	1.16	1.00
	E_{state}	1.18	1.07	1.15	1.19	1.01	1.27	1.15	1.00

Table 10: Summary of estimates for the relative effects of road length and road use (revised by environ.factor)

Case	Equation (5)				Equation (6)			
	$M_{statei} = M_{ipE} (\alpha \times \text{Rel. length} + (1 - \alpha) \times \text{Rel. use})$				$M_{statei} = M_{ipE} (A \times \text{Rel. length} + B \times \text{Rel. use})$			
	r^2	α	(1- α)	Comment	r^2	A	B	Comment
Victorian base & ru _j road use	0.92	0.04	0.96	α is <u>not</u> stat. signif.*	0.97	-0.07	0.93	A is <u>not</u> stat. signif.*
Victorian base & ru _{ij} road use	0.92	0.53	0.47	α is stat. signif.	0.96	0.44	0.44	A & B are stat. signif.
Victorian base	0.95	0.93	0.07	α is stat. signif.	0.99	0.83	0.05	B is <u>not</u> stat. signif.

Note: * Statistically insignificant as the estimated coefficient is less than 95% confidence level

APPENDIX A: ESTIMATES OF MAINTENANCE EXPENDITURE FOR STATES (REVISED)

A.1 Maintenance expenditure estimates, M_{statei} , based on Victorian base rates and road use factor, ru_{ij} (equation (3a))

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban	121838132	119900666	73698005	39860636	45861066	7225077	3790562	5566612
Rural	156164300	17671818	111636569	61724747	22612853	26699974	2004921	0
Remote	2591645	0	10183639	8376841	721784	0	7860383	0
M_{statei}	280594078	137572484	195518213	109962223	69195704	33925051	13655865	5566612
% Total	33.2	16.3	23.1	13.0	8.2	4.0	1.6	0.7

A.2 Maintenance expenditure estimates, M_{statei} , based on Victorian base rates and road use factor, ru_{ij} (equation (3b))

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban	561617174	552686355	339713557	183739009	211398205	33304249	17472728	25659494
Rural	85459171	9670705	52604695	33778179	12374632	14611263	1097171	0
Remote	595019	0	2338075	1923250	165715	0	1804675	0
$M_{statei} =$	647671364	562357060	394656327	219440438	223938552	47915512	20374574	25659494
% Total	30.2	26.3	18.4	10.2	10.5	2.2	1.0	1.2

A.3 Maintenance expenditure estimates, M_{statei} , based on Victorian base rates and no road use factor (equation (3c))

Road type	NSW	VIC	QLD	WA	SA	TAS	NT	ACT
Urban	176291136	328228714	138431462	54214457	68922275	12707626	3048219	4874436
Rural	172979106	49618160	150387555	135384919	47513486	16304950	1839148	0
Remote	5071187	0	30718785	24048976	424935	0	11247225	0
$M_{statei} =$	354341430	377846874	319537803	213648352	116860696	29012577	16134592	4874436
% Total	24.7	26.4	22.3	14.9	8.2	2.0	1.1	0.3

A.4 Estimates of M_{ipE} , Rel. length and Rel. use for all cases (A1, A2 and A3)

Case	Variable	NSW	VIC.	QLD	WA	SA	TAS	NT	ACT
Victorian base & ru _j road use	M_{ipE}	334682144	224696002	185873795	98891903	65702671	25826979	9714227	13752823
Victorian base & ru _j road use	M_{ipE}	847401763	568921262	470624993	250390332	166356527	65392874	24596032	34821597
Victorian base	M_{ipE}	566615011	380409083	314683303	167423443	111234257	43724932	16446132	23283453
Victorian base	Rel. length	0.701	1.168	1.127	1.446	1.109	0.758	1.107	0.234
All cases	Rel. use	0.982	0.854	1.019	1.253	1.060	1.267	1.381	0.926

ACRONYMS

ABS	Australian Bureau of Statistics
ACLG	Australian Classification of Local Governments
ALGA	Australian Local Government Association
ARRB	ARRB Group Ltd
CGC	Commonwealth Grants Commission
CPI	Consumer price index
DOTARS	(Australian Government) Department of Transport and Regional Services
FAG	Financial assistance grant
GFS	Government finance statistics
GST	Goods and services tax
mvt	million vehicle kilometres travelled
NRTC	National Road Transport Commission (now the NTC)
NTC	National Transport Commission
PSMA	Public Sector Mapping Agencies
vkt	vehicle kilometres travelled