Review of Public Transport Investment Proposals for Australian Capital Cities, 1973/74

Report

This is the second Report by the BTE on capital investment in urban public transport, the previous Report having been produced in June 1972.

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BUREAU OF TRANSPORT ECONOMICS

A REVIEW OF PUBLIC TRANSPORT INVESTMENT PROPOSALS FOR AUSTRALIAN CAPITAL CITIES, 1973-74

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FOREWORD

This is the second report by the BTE on capital investment in urban public transport, the previous report having been produced in June 1972.

The study was carried out by an interdisciplinary team, but is largely the work of the Transport Engineering Branch. The team was led by F.C. Keith, and his principal assistants were J.P. Corner and A.G. Mackay. Economic aspects were supervised by P.W. Blackshaw.

The methods used in this study are similar to those used previously, with some refinements. They were developed for the earlier study under the direction of K.E. Thompson. The systems design for the computer application was carried out by W.P. Egan.

J.H.E. TAPLIN
Director

Bureau of Transport Economics,
Canberra,
August 1973.

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SUMMARY

In June 1972 the Bureau of Transport Economics completed a report 'Economic Evaluation of Capital Investment in Urban Public Transport'. It contained a survey of investment required for public transport in Australian capital cities, over the five years commencing 1973-74, and evaluations of 24 of the projects in the survey, estimated to cost some $300m.

At the February 1973 meeting of the Australian Transport Advisory Council, the Minister for Transport announced that the Australian Government, after considering the 1972 BTE report, had approved in principle a scheme to provide two-thirds of the cost of improving urban public transport. The Minister also stated that the Government was prepared to consider alternatives to the projects previously submitted to the BTE.

This report contains the results of evaluations of projects, to commence in 1973-74, which had not previously been evaluated or which have been substantially altered from the projects submitted in 1972.

Evaluations are reported for 25 projects costing $127m (for rolling stock projects this includes only the first year's expenditure), of which the States proposed to incur $36.5m in 1973-74. In addition, the investment programs included seven projects unaltered since the previous study, proposed expenditure on these being $38.4m in 1973-74. Projects estimated to cost a further $14m ($5.1m in 1973-74) were either too small to warrant evaluation or were not readily amenable to it.

Available resources did not permit the evaluation of projects due to commence after 1973-74 nor projects, such as underground railways, having complex interactions with urban land development.

All but two of the projects evaluated had benefit-cost ratios greater than 1.0 at 7 per cent discount rate, but 28 per cent of the evaluated expenditure provided benefit-cost ratios less than 1.0 at a 10 per cent discount rate.

ACKNOWLEDGEMENTS

The following agencies participated in the study by providing basic data for the BTE evaluations. Their courteous assistance is gratefully acknowledged.

New South Wales

Public Transport Commission of New South Wales
State Planning Authority of New South Wales

Victoria

Ministry of Transport
Victorian Railways
Melbourne and Metropolitan Tramways Board
Metropolitan Transportation Committee

Queensland

Department of Transport
Queensland Government Railways

South Australia

Office of Director-General of Transport
South Australian Railways
Municipal Tramways Trust

Western Australia

Office of Director-General of Transport
Metropolitan Transport Trust
Perth Regional Transportation Study

Tasmania

The Transport Commission
Metropolitan Transport Trust

CHAPTER 1 INTRODUCTION

In July 1971 the Australian Transport Advisory Council requested the Bureau of Transport Economics to report on the need for increased investment in urban public transport. The BTE produced its report in June 1972. It included:

- a survey of estimated capital investment requirements for publicly owned public transport in Australian cities, over the period 1973-74 to 1977-78;
- evaluations of representative projects;
- descriptions of the evaluation techniques used;
- statistics on existing public transport services;
- trends in public transport; and
- a review of public transport finances.

The report concluded that public transport fulfils a vital function in capital cities, that current levels of capital expenditure are inadequate and that public transport authorities cannot finance an appropriate level of investment from current revenue sources.

After considering the BTE report, the Australian Government decided to provide funds for public transport. The minutes of the Thirty-Ninth Meeting of the Australian Transport Advisory Council of February 1973 record that:

> 'The Chairman advised Council that the Australian Government has approved in principle a scheme to provide two-thirds of the cost of improving public transport, excluding underground railways. The Government was prepared to consider assisting the latter where the projects can be justified on economic and other relevant grounds ... The States should submit detailed proposals for each project. There would be no objections to changes by States to programmes previously submitted to the Bureau of Transport Economics ...'

Because the 1972 study was designed to provide guidance on the merit of public transport investment in general, not all of the suggested projects were given detailed examination in that study. The 1972 evaluations have been reviewed for this Report, and new or changed projects have been evaluated. The work has been restricted to projects expected to commence in 1973-74. Because of their complexity, no attempt has been made to evaluate underground railways as part of the 1973-74 program review.

CHAPTER 2 PROCEDURE

2.1 ECONOMIC EVALUATION

The evaluation procedure was benefit-cost analysis as described in Annexes D and E of the 1972 Report[1]. This method of analysis relates the net present value of a time stream of benefits and costs to the capital cost. The result is expressed in the form of a benefit-cost ratio. Net present value and internal rate of return were also computed.

Some changes were made to the BTE computer model used in the 1972 Study to make it more efficient and more accurate, and the cost relationships were updated. Annex A deals with some technical aspects of the evaluation model.

Contingency allowances were applied to capital costs, depending on the level of confidence in the estimates. Operating cost estimates were compared for consistency with costs in similar situations elsewhere. In estimating travel time and train operating costs, train diagrams and timetables were prepared where particular accuracy was required. All travel forecasts were closely examined in the light of source data and comparable situations elsewhere. The computer model was used systematically to detect a variety of data inconsistencies, particularly between the base case and the project case.

Benefits estimated in the evaluations include, where appropriate:

- savings in public transport operating costs
- maintenance cost savings
- trip time savings by passengers
- reduced waiting time

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(1) Economic Evaluation of Capital Investment in Urban Public Transport, Bureau of Transport Economics, Canberra, June 1972.

- reduced walking time at transfer points
- improved comfort
- greater probability of getting a seat
- reduced congestion on roads
  - time savings
  - car operating cost savings
  - operating cost savings by commercial vehicles
- reduced need to construct new roads
- parking cost savings
- road accident savings
- benefits to new public transport passengers

2.2 FINANCIAL ANALYSIS

The selection of the best alternative for a public transport improvement should be based on an economic evaluation in which all costs and benefits to the whole community are assessed. The economic evaluation methods used in this review approximate to this ideal. However, in practical decision making it is also important to appreciate the financial implications for the agency concerned of a particular investment proposal.

Public transport improvements directly affect the finances of the operating authorities. They could also affect many other public and private agencies by changing the pattern of motor vehicle use. For example, the Australian Government could save money on road constructions, but also lose tax revenue owing to decreased use of motor vehicles. Local government could lose revenue from parking. Private enterprise could be affected by changes in expenditure associated with motor vehicles and by changes in people's behaviour with respect to shopping, work location and recreation. Effects which could be even more widespread are those relating to changes in urban land use and development.

