Contract Report

Review of asset preservation costs

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for Department of Planning and Community Development

RC74911 - May 2009

arrb research

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for Department of Planning and Community Development

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RC74911 - May 2009

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Summary

Scope:

The tasks involved in the consultancy to review the asset preservation costs associated with local roads and bridges in Victoria were defined as follows:

- Review the annual average preservation costs associated with both kerbed and unkerbed roads over a range of traffic volumes using a questionnaire survey of selected councils to assess typical current maintenance costs and establish a relationship between preservation cost, road type and traffic volume.
- Review the appropriateness of the range of traffic volumes for the various road types based on the above survey of selected councils.
- Review the current weightings assigned to the cost modifier factors based on the above survey of selected councils, re-run the pavement life-cycle costing (PLCC) analysis model with revised deterioration predictions, vary the model inputs to assess any possible changes to the current cost modifier factors and provide a revised table of cost modifier factors if needed.
- Review the annual average preservation costs for bridges using a questionnaire survey of selected councils to assess typical current maintenance costs, review alternative methods to assess bridge maintenance costs and recommend any changes to current preservation rates for bridges.

This report documents the work undertaken on the above tasks and provides a basis for making changes to the current preservation base costs.

Findings:

Road preservation costs

The changes to the previous average annual base road preservation costs were based on a combination of the information provided by the previous 2003 report, the council survey, revised cost estimates from re-running the ARRB PLCC model and VicRoads cost data for main roads.

In summary the updated estimates are as follows:

Road type	Road preservation cost ($/km)
Rural roads: natural surface	350 (17% increase)
Rural roads: AADT < 100	2500 (25% increase)
Rural roads: AADT 100 – 500	5200 (30% increase)
Rural roads: AADT 500 – 1000	5800 (18% increase)
Rural roads: AADT > 1000	6600 (22% increase)
Urban roads: AADT < 500	3600 (33% increase)
Urban roads: AADT 500 – 1000	4900 (23% increase)
Urban roads: AADT 1000 – 5000	6600 (20% increase)
Urban roads: AADT > 5000	10700 (19% increase)

Table 5 in this report details the above annual average base preservation costs. The changes are a reasonably consistent increase from the 2003 base costs for the various traffic ranges for both kerbed and unkerbed roads.

Traffic volume ranges for costs

The survey of annual average base road preservation costs found, by implication from the completed questionnaires, that the current ranges of traffic volumes used are reasonable because most of the surveyed councils were able to provide road preservation costs for these traffic ranges.

Review of cost modifier factors

Table 5 in the report shows that the cost modifier factors remain the same as previously established for the various influences on base costs. No changes to the cost modifier factors were recommended on the basis of the surveys and reviews undertaken.

Bridge preservation costs

Table 3 shows the recommended annual bridge preservation costs for concrete ($60/$m^2$) and timber ($100/m^2) deck bridges.

These recommendations were initially based on the average preservation cost from the previous 2003 report for timber deck bridges provided by the Timber Bridges Group of Councils and supported by VicRoads cost data for repairing timber and concrete bridges. However, the current survey review found that the ratio of timber deck preservation costs to concrete deck preservation costs was 1.5:1 which was modified to 1.67:1 on the basis that the timber preservation costs were likely to be understated by the survey. Consequently, the average preservation costs for timber and concrete bridges were increased in line with the ratio 1.67:1.

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Contents

1 Introduction

In October 2008, the Department of Planning and Community Development (DPCD) awarded ARRB a consultancy to review the asset preservation costs associated with local roads and bridges in Victoria that were recommended in the 2003 report (Martin et al. 2003). The tasks involved in the consultancy were defined as follows:

- Review the annual average preservation costs associated with both kerbed and unkerbed roads over a range of traffic volumes using a survey of selected councils to assess typical current maintenance costs and establish a relationship between preservation cost, road type and traffic volume.
- Review the appropriateness of the range of traffic volumes for the various road types based on the above survey of selected councils.
- Review the cost modifier factors for freight loading, climate, materials, subgrade conditions and strategic routes to adjust the annual average preservation costs. These factors require review by re-running the PLCC model with revised inputs to re-assess the sensitivity of the road preservation costs to these factors.
- Review the annual average preservation costs for bridges using a survey of selected councils to assess typical current maintenance costs, review alternative methods to assess bridge maintenance costs and recommend any changes to current preservation rates for bridges.

The current base annual average preservation costs for roads and bridges were derived from a study undertaken in 1998 and 1999 by ARRB and the National Institute of Economic and Industry Research (NIEIR) (ARRB and NIEIR 1999). These costs were subsequently revised in 2003 for the Victorian Grants Commission by ARRB (Martin et al. 2003). The 1998 and 1999 study undertook seven workshops involving meetings of local government to discuss possible options for distributing identified local roads grants in Victoria in the future. The Final Report of ARRB and NIEIR (1999) recommended the introduction of a new methodology based on the average annual life-cycle costs of each council's local road network using several cost disabilities (cost modifier factors).

