

A REVISED FRAMEWORK FOR EVALUATING INVESTMENT IN
RURAL LOCAL ROADS

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ABSTRACT: The papers first reviews existing methods used for evaluating rural local roads. It then draws attention to the discrepancy in recent years between economically efficient levels of spending and actual expenditures on this category of road. The final part of the paper suggests a broader framework for evaluation. This incorporates the idea that local rural roads are a merit good.

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LOCAL ROADS

John Stanley and David Starkie

INTRODUCTION

By 1978-79, road expenditure in Australia exceeded \$2 billion. This level of spending was equivalent to about one-quarter of total capital expenditure by all public authorities and was far in excess of capital spending in sectors such as Education and Health. It also outpaced by a comfortable margin the \$1.2 billion spent on capital during the same period by the Power utilities.

A sizeable chunk of this massive programme was directed to rural roads and particularly to local rural roads. For example, taking the years 1974-75 to 1978-79, over a quarter of all estimated expenditure on roads Australia-wide was spent on rural local roads. Thus, spending on this road category has had a significant bearing upon the total road expenditure programme and upon the distribution of resources in the economy as a whole.

This paper first reviews the existing evaluation framework in relation to this class of road. It then draws attention to the discrepancy between the economically efficient levels of spending on rural local roads and actual expenditures. The final part of the paper suggests a broader framework of evaluation which will help to minimise the consequences of sub-optimal expenditure.

AN OUTLINE OF THE CBR'S APPROACH

The evaluation framework used to evaluate expenditures on rural local roads was developed at the Commonwealth Bureau of Roads (CBR) in the late sixties and early seventies. It formed part of a broader framework for evaluating road expenditures as a whole.

The starting point was a nationwide survey of roads, initiated by the National Association of Australian State Road Authorities (NAASRA) in 1958, and subsequently updated. The standard of every road in Australia was examined and compared with "practical engineering criteria" to determine deficient sections. Later costs of improving deficient sections of road for a design life, generally of 15 years, were estimated. The Bureau then evaluated those improvement projects "revealed by the Australian Roads Survey to be

necessary if the ... system were to operate at a minimum level of service based on the specified engineering standards". These evaluations showed which improvements would be "economically warranted". Adding an assessed requirement for maintenance and administration and an estimated Commonwealth commitment on special purpose roads, a total warranted investment programme was arrived at.

Because the approach used focused on the individual project (the Roads Survey revealed the "need" for more than 80,000 improvement projects and 55,000 of these were subject to economic evaluation) it was, of course, possible for the Bureau to suggest a disaggregate warranted programme of investment. This was by area (State, cities, rural areas) and by functional classes of road.

The results of this analysis were published in 1969 (CBR, 1969). The exercise was repeated and published in 1973 prior to the 1974 roads legislation and again in 1975 before the 1977 legislation. In these later analyses by contrast the manpower, materials and financial constraints had the effect of revising the programme (which was now referred to as an economically warranted and feasible programme). Prior to the 1980 roads legislation, a similar exercise was carried out by the BIE. However, on this occasion the analysis was restricted to estimating an economically warranted programme only.

THE ECONOMIC METHODOLOGY

The basic methodology used by the two Bureaux to derive their economically warranted programmes was cost benefit analysis (CBA). However, the rigour with which CBA was applied varied. At one extreme rural arterial roads and outer urban arterials projects were subject to full CBA in all 4 assessments conducted between 1969 and 1979. At the other extreme, warranted programmes for rural local roads were derived from analysis of individual projects in 1969 and 1973 only. In the two more recent assessments, the analysis of these roads merely updated the earlier warranted programmes by adjusting the aggregate evaluation results generated in 1975. The adjustment took account of additional benefits from increased traffic; construction that had taken place since the last assessment; price changes; and additional requirements on account of deterioration in pavement conditions (BIE, 1979, p. 82). The overall situation is summarised in Table 1.