The degree to which it is feasible to take account of these financial implications depends on the magnitude of the project, the significance of particular 'spillover effects' and the availability of appropriate data. For projects of the types described in this Report, it is probably sufficient to confine the financial analysis to the effects on the public transport agencies most directly concerned. The financial analyses in this Report cover the cost of capital, changes in fare revenues and changes in the costs of operating and maintaining the public transport services. Because the source of the capital has not been taken into account, the results do not allow for the beneficial effect that any capital grants would have on transport authority finances. Further details are given in Annex A.

2.3 THE TIME CONSTRAINT

Following the Australian Government decision to provide funds for urban public transport, there was little more than three months for:

- States to prepare revised investment programs;
- BTE to select the projects which should be evaluated;
- BTE to advise the States on details required on particular projects for evaluation;
- States to determine costs and operating characteristics of projects;
- BTE to critically review data supplied by States;
- BTE to refer back to States data found to be inconsistent or inaccurate;
- States to investigate inconsistencies in data;
- BTE to perform evaluations; and
- BTE to report the results of its investigations.

The limited time made it impracticable to evaluate small projects or to make the detailed investigations necessary to provide benefit-cost ratios which could be used to rank projects in order of merit. Where benefits which could be readily quantified gave a benefit-cost ratio greater than 1.0 at a 10 per cent discount rate, resources were not committed to the data collection and analyses required to incorporate less tangible benefits in the evaluation.

The study timing restricted the amount of independent estimation of travel data and costs by the BTE. This made the study dependent on data provided by the States. However, these data were thoroughly checked for consistency and accuracy.

The time available also prohibited extensive sensitivity testing of results. Most results are based on the best estimates of the expected parameter values.

2.4 PROJECT DEFINITION

As in the original study, the BTE was limited to the analysis of projects proposed by the State Governments. Where it became apparent during the evaluation that construction or operational changes would improve the project, these were drawn to the attention of the State concerned and incorporated in the project where appropriate. However, with two or three exceptions, the BTE did not evaluate alternatives and did not subject projects to systematic optimisation studies.

Evaluations were restricted to projects within capital city Statistical Divisions.

Privately owned public transport has been excluded from the current scheme. This excludes a large portion of public transport services in most cities[1], particularly in developing areas.

Administrative convenience in the States influenced the selection of a predominance of expensive projects designed to carry large numbers of passengers. If resources had existed to examine a wider range of projects, there could have been an increased number of lower cost projects designed to serve less densely trafficked areas.

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(1) Ibid., Annex A.

In this Report, attention is drawn to some aspects of the program where additional investigations appear particularly relevant. Generally the BTE, in consultation with State authorities, attempted to ensure that the proposals comprised an appropriate first stage in a long term program consistent with urban planning and social objectives. However, it has been necessary to accept the operating circumstances of the urban transport services. This acceptance does not imply that the BTE considers the existing situation to be optimal nor that the range of proposed projects are exhaustive or necessarily the best means of improving public transport.

2.5 FACTORS EVALUATED

The current BTE evaluations include only those factors which are fairly readily quantified. Such factors are construction costs, operating costs and user costs, including travel time. In some cases, values for particular comfort characteristics have been estimated.

Air pollution, noise, social dislocation, employment opportunities and the generation of waste materials would generally be ameliorated or improved by diverting resources to public transport. Because these factors have not been quantified, the evaluations underestimate the benefits.

The accuracy of the evaluation results is dependent on the accuracy of estimates of future travel, modal split, operating costs, value of time, road construction costs, trip purpose, the ratio of peak to off-peak travel, the ratio of daily to annual traffic, car occupancy, and a variety of other factors. The BTE considers that these factors have been estimated with sufficient accuracy to determine whether a project is warranted. However, the results of a particular evaluation should not be taken as a complete measure of the merit of the project.

2.6 ROLLING STOCK

As in the 1972 study, the BTE limited its analyses of rolling stock to replacement purchases proposed by the States. The evaluations only tested whether replacements of the scale and type proposed would be better than retaining the oldest vehicles in the respective fleets for a further ten years. From that point of view, the favourable evaluation results imply that the new vehicles are a sound investment, but the possibility cannot be ruled out that replacement with different vehicles would yield even greater returns. Nor can the possibility be excluded that complete abandonment of some existing systems (or parts of them) and their wholesale replacement by other systems (using either conventional or new technology) could yield better returns.

This reservation applies far more to the longer-lived and more expensive items (trains and trams) than to buses. The risks of misinvestment in buses are far less, as are the penalties. The initial outlay on buses is lower, the design options are less extensive and, if it is subsequently decided that another design is preferable, there would be a market for the unwanted buses. Replacement of the oldest buses in each fleet is a low risk, low cost investment offering attractive returns, provided that the assumed maintenance cost savings can be attained(1). The BTE believes that such savings are attainable, if appropriate adjustments are made to workshop size and maintenance procedures as fleets are modernised. Available information suggests that many systems find it worthwhile to use short replacement cycles for buses and thus keep maintenance costs low. In some countries expected bus lifespans are 10 years or less(2). The National Bus Company, by far the largest bus operator in the United Kingdom

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(1) On the other hand, the maintenance cost function may underestimate maintenance savings, as explained in Annex A.

(2) Motor Transport (UK) Bus and Coach Supplement, 3 April 1970.

(with 25 per cent of the buses), operates on a ten-year replacement cycle[1], while the Hamburg Transport Authority takes buses out of service after 5 years[2].

The risks of misinvestment are greater for trains and trams, which are more expensive initially, and more difficult to sell should the need arise. Furthermore, trains are generally operated in Australia as part of an integrated system, the overall performance of which is influenced by the poorest parts of the fleet. Thus, trains and trams which are purchased over the next five years could have a profound effect on the quality of urban public transport systems for perhaps 30 years. It is possible that inappropriate replacement policies now would lock the entire system into an obsolescent technology. It is essential, therefore, that the proposed expenditure on trains and trams up to 1977-78 be spent on the most modern and efficient vehicles available, even though it may not be possible to take full advantage of their performance until a large part of the system has been upgraded.

The rolling stock evaluations did not deal with purchases for fleet expansion, which would have to be evaluated on entirely different principles. However, some fleet increases were evaluated as part of the corridor projects, additional rolling stock to service the projects being included in the project costs.

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(1) See also Holland, D.G., 'The Replacement of Buses in Bristol, 1920-1952', Bulletin of Oxford University Institute of Economics and Statistics, Vol. 24, No.2, November 1962. Although this study relates to a period when expected life of a bus was considerably longer than is now the case, Holland found that the age of buses replaced in Bristol varied from 10-17 years, and only attained the upper end of that range during the war and in periods of financial stringency.

(2) Mross, M. The Operation of a Non-Subsidised Public Transport System, unpublished paper to University of Newcastle-Upon-Tyne Workshop, circa 1970.

CHAPTER 3 REVIEW OF INVESTMENT PROGRAMS

3.1 THE PROGRAMS

Table 3.1 summarises the proposed 1973-74 capital investment programs as submitted by the States. As the total is almost 100, the figures may also be read as percentages.