2 Review of preservation costs

2.1 Road preservation cost survey

The road and bridge preservation cost survey was directed to 35 councils covering a wide range of rural and urban areas across Victoria. Appendix A includes a generic list of the surveyed councils and a copy of the questionnaires used. The questionnaire defined the preservation costs that were required with the aim of ensuring consistency of the responses. Seven councils failed to make any formal response leaving 28 councils responding to the survey with six councils declining to comment and two councils not able to provide usable data.

The responses to the road preservation survey are shown in Table 1 and Table 2; however, in each of the specified road categories 7 to 15 councils were able to provide useable figures. Several councils provided some slightly different AADT categories for their roads which have been reported in these tables.

2.2 Bridge preservation cost survey

The outcome of the bridge survey questionnaire gave 9 responses (26% response rate) that provided data for the analysis of deck preservation costs for concrete and timber bridges. Table 3 shows a summary of the results provided by the 9 responding councils. In Appendix A the bridge survey questionnaire shows that the bridge preservation costs requested included both maintenance and restoration (rehabilitation) costs.

2.3 Other sources of preservation costs

2.3.1 Road preservation costs

VicRoads data

VicRoads supplied the 2008/09 maintenance and rehabilitation expenditures for all roads under their authority in Victoria. These expenditures could be regarded as an upper bound estimate relative to the local government expenditures because the funding constraints are less and the maintenance standards are generally higher on these roads. The expenditure data supplied by VicRoads was sorted into the various traffic levels for urban and rural areas which for this data set was considered to be equivalent to kerbed and unkerbed roads.

Column 9 of Table 1 summarises the results of the above analyses by sorting expenditures on the basis of AADT and annualising the expenditure where appropriate. The average annual preservation estimates ($/km) have a sound basis and should be given a reasonable degree of credibility as they cover road preservation costs over the whole of Victoria.

Re-run of ARRB PLCC model

The ARRB PLCC model analysis was re-run using a higher calibration coefficient for its roughness deterioration model for the range of traffic levels for the urban and rural roads base case. This change in calibration coefficient for roughness deterioration was based on a recent ARRB study (Choummanivong and Martin 2007) observing local road deterioration for a number of councils where much higher rates of roughness deterioration were measured than was assumed for the PLCC analyses used in the 2003 report (Martin et al. 2003).

2.3.2 Bridge preservation cost submission

Timber Bridges Group of Councils (TBGC)

An earlier submission from the Timber Bridges Group of Councils (TBGC 2002) was used as an input to the estimation of average preservation costs for timber bridges as this submission was made by 16 contributing councils. Table 3 includes the results of this submission for timber bridge preservation based on the estimated maintenance and restoration costs for over 1000 timber bridges. The definition of this preservation cost estimate is consistent with that used for the survey questionnaire in Appendix A. There appears to be no other available and reliable source to acquire bridge preservation cost information directly from councils.

Department of Planning and Community Development (DPCD)

The DPCD provided generalised data on local government bridge spending which included decking area for each bridge type. From this data approximate annual preservation costs were determined as well as the ratio of the preservation costs of bridge decks for timber to those of concrete.

Table 1: Summary of average annual road preservation costs

Road type (1)	Daily traffic volume (AADT) (2)[i]	Survey average cost ($/km)[ii] (3)	Survey range cost ($/km) (4)	Min. cost modifier factors[iii] (5)	Max. cost modifier factors[iii] (6)	No. responses in survey (7)	PLCC run ($/km) (8)	VicRoads average cost ($/km)[iv] (9)	2003 min. cost modifier factors[v] (10)	2003 max. cost modifier factors[v] (11)
Unkerbed	Natural surface	350	69 - 1094	0.2	3.13	7			0.33	2.69
	<100 (gravel or seal)	2050	488 - 6000	0.24	2.93	15			0.39	1.91
	20-500	3350	3370	-	-	1				
	100 - 500 (seal)	2800	1005 - 4500	0.36	1.61	15	5422	6200	0.32	2.11
	500 - 1000 (seal)	3100	1413 - 5000	0.46	1.61	11	5465	8400	0.46	1.82
	<1000	2700	2715	-	-	1				
	>1000 (seal)	3250	1413 - 4144	0.43	1.28	8	6597	16000	0.49	1.53
Kerbed	<500	3700	1310 - 8129	0.35	2.2	15			0.37	1.88
	500 - 1000 (seal)	4450	1310 - 9700	0.29	2.18	15	3209	10000	0.53	1.77
	1000 - 5000	4750	1310 - 9019	0.28	1.9	13	5603	12000	0.41	2.29
	<2000	8800	8799	-	-	1				
	2000 - 5000	8800	8799	-	-	1				
	>5000	9650	1310 - 44700	0.14	4.63	10	9047	12750	0.26	1.98

Note:
i. Additional traffic volume categories included where ocuncils provided different traffic volume ranges
ii. All survey average costs rounded to nearest $50.
iii. Min. and max. cost modifier factors are based on the minimum and maximum preservation cost survey results relative to the survey average result.
iv. VicRoads costs are based on an estimate of 2008/09 maintenance and rehabilitation expenditure for all roads in Victoria under their authority.
v. Min. and max. cost modifier factors are based on the 2003 minimum and maximum preservation cost survey results relative to the survey average result.