Details of the cost benefit analysis applied at the individual project level evolved over the years. In 1969, the analysis was confirmed to "direct" costs and benefits. That is to say the benefit side focused on monetary benefits

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TABLE 1

Nature of Evaluation Determining Economically Warranted Programmes in the 1969-79 Bureaux Reports

Reports	National Highways	Rural Arterials	Urban	Rural Local Roads	Urban Roads	MITERS	Maint. Pl. and Res. Admin.
1969(1)	PE	PE	PE	PE	PE	PE(2)	NE
1973	PE	PE	PE	PE	PE	PE	NE
1975	PE	PE	PE	A	A	A	NE
1979	A	PE	PE(3)	A	A	A	A

Legend: PE Evaluation of individual projects
 A Adjustment of overall, earlier programme
 NE No economic evaluation

Notes: (1) The 1969 analysis distinguished between principal rural roads, other rural roads and city roads only.
 (2) Small urban centres only.
 (3) Outer urban arterials only, i.e., within urban statistical division, but outside that part having a population density of 500 persons per square mile.

to road users in the form of travel time savings, operating cost savings and reduced accident costs. Also there was a saving due to reduced maintenance costs. These savings (benefits) were then set against project construction costs, all suitably discounted (a 10% rate was considered appropriate in assessing the magnitude of the finance to be made available) over a 20 year period.

A number of State road Authorities, particularly Western Australia and Queensland, and local government bodies expressed considerable concern about the apparently limited scope of these initial CBR evaluations when applied to rural local roads. In consultation with State Road Authorities,

the Bureau sought to identify reasons for this concern and to extend the evaluation methodology to make it more comprehensive. The result, early in the 1970's, was an extension of the CBR's evaluation methodology to incorporate allowance for benefits of rural local road improvements due to:

- .. reduction in period of road closure in terms of reduction in time delays, education cost and milk production foregone;
- .. increased comfort and avoided production losses due to reduction in road dust and road roughness;
- .. generated traffic (in limited cases)..

Common parameter values were applied across all States to these so-called "indirect" benefit items.*

The consequences of extending the cost benefit analysis in this way were shown subsequently in a paper by Bayley (1967). Indirect benefits increased the construction expenditure economically warranted in each State by amounts varying from 5% (SA) to 27% (NSW). As a proportion of total benefits associated with rural local road improvements, indirect benefits varied from 12% (SA and WA) to 60% (Victoria). The major indirect benefits of rural locals related to "reduced road closure" and "school bus" benefits.

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It is clear from this data that the incorporation of indirect benefits had a notable impact on the evaluation of rural local road construction projects and especially the number of projects in this road sector that were economically warranted. Yet, in spite of this there is evidence that actual expenditure on local rural roads was pushed beyond the levels indicated by the "generous" economic analysis. For example, an analysis of actual and warranted expenditure on rural locals between 1974-75 and 1978-79 shows that the former exceeded the latter by as much as 25 per cent in NSW and Victoria and by over 20 per cent in Western Australia.

Such over-investment on rural locals is evident even more, once the fact that road investment overall was well below warranted levels is taken into account. After re-distributing actual expenditure between road categories

* For further details see CBR (1973b)..

and States until the marginal-benefit-cost-ratios of expenditure in each category are equal, rural locals emerge as a sector of gross over-investment. Not only does actual expenditure on such roads exceed by almost 100 per cent the economically efficient level (given the budget constraint) but it is, moreover, the only sector to record such over-investment (see Table 2).

Clearly, therefore, there are considerable and powerful pressures to upgrade and develop local rural roads beyond the level justified by the traditional economic analysis. It may well be, of course, that the economic methodology, as applied underestimated the true gain in efficiency from investing in rural locals. It is possible, for example, that the 10 per cent discount rate used was too high (Taplin, 1980). It is possible that the value of so-called "private time" saved was too low. And it is possible that the estimates of vehicle operating costs were understated because the analysis failed to foresee the increase in the real cost of fuel that has since taken place. But we see no a priori reason why any of the above "explanations" should tip the balance of expenditure towards rural locals and away from other road categories.