TABLE 3.1 - PROPOSED 1973-74 INVESTMENT PROGRAM

($m)

Project type	NSW	Vic.	Qld	SA	WA	Tas.	Total
Railway							
Additional tracks	2.67	6.00	0.74				9.41
Electrification	1.10	2.10	1.31	1.90			6.41
Signalling	0.03	1.10					1.13
Rolling stock	18.22	10.70		2.00			30.92
New routes	8.10	17.90	1.20	3.00			30.20
Miscellaneous	0.52						0.52
Total Railway	30.64	37.80	3.25	6.90			78.59
Bus							
Busways	0.32				0.34		0.66
Rolling stock	3.36	0.81		1.30	1.35	1.50	8.32
Miscellaneous	0.50			0.70		.04	1.24
Total Bus	4.18	0.81		2.00	1.69	1.54	10.22
Tramway							
Route upgrading				0.30			0.30
Rolling stock		0.23					0.23
Total Tramway		0.23		0.30			0.53
Ferry	2.18				0.11		2.29
Passenger Interchange	0.95	3.80			1.01	0.02	5.78
Planning, Research and Development		0.50	0.24	0.60	0.24		1.58
Miscellaneous	0.25						0.25
TOTAL	38.20	43.14	3.49	9.80	3.05	1.56	99.24
PER CENT OF TOTAL	38.5	43.5	3.5	9.9	3.1	1.5	100.0

The bulk of the proposed expenditure is for railways (79 per cent), with rolling stock being the largest item (31 per cent), closely followed by new routes (30 per cent). Bus expenditure amounts to 10.3 per cent of the total and 5.8 per cent is planned for passenger interchanges.

Queensland and Western Australia have proposed relatively small expenditure programs for 1973-74, due to a concentration of efforts on design and feasibility studies for large expenditures which are proposed for later years.

Table 3.2 shows the proportion of each item which was evaluated. A number of small projects were not evaluated, some being not readily amenable to economic evaluation. These small projects amounted to only 5 per cent of the proposed program.

TABLE 3.2 - PROPORTION OF PROPOSED 1973-74 INVESTMENT PROGRAMS EVALUATED

(Per cent)

Project type	NSW	Vic.	Qld	SA	WA	Tas.	Total
Railway							
Additional tracks	100.0	80.0	100.0				87.3
Electrification	54.6	100.0	100.0	100.0			92.2
Signalling	66.7	100.0					99.1
Rolling stock	100.0	100.0		100.0			100.0
New routes	0.0	77.4	100.0	100.0			59.9
Miscellaneous	76.9						76.9
Total Railway	71.5	86.1	100.0	100.0			82.2
Bus							
Busways	0.0				97.1		50.0
Rolling stock	100.0	100.0		100.0	100.0	100.0	100.0
Miscellaneous	0.0					0.0	0.0
Total Bus	80.4	100.0		100.0	99.4	97.4	91.5
Tramway							
Route upgrading				100.0			100.0
Rolling stock		100.0					100.0
Total Tramway		100.0		100.0			100.0
Ferry	0.0				100.0		48.0
Passenger Interchange	0.0	0.0			100.0	0.0	17.5
Planning, Research and Development		0.0	0.0	0.0	0.0		0.0
Miscellaneous	0.0						0.0
ALL PROJECTS	66.1	77.9	93.1	86.7	91.8	96.2	74.5

3.2 EVALUATION RESULTS

All final evaluations, apart from buses for Adelaide and Hobart, gave benefit-cost ratios greater than 1.0 at a 7 per cent discount rate. However a number did not have benefit-cost ratios greater than 1.0 at a 10 per cent discount rate. Table 3.3 shows that, of the total expenditure evaluated, 72 per cent provided a benefit-cost ratio greater than 1.0 at a 10 per cent discount rate.

Table 3.3 - PROPORTIONS OF EVALUATED EXPENDITURE WITH BENEFIT-COST RATIOS GREATER THAN 1.0 AT 10 PER CENT DISCOUNT RATE

(Per cent)

Project type	NSW	Vic.	Qld	SA	WA	Tas.	Total
Railway							
Additional tracks	22.5	100.0	100.0				74.8
Electrification	100.0	0.0	100.0	100.0			64.5
Signalling	0.0	100.0					98.2
Rolling stock	100.0	100.0		100.0			100.0
New routes		0.0	100.0	100.0			17.3
Miscellaneous	100.0						100.0
Total Railway	90.5	51.1	100.0	100.0			72.1
Bus							
Busways					100.0		100.0
Rolling stock	100.0	100.0		0.0	100.0	0.0	66.3
Miscellaneous							
Total Bus	100.0	100.0		0.0	100.0	0.0	67.6
Tramway							
Route upgrading				100.0			100.0
Rolling stock		100.0					100.0
Total Tramway		100.0		100.0			100.0
Ferry						100.0	100.0
Passenger Interchange						100.0	100.0
Planning, Research and Development							
Miscellaneous							
ALL PROJECTS	91.7	52.5	100.0	84.7	100.0	0.0	71.9

Only 60 per cent of the proposed expenditure on new railway routes was evaluated. All of this gave benefit-cost ratios greater than 1.0 at a 7 per cent discount rate, but less than one fifth did so at 10 per cent. This small proportion (and the small proportion for Victoria in total) is influenced largely by the Melbourne Eastern Railway result.

Table 3.4 compares capital cost and economic and financial net present values, at 7 per cent discount rate, for those projects for which all three measures were computed. After discounting capital costs to present values, the aggregate benefit-cost ratio would exceed 2.0. The net present value of financial losses would be of the order of half the present value of the capital costs.

Because financial evaluation includes initial capital, financial net present values do not reflect the impact of the projects on the public transport authorities' accounts if portion of the capital is provided in interest free grants. If two-thirds is provided interest free, the net impact of the program on transport authorities' financial position is favourable.

TABLE 3.4 - COMPARISONS OF CAPITAL COST, AND ECONOMIC AND FINANCIAL NET PRESENT VALUES FOR SELECTED PROJECTS

($m)

Project type	Capital cost	Net present value at 7 per cent	
		Economic	Financial
Railway			
Additional tracks	36.28	16.15	-23.79
Electrification	22.63	31.53	-11.05
Signalling	5.50	11.64	3.84
Rolling stock	0.44	0.20	0.20
New routes	8.37	10.30	1.45
Total Railway	73.22	69.82	-29.35
Tramway			
Route upgrading	0.80	0.98	- 0.82
TOTAL	74.02	70.77	-30.17