Table 2: Summary of average annual toad preservation costs ($/km) supplied by councils (continued on next page)

Road type	Daily traffic volume (AADT) [i]	Survey average cost [ii]	Urban council A	Urban council C	Urban council D	Urban council E	Urban council G	Urban council H	Urban council J	Regional council A
Unkerbed	Natural surface	350								
	<100 (gravel or seal)	2050			6000			3531	769	4058
	20-500	3350								
	100 - 500 (seal)	2800					4144	3531	1413	4058
	500 - 1000 (seal)	3100					4144	3531	1413	4058
	<1000	2700								
	>1000 (seal)	3250					4144	3531	1413	4058
Kerbed	<500	3700	7750	8129	4160		4178		3926	3715
	500 - 1000 (seal)	4450	9700	8129	4040		4178	9019	3926	3715
	1000 - 5000	4750	6000	8129	8763		4178	9019	3926	3715
	<2000	8800				8799				
	2000 - 5000	8800				8799				
	>5000	9650	44700	8471	8801	8799	4178	9019	3926	3715

Note: i. Additional traffic volume categories included where ocuncils provided different traffic volume ranges

ii. All survey average costs rounded to nearest $50.

Table 2: Summary of average annual road preservation costs ($/km) supplied by councils (continued)

Road type	Daily traffic volume (AADT)	Rural council A	Rural council B	Rural council C	Rural council D	Rural council E	Rural council F	Rural council I	Rural council L	Rural council O	Rural council P	Rural council Q	Rural council R
Unkerbed	Natural surface	160			238	69	1094				285	255	261
	<100 (gravel or seal)	1160	2577	1047	488	1017	2579	1500	1229	1294	2305	977	
	20-500	3370											
	100 - 500 (seal)		2577	1005	1620	1282	2601	4500	2703	3060	2718	2572	4057
	500 - 1000 (seal)		2577		1620		2601	5000	2703	3060	3451		
	<1000												2715
	>1000 (seal)		2577				3247			3060	4012		
Kerbed	<500		3462		1818	2561	1310	5900	2478	1570	1832	2572	
	500 - 1000 (seal)		3462		1818		1310	6075	2590	1570	2373		4748
	1000 - 5000		3462				1310	6075	2870	1570	2969		
	<2000												
	2000 - 5000												
	>5000						1310		3340				

Table 3: Summary of bridge preservation costs[i]

Council	Average annual preservation costs concrete decking $/m^2	Average annual preservation costs timber decking $/m^2
Rural council D	89	136
Rural council I	10	49
Rural council L	54	156
Rural council O	12	55
Regional council A	16	25
Urban council C	33	-
Urban council D	6	-
Urban council G	1	69
Urban council H	84	-
Average value	**38**	**57**
Other Data		
Submission towards Fairer Grants for Timber Bridges[iii] (2002)	-[ii]	96
Recommended preservation cost	**60**	**100**

Note: i. Preservation costs include maintenance and restoration costs (see Section 2.3.2 and Appendix A.2.2.
ii. No concrete bridge information provided.
iii. TBGC (2002) submission based on the estimated preservation costs of over 1000 timber bridges.

3 Discussion of preservation costs

3.1 Road preservation costs

3.1.1 Survey of road preservation costs

The completed questionnaires contained widely varying costs, including some which were presented as total costs rather than per kilometre costs. Therefore in addition to any prior consultation used to initially explain the questionnaire and to answer any subsequent questions from councils, further contact was made with most councils after the data was received.

An additional question in the survey questionnaire asked councils if their estimated current preservation costs were sufficient to maintain the roads. Of the councils that answered the question, 11 councils responded that the funds were sufficient and five councils said they were not. The councils were also asked to provide comment if funds were not sufficient. A summary table of the responses and the additional council comments are given in Appendix A.2.

The annual average preservation costs derived for unkerbed roads from the survey were significantly lower than those provided in the 2003 report. In many cases it would appear that the annual expenditure was divided over the entire road network to produce an underestimate of the actual per kilometre cost. Many councils indicated they did not have the information available to give expenditures in the form required by the questionnaire and could only give an overall annual expenditure estimate.

As a consequence it is suspected that the annual preservation costs derived from the survey for the rural roads are likely to be an under-estimate and an inaccurate one. This is because of the difficulty in quantifying the long term rehabilitation work requirements in accordance with the traffic levels on the rural roads. The estimation of the likely deterioration on these roads that initiates the need for rehabilitation in the longer term is also a difficult task for most councils.