There is, however, one possible explanation not mentioned in the previous paragraph that could favour rural locals. This explanation is that the money wage component in rural road construction costs over-stated the true economic cost of rural labour in view of the lack of prospects for alternative employment in rural areas. In such circumstances the labour component in road construction (and maintenance) costs should be shadow priced at a lower rate more accurately reflecting the relevant opportunity cost. The introduction of such an adjustment would no doubt increase the economically justified expenditure in rural areas. However, it would still fail to explain why "over-investment" in rural locals has taken place at the expense of rural arterial roads (see Table 2).*

LOCAL ROADS AS A MERIT GOOD

It is necessary, therefore, to seek an explanation for the "indulgent" spending on rural locals outside the normal economic efficiency framework. Our considered view is that this explanation is to be found in the basic access characteristic of rural locals, which result in such roads

* One explanation might be that local government was a source of funds in the former but not latter case.

TABLE 2 - ACTUAL AND ECONOMICALLY EFFICIENT ROAD EXPENDITURES
1974-75 TO 1978-79 : SELECTED CONSTRUCTION CATEGORIES BY STATE^(a)
 (\$ MILLION, 1971-72 PRICES)

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

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

(b) Excludes Commerce roads.

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

Source : BTE (1979)

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being looked upon as a "merit good" like education, health, law and order: fundamental access is seen as a basic right.

Recent research by the BIE has shed more light on this issue. It has been postulated tentatively by the BIE researchers that a hierarchy of access and travel aspirations is applicable to Australian rural local government areas. The suggested hierarchy is as follows:

- .. Level 1 Provision of routes to places of primary importance to community.
- .. Level 2 Provision of routes to places of secondary importance to community.
- .. Level 3 Reduction of driver stress on routes to places of primary importance; and provision of routes to places of tertiary importance to community.
- .. Level 4 Reduction of driver stress on routes to places of secondary importance.
- .. Level 5 Reduction of travel time on routes to places of primary importance.
- .. Level 6 Reduction of driver stress on routes to places of tertiary importance.
- .. Level 7 Reduction of travel time on routes to places of secondary importance.

Thus, once basic access (which the BIE researchers point out subsumes the problem of route closure due to flooding, etc.) is provided, more emphasis is placed on reducing driver stress and, once this is achieved, emphasis shifts to reducing travel time. For example, in a local authority area where basic access has been provided it is likely that the local community will aspire to a high level of stress-free driving and will consider journeys on particular routes at a reduced level of stress as "essential" or "justified on merit".

Two conclusions follow from this. First it suggests that the merit good argument may indeed be multi-faceted and, in the extreme case, the rural community may expect (without economic justification) not only all-weather access, more relaxed driving but a certain minimum speed of travel also. However, we feel this would be to push the argument too far. Nevertheless, there is a case for viewing the merit good argument in at least two dimensions, namely all-weather access to isolated properties (and, therefore, probably associated with ultra-low volume roads or tracks) and, secondly, a requirement for stress-free driving on roads

which, in traffic terms, are low to medium volume routes.

The second conclusion which we draw from the BIE's research is that there are two characteristics which associate closely with the merit good concept. One is a strong notion of equity, that everyone has an equal right to the prescribed "social" standards of road provision, and the other is that the processes involved are dynamic; that is the standard is continually reassessed in the light of what is achieved.

These conclusions suggest the need for three components in a broader evaluation framework. First, the need to establish for a State, or a region within a State, what level of all-weather access or stress-free driving the "average" local government area (LGA) experiences: that is, to establish a regional or State "norm". Second, to establish the variation around this average. Third to have a process for moving the LGA's that are below average, towards the "norm".

We believe that a simple linear model could be used for this purpose. In such an approach the dependent variable would represent the merit good or its proxy. For example, the percentage of local roads sealed in an LGA might be an adequate indicator of (the non-measurable) driver stress. The explanatory variables would be relief, population density etc. Thus,

$$Y, f, (X_1, X_2, X_3, X_4, X_5, X_6 \dots n)$$

where Y is the percentage of sealed rural local road in an LGA and X_1 is the total length of road; X_2 the LGA's population; X_3 the LGA's area; X_4 is the rateable value; X_5 is an index of the LGA's climatic regime; and X_6 is an index of the LGA's topography.*

Applying this formulation the function would allow estimation of the expected percentage sealed for an LGA given its characteristics. One would then compare this with its actual circumstances, and, if the LGA was "disadvantaged", the next step would be to determine the investment required to bring the LGA up to the "norm". Estimates of the cost of sealing would be needed in this regard. Of course, spending

* Climate and topography could perhaps be handled together and may best be handled by stratification. Such matters would need to be addressed during model estimation.

to reduce the variability will continually shift the norm, and, therefore, it will be necessary to re-calibrate the process at regular intervals. But, such a convergent, 'iterative' process is fully consistent with both the dynamic and equity aspects of the local rural road merit good.