FIGURE 3.1 - NSW PROJECTS

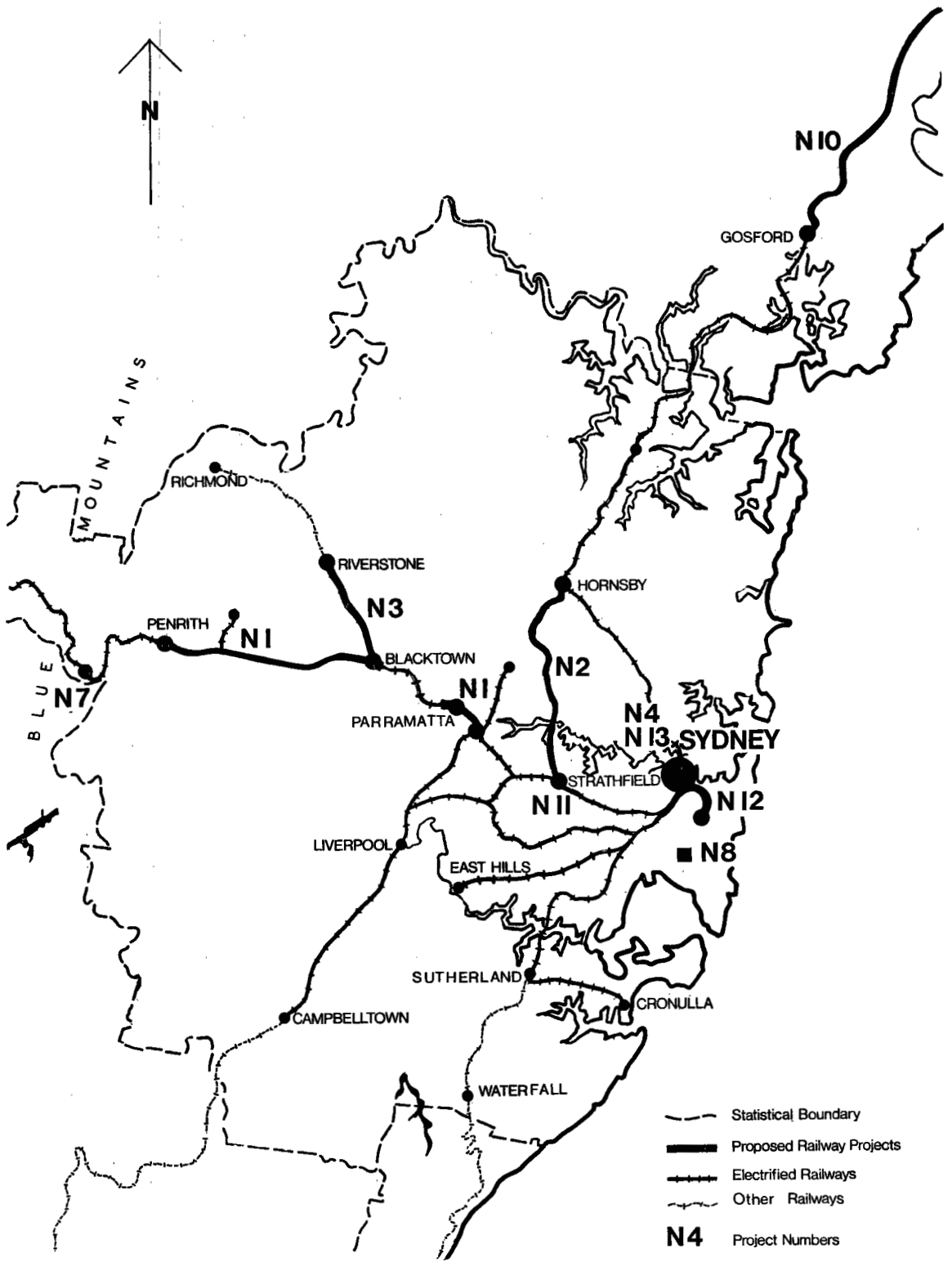

FIGURE 3.1 SYDNEY PROJECTS

0 5 10 15 20 25 km

KEY TO PROJECTS IN FIG. 3.1

N1	Granville-Penrith railway quadruplication
N2	Strathfield-Hornsby railway - additional tracks
N3	Electrification of Blacktown-Riverstone railway
N4	Signalling improvements Sydney station area
N7	Glenbrook tunnel widening
N8	Randwick-Darlinghurst busway
N10	Electrification of Gosford-Newcastle railway
N11	Signalling improvements Strathfield area
N12	Sydney eastern suburbs railway
N13	Sydney city circle

NOTE: Projects 5, 6, 9 and 14-22 are not shown in Fig. 3.1 because they are general system improvements or their locations have not been precisely determined.

3.3 NEW SOUTH WALES

Table 3.5 indicates that the bulk of the 1973-74 expenditure proposed by New South Wales is for the purchase of railway rolling stock. A significant amount is also proposed for buses.

TABLE 3.5 - NEW SOUTH WALES PROPOSED 1973-74 EXPENDITURE PROGRAMME

($m)

Project type	Proposed expenditure	Expenditure evaluated	Expenditure small or not amenable to evaluation	Expenditure with B/C ratio greater than 1.0 at 10% discount rate
Railway				
Additional tracks	2.67	2.67		0.60
Electrification	1.10	0.60		0.60
Signalling	0.03	0.02		
Rolling stock	18.22	18.22		18.22
New routes	8.10			
Miscellaneous	0.52	0.40	0.12	0.40
Total Railway	30.64	21.91	0.12	19.82
Bus				
Busways	0.32			
Rolling stock	3.36	3.36		3.36
Miscellaneous	0.50		0.50	
Total Bus	4.18	3.36	0.50	3.36
Ferry	2.18		0.30	
Passenger Interchange	0.95		0.70	
Miscellaneous	0.25		0.25	
TOTAL	38.20	25.27	1.87	23.18
PER CENT OF TOTAL	100.0	66.2	4.9	60.7

A total of 66 per cent of the proposed expenditure was evaluated. Of this, 92 per cent gave benefit-cost ratios greater than 1.0 at 10 per cent discount rate. The Strathfield-Epping and Sydney Station Area Signalling projects (for location, see Fig. 3.1) were the only ones which did not satisfy this criterion. The first of these projects had a benefit-cost ratio only marginally less than 1.0 at 10 per cent (calculated figure 0.97) while the second could be expected to exceed 1.0 if it were practicable to quantify all benefits.