The spread of annual average preservation costs from the survey of unkerbed roads is quite large and results in the cost modifier factors inferred from the extremes that are greater than those in the ARRB 2003 report (Table 1 column 10 and 11). This spread of preservation costs from the survey also suggests that the variability may also be driven by council policies and the availability of funding as well as the need for preservation. The current long term drought may also be a factor in reducing the expenditures on unkerbed roads.

On the other hand the annual average preservation costs for the low volume kerbed roads extracted from the survey were close to the costs recommended in the 2003 report. The preservation costs for the kerbed roads in rural areas are markedly lower than the kerbed roads in urban councils. This is due to there being less need for expenditure on rehabilitation works for kerbed roads in rural areas.

3.1.2 VicRoads data

The annual average road preservation costs derived from the data supplied by VicRoads (2009) are an estimate of 2008/09 maintenance and rehabilitation expenditure for all roads in Victoria under their authority. As column 9 in Table 1 shows, this expenditure increases with increasing traffic level. The VicRoads preservation costs are higher than the PLCC based cost estimates in column 8 of Table 1 and the cost estimates in column 3 of Table 1 derived from the survey.

As noted in Section 2.3.1, the VicRoads preservation costs are an upper bound estimate of preservation cost because of the generally higher standards of maintenance on main roads

relative to local roads. These costs include pavement rehabilitation costs along with routine and periodic maintenance costs. It could be argued, however, that these costs are somewhat lower than expected because of the extensive drought conditions experienced in Victoria over the last 10 to 12 years.

3.1.3 Re-run of ARRB PLCC model

As noted in Sections 2.3.1 and 3.1.5, the earlier ARRB PLCC model analyses for rural roads were based on a generally lower rate of roughness deterioration than is currently being observed. The higher rate of roughness deterioration for both the urban and rural roads were used in re-running the ARRB PLCC model with the result that the estimated maintenance and rehabilitation costs are higher than previously estimated for the base case in the 2003 report.

3.1.4 ARRB 2003 average annual preservation costs

The annual average base road preservation cost estimates in the 2003 report were derived by reviewing the cost estimates from the council survey, VicRoads, ARRB PLCC models with the final assessment of the base road preservation costs found by weightings of these various estimates. However, local road deterioration data suggests that the deterioration rates used in the PLCC model were too low giving lower estimates of road preservation costs. Also these preservation costs were estimated five years ago and therefore a cost increase would be expected on this basis alone.

Both the Australian Bureau of Statistics (ABS) producer price index for road and bridge construction (ABS 2008) and the BITRE road construction and maintenance price index (BITRE 2008) indicate a 28% increase in these costs between 2003 and 2008. However, the full effect of this increase in costs may not be occurring in Victoria due to the prolonged drought which is reducing the amount of maintenance that needs to be done.

3.1.5 Assigning average base road preservation costs

Table 5 summarises the revised 2009 base road preservation costs compared to the 2003 base road preservation costs on the basis of the current review and survey of road preservation costs over the various road types and traffic ranges. The following discussion provides the basis of the base road preservation costs assigned to various road types and traffic ranges. Note that these costs are inclusive of kerb and channel or shoulder maintenance.

Unkerbed roads: natural surface

An increase in the base cost to $350/km (see Table 4) is suggested for this traffic range because, as column 3 in Table 1 shows, the survey average result arrived at this cost after rounding. No other sources of information about costs for this traffic range were available.

Unkerbed roads: AADT < 100

An increase in the base cost to $2,500/km (see Table 4) is suggested for this traffic range which represents a 25% increase from the 2003 cost. While the council survey costs of $2,050/km (see column 3 of Table 1) were similar to the 2003 reported costs, it is suggested that this cost be increased because the PLCC model estimated cost is more reliable for rural roads. While the PLCC analysis was not run for this road class, the trend is for the PLCC cost estimates to be higher than the council survey estimated average cost so these preservation costs should be increased.

Unkerbed roads: AADT 100 - 500

An increase of 30% in the base preservation cost to $5,200/km (see Table 4) is suggested for this traffic range. The increase is largely based on the PLCC re-run estimate cost of $5,524/km shown in column 8 of Table 1. The recommended cost was slightly reduced from the PLCC estimate in Table 1 due to the much lower estimated cost from the council survey of $2,800/km (see column 3 in Table 1) which is likely to be a lower bound estimate for the case of unkerbed roads. The slight decrease in the assigned base preservation costs is also justified on the basis of maintaining a degree of separation between this traffic volume category and the next. The VicRoads preservation costs of $6,200/km (see column 9 of Table 1) were also higher than the PLCC re-run estimated cost, but these costs are likely to be the upper bound for local road preservation costs, as noted.