By definition, it is not possible, of course, to incorporate this merit good element of road spending into the conventional economic framework: quite simply ex-hypothesis there is no economically efficient level of spending on merit goods. However, the dilemma can be resolved by showing clearly the consequences of spending to improve all-weather access and reduce driver stress on the cost benefit return* and vice versa. Thus, within any given budget for rural local roads it will be possible to spend the whole or part of it on projects with a positive cost benefit return; or the whole of it on providing all-weather access to isolated properties; or the whole or part of it in reducing driver stress (i.e., reducing the variability of our norm of per cent sealed).

This situation is shown in the accompanying Figure 1 which, in essence, summarises the basic evaluation framework proposed. The three axes relate to average conditions by LGA for cost benefit returns; to a level of variance around a State norm for the proportion of road with a sealed surface (the proxy for driver stress); and to the number of days (multiplied by households affected) when there is no access. Between these three axes is a production frontier which moves closer to the origin of the axes as the budget level is increased. At any given budget level the "production frontier" shows the trade-off possibilities between the three evaluation criterion.

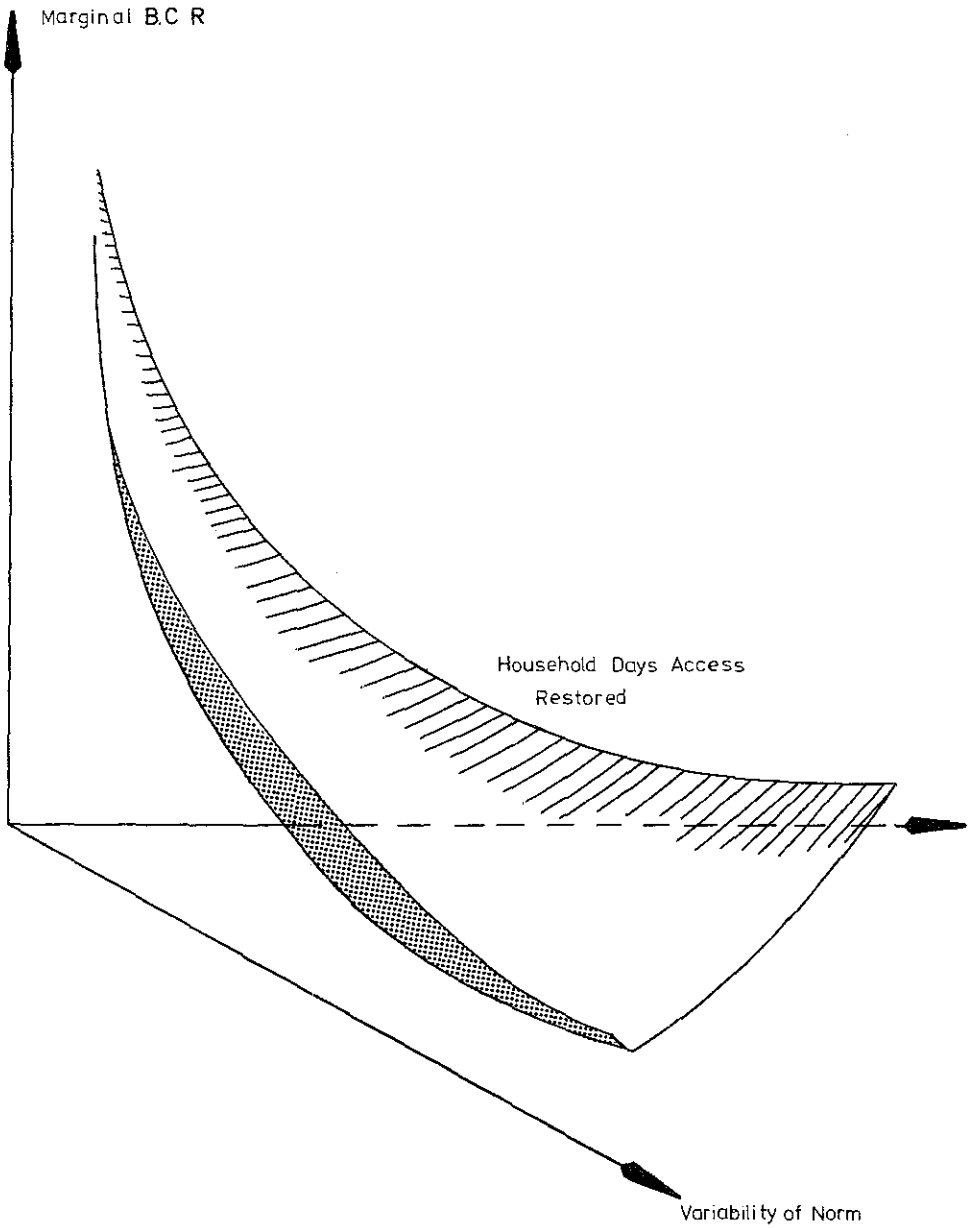
For example, let us take, for ease of exposition, trade-offs between cost benefit returns and reduced variability of the norm (i.e., reduced driver stress). If we move up the frontier towards the north-west, we are spending more on reducing the variability of the norm (driver stress) and less on projects with good cost benefit returns (thus the return on the marginal project in the latter category will be high). Conversely, moving down the frontier towards the south-east will signify more spending on projects with economic returns (thus the returns on the marginal project will fall) and correspondingly less spending on reducing variability around the norm for driver stress.