FIGURE 3.2 - VIC PROJECTS

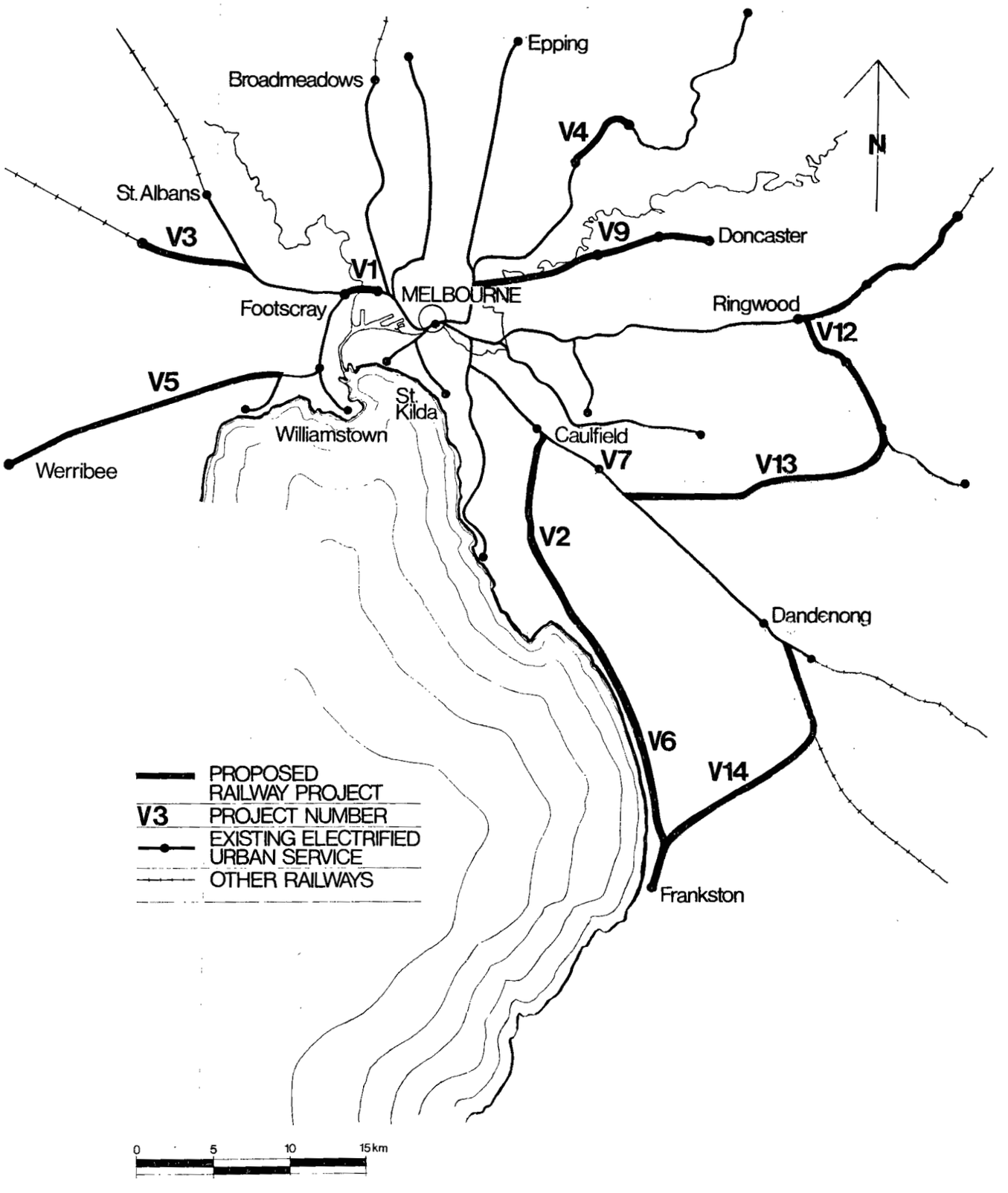

FIGURE 3.2 MELBOURNE PROJECTS

KEY TO PROJECTS IN FIG. 3.2

V1 South Kensington-Footscray railway quadruplication
V2 Caulfield-Mordialloc railway third track
V3 Sunshine-Deer Park West railway
V4 Macleod-Greensborough railway duplication
V5 Electrification of Newport-Werribee railway
V6 Frankston railway resignalling
V7 Signal improvements - Oakleigh station
V9 Melbourne eastern railway stage one
V12 Ringwood corridor
V13 Huntingdale-Ferntree Gully railway
V14 Frankston-Lyndhurst railway

NOTE : Projects 8, 10, 11 and 15-18 are not shown in Fig. 3.2 because they are general system improvements.

Table 3.6 indicates that railway projects dominate the expenditure program proposed by Victoria. Also, the program is composed mainly of large projects.

TABLE 3.6 - VICTORIAN PROPOSED 1973-74 EXPENDITURE PROGRAM

($m)

Project type	Proposed expenditure	Expenditure evaluated	Expenditure small or not amenable to evaluation	Expenditure with B/C ratio greater than 1.0 at 10% discount rate
Railway				
Additional tracks	6.00	4.80		4.80
Electrification	2.10	2.10		
Signalling	1.10	1.10		1.10
Rolling stock	10.70	10.70		10.70
New routes	17.90	13.85		
Total Railway	37.80	32.55		16.60
Bus				
Rolling stock	0.81	0.81		0.81
Tramway				
Rolling stock	0.23	0.23		0.23
Passenger Interchange	3.80		1.40	
Planning, Research and Development	0.50		0.50	
TOTAL	43.14	33.59	1.90	17.64
PER CENT OF TOTAL	100.0	77.9	4.4	40.9

A total of 78 per cent of the proposed expenditure was evaluated. Of this, 53 per cent gave benefit-cost ratios greater than 1.0 at 10 per cent discount rate. Electrification of the Newport-Werribee Railway and the Melbourne Eastern Railway (for location, see Fig. 3.2) had benefit-cost ratios less than 1.0 at 10 per cent, although the benefit-cost ratios were greater than 1.0 at 7 per cent. These two projects amount to 39 per cent of the total program.

FIGURE 3.3 - QLD PROJECTS

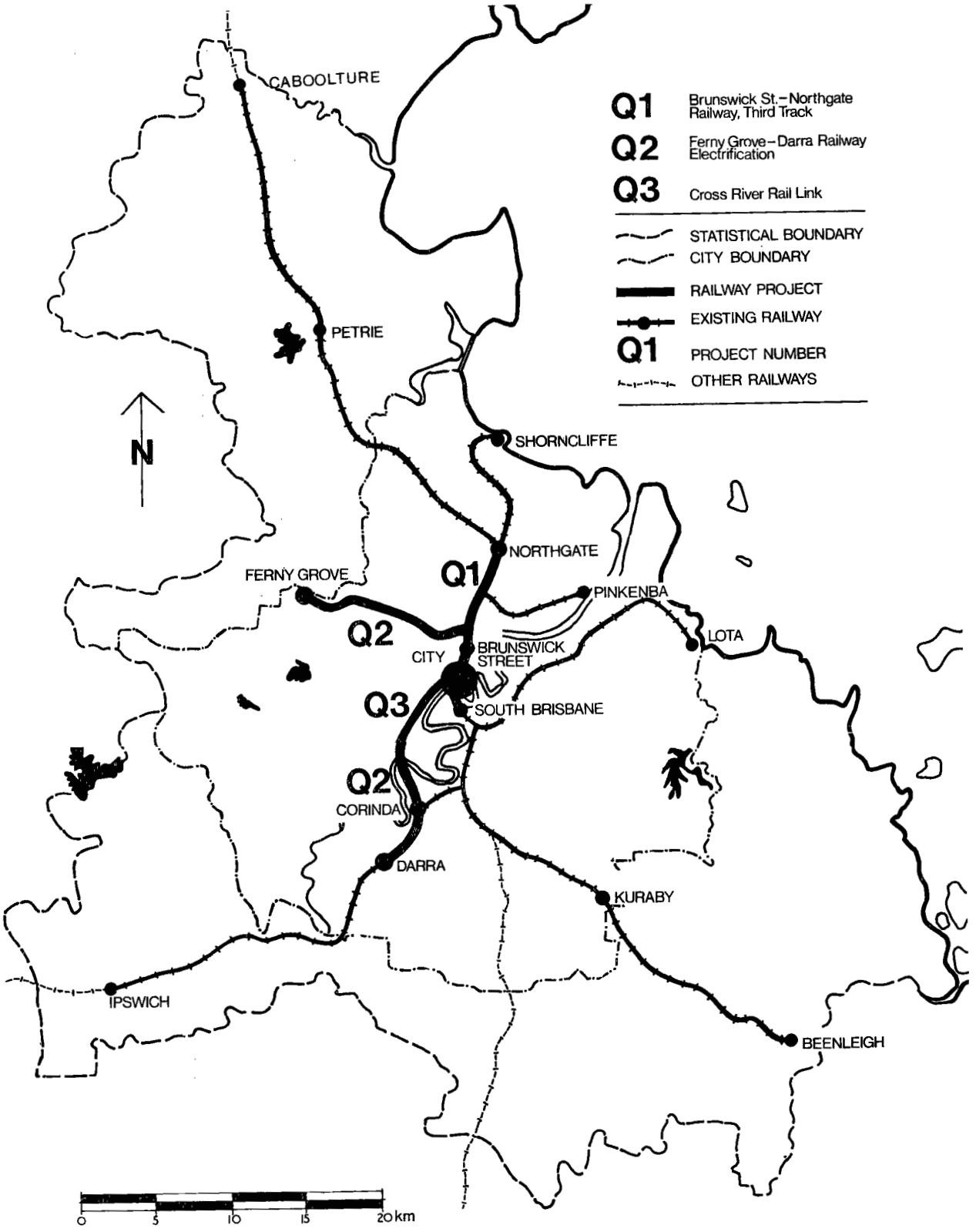

FIGURE 3.3 BRISBANE PROJECTS

Table 3.7 shows that, apart from planning and research, the entire investment program proposed by Queensland for 1973-74 would be in railways. All projects evaluated had benefit-cost ratios greater than 1.0 at 10 per cent discount rate. Figure 3.3 shows the location of projects.