Unkerbed roads: AADT 500 - 1000

An 18% increase in the base preservation cost to $5,800/km (see Table 4) is suggested for this traffic range. An increase in the preservation cost for this traffic range to $5,465/km was estimated by the re-run of the PLCC model with higher rates of deterioration (see Section 3.1.3) as shown in column 8 of Table 1. However, these costs were only slightly higher than those for the previous traffic category. The VicRoads cost estimate in column 9 of Table 1 of $8,400/km is significantly higher than the PLCC cost and is a large cost increase from the previous traffic volume category. The suggested base preservation cost of $5,800/km is based on a slight increase to the PLCC estimated cost for this road class.

Unkerbed roads: AADT > 1000

A 22% increase in the base preservation cost to $6,600/km (see Table 4) is suggested for this traffic range. This increase is based on a preservation cost estimate from a re-run of the PLCC model of $6,597/km (see column 8 of Table 1) with the council survey average preservation cost of $3,250/km being much lower (see column 3 of Table 1) and the VicRoads average preservation cost of $16,000/km being much higher (see column 9 of Table 1). The increase is also approximately in line with the other unkerbed cost increases.

Kerbed roads: AADT < 500

A significant 33% increase in the base preservation cost to $3,600/km (see Table 4) is suggested for this traffic range. This is largely based on the council survey average preservation cost of $3,700/km (see column 3 of Table 1) reduced slightly due to some council figures being on the high side and the PLCC estimates of preservation costs typically being lower than the survey costs for the kerbed road. As noted below and in Section 3.1.1, the survey results for the kerbed road types consistently produced much higher estimates of road preservation cost than was found for the unkerbed roads.

Kerbed roads: AADT 500 - 1000

A 23% increase in the base preservation cost to $4,900/km (see Table 4) is suggested for this traffic range. This increase is based on the council survey average preservation cost of $4,450/km (see column 3 of Table 1) increased by the higher VicRoads average preservation cost of $10,000/km (see column 9 in Table 1). While the PLCC analysis re-run estimate of preservation cost shows a lower cost of $3209/km (see column 8 of Table 1), this is likely to be less reliable for the kerbed roads in urban areas. The base preservation cost was also increased from the council survey average preservation cost because the VicRoads data is likely to better account for the longer term maintenance of the road than the council survey preservation cost. However, given that the VicRoads data is the upper bound estimate, the suggested base preservation cost has still remained close to the council survey average.

Kerbed roads: AADT 1000 - 5000

A 20% increase in the base preservation cost to $6,600/km (see Table 4) is suggested for this traffic range. In this traffic volume range an increased weighting was given to the VicRoads average preservation cost of $12,000/km (see column 9 in Table 1) as this value is higher than both the council survey average preservation cost of $4,750/km (see column 3 of Table 1) and the PLCC analysis re-run estimate of preservation cost of $5,603/km (see column 8 of Table 1). Also this increase keeps it in line with the percentage increases in other traffic volume categories.

Kerbed roads: AADT > 5000

An increase of 19% in the base preservation cost to $10,700/km (see Table 4) is suggested for this traffic range. Again the higher VicRoads average preservation cost of $12,750/km (see column 9 in Table 1) for this road category is higher than the PLCC analysis re-run estimate of preservation cost of $9,047/km (see column 8 of Table 1) and the council survey average preservation costs of $9,650/km are on the low side (see column 3 of Table 1). This increase also keeps it in line with the percentage increases in other traffic volume categories.

Table 4: Summary of base road preservation costs changes

Road type	Road preservation cost ($/km)
Unkerbed roads: natural surface	350 (17% increase from 2003)
Unkerbed roads: AADT < 100	2500 (25% increase from 2003)
Unkerbed roads: AADT 100 – 500	5200 (30% increase from 2003)
Unkerbed roads: AADT 500 – 1000	5800 (18% increase from 2003)
Unkerbed roads: AADT > 1000	6600 (22% increase from 2003)
Kerbed roads: AADT < 500	3600 (33% increase from 2003)
Kerbed roads: AADT 500 – 1000	4900 (23% increase from 2003)
Kerbed roads: AADT 1000 – 5000	6600 (20% increase from 2003)
Kerbed roads: AADT > 5000	10700 (19% increase from 2003)

3.2 Bridge preservation costs

3.2.1 Survey of bridge preservation costs

The information provided by the 9 contributing councils was not on a consistent annual cost basis. Some councils were able to provide details of their full bridge preservation costs involving routine and periodic maintenance and rehabilitation (restoration) works, while others provided an average $/m^2 cost for each bridge irrespective of type or size. The bridge information provided by the survey respondents covered a wide variety of bridges, culverts and pedestrian footbridges.