In this way the fundamental issue of a resource

* We anticipate here the use of a modified cost benefit approach based on, for example, a shadow price for rural labour.

FIGURE 1

TRADE OFFS BETWEEN CONSTRUCTION EXPENDITURE OBJECTIVES



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constraint is illustrated but so too are the consequences of changing this constraint. For different funding levels it is possible to see what kind of rural local road "package" is being purchased. Moreover, for any given level of funding it is possible also within this framework to see the "costs", in terms of economic benefits foregone, of placing more emphasis on reduced driver stress and increased all-weather access. Consequently, choices become more explicit and systematic.

SUMMARY AND CONCLUSION

During the seventies advice was received by all levels of government and spending authorities on appropriate procedures for evaluating rural local road schemes along with other road projects. This advice focused upon the use of cost benefit analysis and led to the formulation of suggested levels of expenditure on rural local roads. The course of events showed that spending on the construction and reconstruction of these roads was greater than could be justified on the grounds of economic efficiency.

In this paper we have suggested that this over-investment reflected attitudes towards an equitable distribution of access and concomitant treatment of rural local roads as a form of merit good. As a consequence we have suggested a broader evaluation framework which incorporates this view. As an approach it has, we feel, a number of advantages. In particular it has the advantage of making the process of resource allocation more explicit and systematic. More importantly, by revealing the efficiency consequences of varying the patterns of expenditure on rural local roads, we feel ultimately that it could lead to a more efficient use of resources.

However the initiative in this matter lies at State and Commonwealth level. The approach suggested here implies that State and Commonwealth governments allocate resources so that, for example, the relatively disadvantaged LGA's are moved towards the regional norm. With the Commonwealth having contributed 36 per cent, and the States 28 per cent, of the funds spent on rural local road construction during 1979/80,* the opportunity for these two levels of government to affect the regional pattern of construction expenditure is considerable.

Achieving a better use of resources will not be helped, however, by the continued use of simple distribution

* See Thoresen (1981) Table 4.4.

formulae. Seventy per cent of the 1981-82 Commonwealth grant for Tasmanian local roads for example is being apportioned between councils pro rata to the length of road (73 per cent) and to population (27 per cent). Only by accident will such a distribution correspond to one produced by a rational assessment of road needs and requirements. Indeed it is questionable whether the distribution of these funds relates at all to road transport objectives. Thus we suggest that either the Commonwealth absorbs these funds into an enhanced share of personal income tax for which local government is eligible, or it take steps to develop evaluation methodology. In the latter case we offer ours as a starting point.

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