TABLE 3.7 - QUEENSLAND PROPOSED 1973-74 EXPENDITURE PROGRAM

($m)

Project type	Proposed expenditure	Expenditure evaluated	Expenditure small or not amenable to evaluation	Expenditure with B/C ratio greater than 1.0 at 10% discount rate
Railway				
Additional tracks	0.74	0.74		0.74
Electrification	1.31	1.31		1.31
New routes	1.20	1.20		1.20
Total Railway	3.25	3.25		3.25
Planning, Research and Development	0.24		0.24	
TOTAL	3.49	3.25	0.24	3.25
PER CENT OF TOTAL	100.0	93.1	6.9	93.1

FIGURE 3.4 - SA PROJECTS

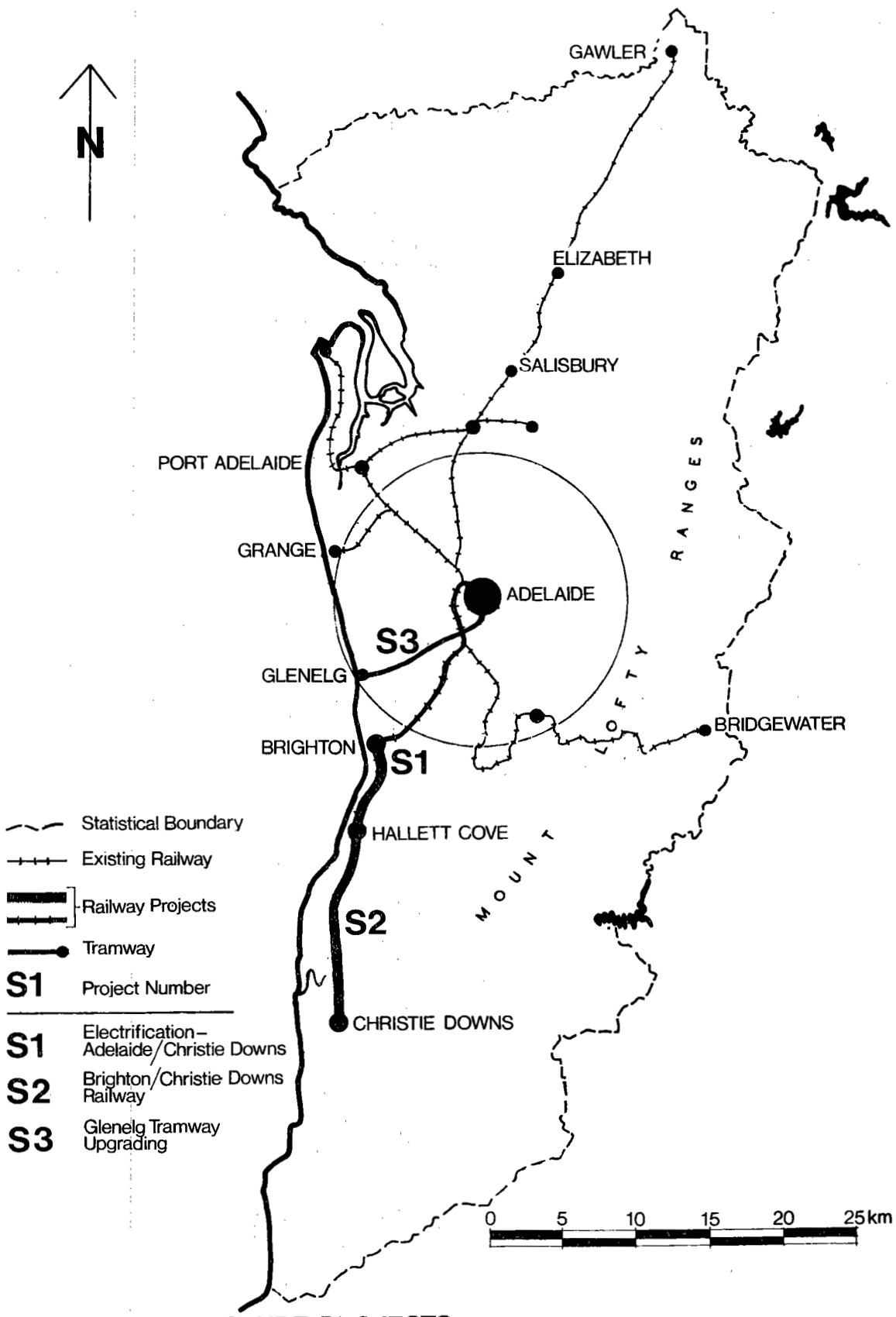

FIGURE 3.4 ADELAIDE PROJECTS

3.6 SOUTH AUSTRALIA

Table 3.8 shows that expenditure proposed by South Australia for 1973-74 was distributed between rail, bus and tram. A total of 87 per cent of the proposed program was evaluated. All projects evaluated except bus replacement had benefit-cost ratios greater than 1.0 at 10 per cent discount rate. The less favourable bus result may be caused by the use of a general maintenance cost function which may not be appropriate for Adelaide buses. Figure 3.4 shows the location of projects.

TABLE 3.8 - SOUTH AUSTRALIAN PROPOSED 1973-74 EXPENDITURE PROGRAM

($m)

Project type	Proposed expenditure	Expenditure evaluated	Expenditure small or not amenable to evaluation	Expenditure with B/C ratio greater than 1.0 at 10% discount rate
Railway				
Electrification	1.9	1.9		1.9
Rolling stock	2.0	2.0		(a)2.0
New routes	3.0	3.0		3.0
Total Railway	6.9	6.9		6.9
Bus				
Rolling stock	1.3	1.3		
Miscellaneous	0.7	0.2		
Total Bus	2.0	1.5		
Tramway				
Route upgrading	0.3	0.3		0.3
Planning, Research and Development	0.6		0.6	
TOTAL	9.8	8.5	0.6	7.2
PER CENT OF TOTAL	100.0	86.7	6.1	73.5

(a) Evaluated as part of the electrification project.