Table 3 shows the bridge preservation cost estimated on the basis of bridge deck type only. Some structures are a hybrid of concrete supporting structure with a timber deck and others are a timber supporting structure with a concrete superstructure. This combination of material use could also explain the wide variation in preservation costs seen in Table 3 which ranges from $1/m^2 to $89/m^2 for concrete bridges with an average of $38/m^2 and preservation costs of $25/m^2 to $156/m^2 for timber bridges with an average of $57/m^2. The most important aspect of the survey was the outcome that on average the ratio of concrete deck preservation costs to timber deck preservation costs was approximately 1:1.5.

3.2.2 Department of Planning and Community Development (DPCD) data

The state-wide data provided by the DPCD also supported a concrete to timber preservation cost ratio of approximately 1:1.5 with the average costs being close to those found in the council survey. However, the actual figures were not reported as the calculation methodology is likely to produce a significant underestimate of the true preservation cost.

3.2.3 TBGC bridge preservation cost submission

The Timber Bridges Group of Councils (TBGC 2002) submission has substantiated the basis for an average timber bridge preservation cost of $96/m^2 using the submissions from 16 councils (see Table 3). On this basis the TBGC preservation costs, because they cover a large number of bridges and a wide range and number of councils, should be regarded as a better current estimate of the preservation costs than the council survey estimates. As noted in Section 3.2.1, the council survey estimates were difficult to obtain from the councils surveyed and these estimates relied on the input of 9 councils only.

3.2.4 Assigning average base bridge preservation cost

Timber bridge preservation costs

The TBGC submission timber bridge preservation costs ($96/m^2) are higher than those from the council survey costs ($57/m^2), however, they are still the most detailed analysis of costs associated with any type of bridge. The higher cost derived in the TBGC submission is likely to be due to accurate accounting of the larger and relatively frequent intervention costs associated with timber bridge maintenance.

Therefore the cost of $80/m^2 recommended in the 2003 study is a valid estimate, but should be increased to reflect the market trends which indicate an approximate 28% increase in costs between 2003 and 2007 (BITRE 2008, ABS 2008). The full 28% is not recommended due to the changing ratio of timber to concrete bridge preservation costs that would cause the overall preservation costs to increase substantially. Consequently, a 25% increase in costs to $100/m^2 is recommended for timber bridge preservation costs.

Concrete bridge preservation costs

The council survey resulted in an average preservation cost of $38/m^2 for concrete decked bridges, which as with timber decked bridges, is likely to be an under-estimate of the bridge preservation costs. As noted in Section 3.2.1, the survey was able to determine that on average the ratio of timber deck preservation costs to concrete deck preservation costs was closer to 1.5:1 than 2:1, so therefore a ratio of 1.67:1 is recommended. If this is related to the estimated timber bridge preservation cost estimate of $100/m^2, then the resulting concrete bridge preservation cost is $60/m^2.

4 Review of traffic volume ranges

4.1 Cost survey of road preservation

As the survey details of each council's road preservation costs show in Table 2, most councils were able to comply with the range of traffic volumes for the various road types that were used in the ARRB and NIEIR (1999) report and the previous 2003 report.

The above result implies that the ranges of traffic volumes are reasonable because all councils surveyed were able to provide road preservation costs for them. However, this result is not fully conclusive because of the relatively low response to the survey.

4.2 Other sources of preservation costs

4.2.1 VicRoads data

Column 9 of Table 1 shows that the average preservation cost estimates extracted from the VicRoads data were generally capable of being split into the ranges of traffic volumes used in the previous reports. The exception to this was the very low volume unkerbed roads which are not roads that VicRoads would normally maintain or manage.

The above result suggests that the ranges of traffic volumes used in the 2003 report are generally reasonable.

5 Review of cost modifier factors

5.1 Re-run of PLCC model parametric analysis

The PLCC model parametric analysis was not re-run because the council survey of road preservation cost results showed no unexpected changes in the extreme estimates of the road preservation costs compared with those found in the 2003 report.

5.1.1 Cost modifier factors

Table 5 shows that the cost modifier factors remain the same as previously established for the various influences on base costs. No changes to the cost modifier factors were recommended on the basis of the surveys and reviews undertaken.

The cost modification factors were designed to account for local extremes in climate, material costs, traffic loads and volumes via a factor representing the percent change from the normal or average cost. While the base costs have changed, the same percentage change from the base cost was still applicable, as observed by the cost range in the survey data, so the recommended preservation costs were allocated using the same methodology as in 2003. Because of this there was no need to re-run the PLCC parametric study to re-estimate the cost modification factors.

The overall cost modification factor for any particular road is calculated by multiplying each of the relevant factors for that road together. This is because the factors were calculated using a ratio between the base road cost and the cost of a road with an extreme in climate, material costs, traffic loads or volumes. Therefore each one of these factors needs to be applied as a direct multiplier to the road cost, regardless of what other factors have been applied, which is equivalent to multiplying all relevant factors together before applying to the base cost.