FIGURE 3.6 - WA PROJECTS

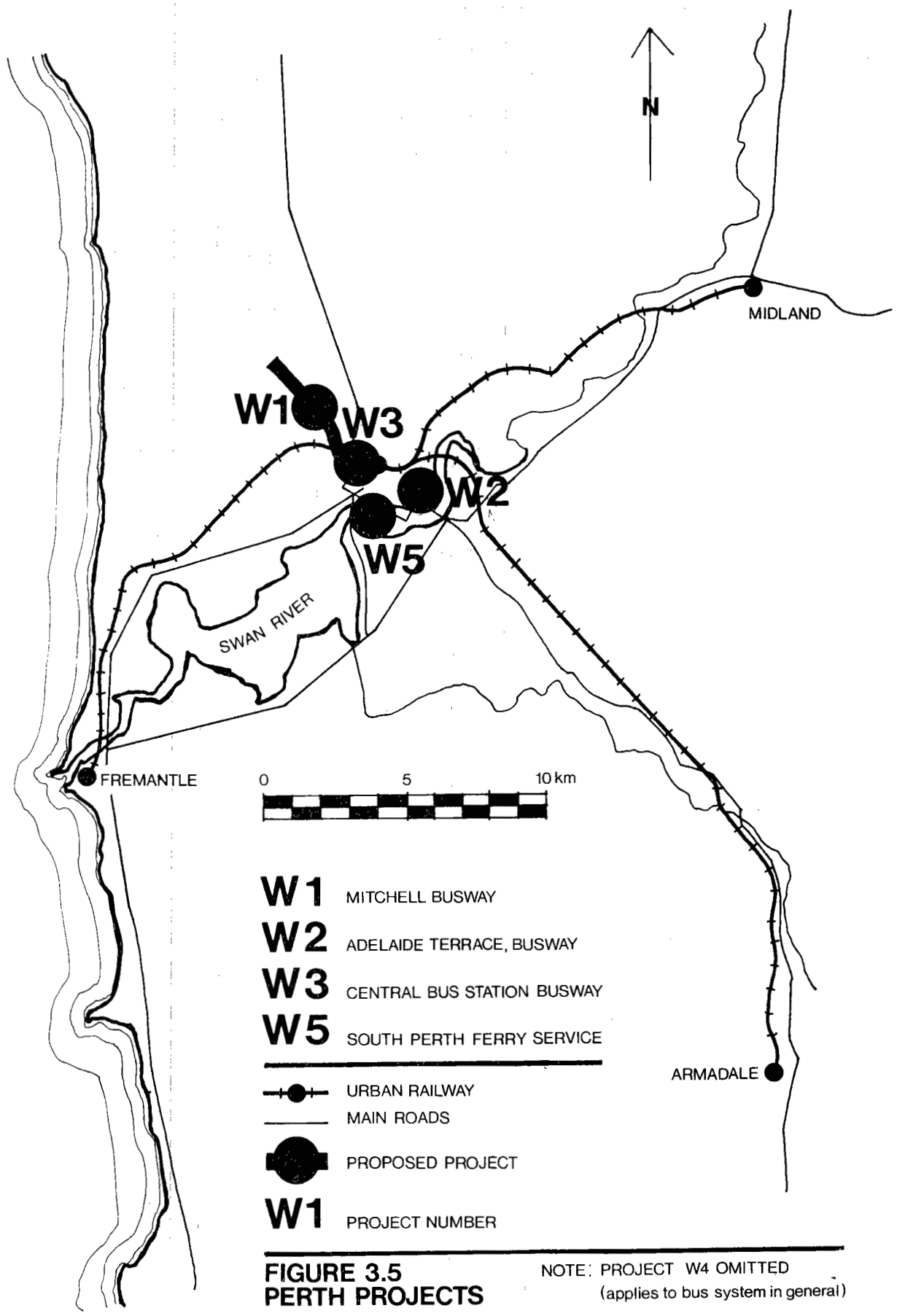

FIGURE 3.5
PERTH PROJECTS

NOTE: PROJECT W4 OMITTED
(applies to bus system in general)

Table 3.9 shows that the total expenditure for 1973-74 by Western Australia is relatively small, and Annex B indicates that the proposed expenditure is distributed over a number of small projects. As WA provided economic analyses of all projects except planning and research, the BTE was readily able to extend the WA data into its normal evaluation results. Accordingly, results are given even for small projects. All projects gave benefit-cost ratios greater than 1.0 at 10 per cent discount rate. Figure 3.5 shows the location of projects.

TABLE 3.9 - WESTERN AUSTRALIA PROPOSED 1973-74 EXPENDITURE PROGRAM

($m)

Project type	Proposed expenditure	Expenditure evaluated	Expenditure too small or not amenable to evaluation	Expenditure with B/C ratio greater than 1.0 at 10% discount rate
Bus				
Busways	0.34	0.33		0.33
Rolling stock	1.35	1.35		1.35
Total Bus	1.69	1.68		1.68
Ferry	0.11	0.11		0.11
Passenger Interchange	1.01	1.01		1.01
Planning, Research and Development	0.24		0.24	
TOTAL	3.05	2.80	0.24	2.80
PER CENT OF TOTAL	100.0	91.8	7.9	91.8

3.8 TASMANIA

Table 3.10 shows that 96 per cent of the expenditure proposed by Tasmania was evaluated. Bus replacement gave benefit-cost ratios 0.95 and 0.89 at 7 per cent and 10 per cent discount rates respectively (see Annex B). The poor result may be due to the general maintenance cost function not being appropriate for Hobart buses (see Annex A).

TABLE 3.10 - TASMANIA PROPOSED 1973-74 EXPENDITURE PROGRAM

($m)

Project type	Proposed expenditure	Expenditure evaluation	Expenditure small or not amenable to evaluation	Expenditure with B/C ratio greater than 1.0 at 10% discount rate
Bus				
Rolling stock	1.50	1.50		
Miscellaneous	0.04		0.04	
Total Bus	1.54	1.50	0.04	
Passenger Interchange	0.02		0.02	
TOTAL	1.56	1.50	0.06	
PER CENT OF TOTAL	100.0	96.2	3.8	

CHAPTER 4 TRANSPORT PLANNING AND RESEARCH

4.1 PLANNING CRITERIA

Much of the planning of projects and most of the vehicle designs used as a basis for the proposed investment programs have been heavily influenced by the financial criterion of minimising loss to public transport agencies. If the higher criterion of optimising urban transport costs and benefits to the community is adopted, substantial changes would be required in vehicle design and project selection. For example, much more importance would be placed on public transport speed, comfort, service frequency and accessibility.

The BTE recognises that some time must elapse before the provision of public transport is based on social-economic criteria rather than financial criteria. It takes some years to put a new vehicle design into service and the modernising of extensive transport facilities must proceed incrementally. The current evaluations have demonstrated the economic merits of the programs currently proposed. However, every opportunity should be taken to move towards the provision of facilities which promote the welfare of the entire community.

4.2 PRICING POLICIES

The benefits of public transport improvements are sensitive to pricing policies, both for public transport and for private car use. The evaluations in this Report were performed on the assumption that existing pricing policies will continue, except where the State travel forecasts specifically presuppose private travel restraints. Where such restraints were assumed, they were applied to both the base case and the project case in the evaluations.

In the view of the BTE, current pricing policies are not optimal from a community viewpoint. The subject is of some complexity and is not pursued in this Report. However, transport planning should take direct account of alternative pricing strategies, in the interests of promoting both economic efficiency and social equity.

4.3 LAND PLANNING

The close relationship between transport and the nature and intensity of land development is well known. Clearly, measures to achieve a community optimum should take account of possible alternatives in land development as well as in transport. In the view of the BTE, the planning which has led to the formulation of the proposed expenditure programs is less than satisfactory in its considerations of land development.

Planning to optimise land use and transport is technically difficult. Although progress is being made in developing practicable procedures, for the present, decisions have to be made somewhat independently in each of these areas. To that extent, the evaluations in this report are less than ideal.