6 Recommendations

6.1 Road preservation costs

Table 5 shows the recommended revised annual average road preservation base costs for the various road types and traffic volumes. The supporting discussion for these changes in Table 5 is provided in Section 3.1.6. The changes in the road preservation base costs were based on a combination of the cost information provided by the council survey, revised cost estimates from re-running the ARRB PLCC model analysis and the VicRoads cost data of 2008/09 for roads under their authority.

Overall there have only been minor changes in the annual average preservation base costs from the 2003 report which are approximately in line with preservation cost increases for this period.

6.2 Traffic volume ranges for costs

The survey of annual average base road preservation costs found, by implication from the completed questionnaires, that the ranges of traffic volume used in the 2003 report are reasonable because most of the surveyed councils were able to provide road preservation costs for these traffic ranges.

Other estimates of road preservation cost from the ARRB PLCC model analysis and the VicRoads cost data for the roads under their authority also supported the ranges of traffic volumes listed above to define the road preservation costs.

6.3 Review of cost modifier factors

Table 5 in the report shows that the cost modifier factors remain the same as previously established for the various influences on base costs. No changes to the cost modifier factors were recommended on the basis of the surveys and reviews undertaken.

6.4 Bridge preservation costs

Table 3 shows the recommended bridge preservation costs ($/m^2) for concrete and timber deck bridges.

These recommendations are based on the recommended ratio of timber deck preservation costs to concrete deck preservation costs of 1.67:1 in conjunction with the following: the council survey; the 2003 report; the costs recommended in the 2003 report; and, an allowance for an increase in market prices.

Table 5: Revised Life-Cycle Costs and Modifiers

Road type	Daily traffic tolume (AADT)	2003 Recommenced cost ($/km)[i]	2009 Recommenced cost ($/km)[i]	Freight loading:		Climate:		Cost effects[ii]:		Strategic route	Min. cost modifier factors[iv]	Max. cost modifier factors[iv]
				Half	Double	Favourable	Adverse	Favourable	Adverse			
Unkerbed	Natural surface	300	350	0.91	1.10	0.75	1.15	(N/A) [iii]	(N/A) [iii]	1.65	0.68	2.09
	< 100 (gravel or seal)	2000	2500	0.95	1.10	0.80	1.15	0.80	1.20	1.65	0.61	2.50
	100 – 500 (seal)	4000	5200	0.95	1.10	0.80	1.10	0.80	1.20	1.15	0.61	1.67
	500 – 1000 (seal)	4900	5800	0.95	1.10	0.80	1.10	0.80	1.20	1.10	0.61	1.60
	> 1000 (seal)	5400	6600	0.95	1.10	0.80	1.10	0.80	1.20	1.00	0.61	1.45
Kerbed	< 500	2700	3600	0.95	1.05	0.80	1.10	0.80	1.20	1.65	0.61	2.29
	500 – 1000	4000	4900	0.95	1.10	0.80	1.10	0.80	1.20	1.15	0.61	1.67
	1000 – 5000	5500	6600	0.95	1.10	0.90	1.10	0.80	1.20	1.15	0.68	1.67
	> 5000	9000	10700	0.95	1.10	0.90	1.10	0.80	1.20	1.15	0.68	1.67

Note:
i. All base average preservation costs rounded to nearest $100 using results of ARRB data, VicRoads costs, survey and re-run of PLCC model analysis.
ii. Cost effects account for materials supply availability, materials quality and influence of subgrade.
iii. The effects of suitable hard rock materials and influence of subgrade are not applicable to natural surface roads.
iv. Min. and max. cost modifier factors are derived by multiplying through all the cost modifiers in this Table
v. Cost modifier factors for natural surfaced roads are based on Table 7.1 with modifications made to be consistent with results of parametric analysis of other roads.

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APPENDIX A: PRESERVATION COST SURVEY DETAILS

A.1 Surveyed councils

Table A 1 summarises details of the councils included in the survey and the status of the information received from them.

Table A 1: Survey reference group

Council	Road		Bridge	
	Data provided	Data used	Data provided	Data used
Rural council A	Y	Y	Y	N
Rural council B	Y	Y	Y	N
Rural council C	Y	Y	Y	N
Rural council D	Y	Y	Y	Y
Rural council E	Y	Y	Y	N
Rural council F	Y	Y	Y	N
Rural council G	-	-	-	-
Rural council H	-	-	-	-
Rural council I	Y	Y	Y	Y
Rural council J	Y	N	N	-
Rural council K	N	-	N	-
Rural council L	Y	Y	Y	Y
Rural council M	-	-	-	-
Rural council N	N	-	N	-
Rural council O	Y	Y	Y	Y
Rural council P	Y	Y	N	-
Rural council Q	Y	Y	N	-
Rural council R	Y	Y	Y	N
Rural council S	N	-	N	-
Rural council T	-	-	-	-
Regional council A	Y	Y	Y	Y
Regional council B	N	-	N	-
Regional council C	-	-	-	-
Regional council D	N	-	N	-

Council	Road		Bridge	
	Data provided	Data used	Data provided	Data used
Regional council E	Y	N	Y	N
Urban council A	Y	Y	N	-
Urban council B	-	-	-	-
Urban council C	Y	Y	Y	Y
Urban council D	Y	Y	Y	Y
Urban council E	Y	Y	Y	N
Urban council F	-	-	-	-
Urban council G	Y	Y	Y	Y
Urban council H	Y	Y	Y	Y
Urban council I	N	-	N	-
Urban council J	Y	Y	Y	N

A.2 Current road allocations

Table A 2 summarises details of the councils response when questioned if the current allocations were adequate to maintain the roads.

Table A 2: Survey reference group

Council	Costs sufficient	Comments
Rural council A	N	Maintenance costs maybe 30% higher in non-drought years.
Rural council B	Y	-
Rural council D	Y	Adequate for current climatic conditions
Rural council I	Y	-
Rural council L	Y	-
Rural council O	N	Majority of roads are of narrow width (both gravel and sealed) with minimal pavement material. Increased traffic volumes and weight plus deteriorating road conditions have increased influences on ability of council to maintain the roads at optimum condition.
Rural council P	Y	-
Rural council Q	Y	-
Rural council R	Y	We note that council has insufficient funds to keep roads to desired level of service.
Regional council A	Y	Council is currently reviewing recent condition data collected on the sealed and unsealed network. Early indications indicate that the renewal funding will have to increase significantly for the sealed road network.
Urban council A	Y	The costs are adequate to maintain the roads at the current condition, however if additional funds were made available it would be possible to improve the overall condition of the network. However in a difficult financial environment this is an unlikely scenario.
Urban council D	N	Current expenditures are very nearly sufficient but based on the age profiles of roads they aren't on an ongoing basis.
Urban council E	Y	-
Urban council G	N	An analysis was undertaken in 2006 to determine if current funding met desired service levels. Shortfalls were identified across all road classes
Urban council H	Y	-
Urban council J	N	Based on our gap analysis for roads reports we need to spend a further $1.6 million this year on sealed roads.

A.3 Survey questionnaires

A.3.1 Road preservation cost questionnaire

Road Maintenance Costs

SHIRE COUNCIL:

Please enter the costs in **column C & D** with your most recent costs based on year 2007 $s.

If you have a different set of traffic volume ranges from those shown in **column B**, please enter them in **column E**.

Please also enter average lane widths for each volume range in **column F**.

Road Type	Daily Traffic Volume Range (AADT)	Average Annual Cost - Road Maintenance (Base Case) *	Average Annual Cost - Kerb & Channel or Shoulder Maintenance (Base Case)	Alternative traffic volume range	Average Lane Width
		$/km	$/km	(if desired)	(m)
(A)	(B)	(C)	(D)	(E)	(F)
Unkerbed	Natural Surface				
	< 100 (gravel or seal)				
	100 – 500 (seal)				
	500-1000 (seal)				
	>1000 (seal)				
Kerbed	< 500				
	500 – 1000				
	1000 – 5000				
	> 5000				

Note:

1. Required figures are **average annual maintenance costs** (routine, periodic, and rehabilitation)
2. Typical costs should be used over a period of, say, 3-5 years of typical maintenance activities
3. Please note that maintenance costs are for pavement related activities. Non-pavement related activities such as grass cutting, rubbish removal, lighting etc are not to be included.
4. Maintenance includes rehabilitation (asphalt overlays and granular resheeting) but not reconstruction.

* Cost excluding kerb & channel or shoulder maintenance costs.

Are the costs provided above adequate to maintain the roads? **YES / NO** (please circle)

If NO please provide details including road classes and approx. quantity:

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OTHER COUNCIL NOTES:

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A.3.2 Bridge preservation cost questionnaire

Victoria Grants Commission – Review of Asset Preservation Costs

Information sought from Councils regarding annual bridge maintenance costs

BRIDGE NAME (1)	ESTIMATED ANNUAL MAINTENANCE COSTS			BRIDGE AGE (3)	BRIDGE DETAILS			DECK DETAILS		OVERALL BRIDGE CONDITION (4)			TRAFFIC VOLUMES		MAIN CONSTRUCTION TYPE			ROAD TYPE		COMMENTS
	Routine $	Periodic (2) $	Restoration $	(year Constr.)	Width (m)	Length (m)	No. of Spans	Concrete	Timber	Good	Fair	Poor	AADT	VC %	Steel	Conc.	Timber	Sealed	Unsealed	

Notes:
1. Use more sheets to add further bridges.
2. For periodic maintenance please divide the total sum spent by the number of years since last periodic maintenance expenditure to arrive at an equivalent annual amount.
3. Please provide the date (or estimate) when bridge was constructed.
4. Provide overall bridge condition based on either a Level 2 Inspection or and estimate based on local knowledge.
5. Restoration or rehabilitation costs.