Improved methods of specifying land use and transport alternatives and of forecasting the associated effects are not only desirable in themselves, but would allow the whole framework of economic evaluation to take into account, as it should, a broader range of costs and benefits, as well as questions of social equity.

4.4 SYSTEM STUDIES

Planning should embrace formal consideration of the entire system in which changes are proposed. This is particularly important in projects involving major changes in technology, such as electrifying a railway network, and in projects which could effect major changes in the operating characteristics of an existing technology, such as one would encounter when completely replacing a fleet of trams. Economic evaluations should be an integral part of such studies if the optimum configurations are to be selected.

An example of factors which give rise to BTE concern about current systems considerations is the question of acceleration rates, which have a major influence on the scheduled speeds of trains making frequent stops, and consequently on both patronage and economic merit. Table 4.1 shows the discrepancy between the performance level of new suburban trains in Australia and in selected overseas systems.

TABLE 4.1 - COMPARISON OF ACCELERATION RATES

Vehicle	Acceleration
	m/sec^2
New Melbourne trains	0.7 (design value)
New Sydney trains	0.8
Moscow Metro	1.2
BART (San Francisco)	1.3
Lindenwold Line (Philadelphia)	1.3

In its development, a project should proceed through several levels of system study. Before performing economic evaluations to determine whether or not it should be undertaken, there should be a preliminary system study to determine broadly its operational requirements and approximate cost. If an economic evaluation then reveals that the project is attractive, a detailed system study should be undertaken to optimise the cost and performance of the component elements of the system. Such a study may be complex, as illustrated in Table 4.2 which lists some of the major design parameters for a new electrified railway.

TABLE 4.2 - MAJOR DESIGN PARAMETERS FOR RAIL ELECTRIFICATION

Power Supply	Rail Car	Track	Stations
AC or DC	Length	Gauge	Spacing
Voltage	Loading gauge	Sleeper type	Length
Third rail or catenary	Temperature control	Noise reduction	Platform type
Electrolysis protection	Seating	Signalling	Manning
Safety	Acceleration	Surface, underground or viaduct	Fare system
	Maximum speed		Security system
	Manning		

Detailed system studies would be undertaken within at least a general financial commitment, to avoid either futile expenditures on investigation or the adoption of design standards which cannot be financed. Full financial commitment should await evaluation when costs can be estimated with an appropriate level of confidence. However, some overlapping of planning, research, development, evaluation and financial commitment is inevitable in constructing a complex engineering system.

A major new program of public transport investment suggests a need for systems studies to ascertain the potential economies from:

- standardising designs
- allocating work between production centres in the best possible way
- minimising fluctuations in orders
- research and development
- encouraging investment in technically advanced equipment providing for likely technological changes.

4.5 RESEARCH AND DEVELOPMENT

A key factor to the growth rate of productivity in an industry is its investment in research and development. Edwin Mansfield says[1]:

> 'Apparently, an industry's rate of growth of total productivity is related in a statistically significant way to (i) its ratio of research and development expenditures to sales, (ii) its rate of change of output level, and (iii) the amplitude of its cyclical fluctuation. Specifically, the rate of growth of total productivity increases (on the average) by 0.5 per cent for each tenfold increase in the ratio of research and development expenditures to sales and by 1 per cent for every 3 per cent increase in the industry's growth rate'.

There is ample evidence of the relatively poor performance of Australia in this area. Peter Stubbs[2] estimated that in 1964 Australia had 1.3 qualified research and development workers

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(1) Edwin Mansfield, The Economics of Technological Change, Longmans, 1969, p. 28.

(2) Peter Stubbs, Innovation and Research: A Study in Australian Industry, Melbourne Institute of Applied Economic Research, 1968, p. 77.

per 1000 employees compared with 27 in the USA and 5.9 in the U.K. Australia was spending approximately one per cent of its Gross National Product on research and development in 1964[1] compared with an expenditure of three per cent in the USA. Project SCORE indicated that by 1968-69 the Australian Government research and development expenditure was 0.7 per cent of GNP[2]. Assuming that the ratio of Australian Government to total research and development remained the same as in 1964, this implies that such expenditure had risen to about 1.3 per cent of GNP.

Expenditure on railway planning, research and development, during the initial years of a much expanded investment program, should be high relative to other Australian industries. Railway operations are complex because of the extensive interactions between track, vehicles and signalling, and the consequent effects on system performance and efficiency. There is much more scope for optimising total system performance than in the case of roads, for example, as the one public authority is responsible for all aspects of the sytem.

The funds specified for planning, research and development in the proposed 1973-74 program amount to 1.6 per cent of the total. Some States have not programmed any funds specifically for planning and research. As the total amount covers planning as well as research and development, it may be inadequate in the light of the amount of technological investigation which should occur before systems, such as electric railways, are introduced into more cities. However, the issue is not quite clear as some planning expenditures are amalgamated with project cost estimates.

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(1) N.F. Clark, 'Expenditure on Research and Development in Australia', Journal of the Institution of Engineers, Australia, Vol 38 No. 6, June 1966.

(2) Department of Education and Science, Project SCORE: Survey and Comparisons of Research Expenditures, Report 1 - Research and Development Expenditure by the Commonwealth Government in 1968-69, Australian Government Publishing Service, Canberra, 1972.

THE EVALUATION MODEL

The main features of the evaluation model were set out in Annexes D and E of the 1972 Report. This Annex outlines some modifications that were made subsequently.

Although the relative magnitudes of the calculated benefit-cost ratios provide some indication of the ranking of projects, care must be exercised in making comparisons between projects considered either in the current series of evaluations or in the 1972 Report. Because of severe time constraints the BTE has, in cases where the more easily quantifiable benefits appear to justify a project, omitted some of the benefits which are difficult to quantify. In addition, the assumptions regarding passenger responses to changes in the characteristics of public transport facilities have been changed slightly from those used in the 1972 Report.

A.1 CORRIDOR PROJECTS

Model

The computerised model used for the current review is essentially the same as that used for the 1972 Report. Modifications were made to allow more efficient data entry and job control, and to provide additional reports to assist in identifying data inconsistencies.

Improved calculation procedures were devised for a number of functions, including those relating to the calculation of converted and generated traffic benefits, the calculation of trip end characteristics, and the calculation of the internal rate of return.

Other facilities added to the model were a financial analysis program (described later) and more direct methods of entering the miscellaneous benefit and cost streams which,in particular projects, were calculated outside the model.

Cost Parameters

The majority of the cost parameters used by the model were updated from 1972 values to 1973 values by an appropriate cost index. Three important cost parameters were not updated:

- value of private time
- cost of providing new road space
- resource cost of parking

Increasing any of these parameters would increase the benefits calculated in this report.

Passenger Conversion and Generation

Patronage forecasts from transportation studies were used, where available. However, transportation study data usually provided only a forecast for the project case. This necessitated the estimation of a base case forecast.

The formula used in the 1972 Report for estimating patronage changes was:

$$P = (0.3r + 0.15)T$$

where P = per cent increase in patronage
r = ratio of car person trips to public transport person trips, and
T = per cent decrease in public transport travel time.

This formula was difficult to apply in many situations because of the difficulties associated with estimating an appropriate value for 'r'. An extensive review was made of studies performed around the world on the elasticity of demand for public transport relative to reductions in travel time. As a result, the following alternative formula was devised for the estimation of travel changes:

$$P = 0.5T$$

It was assumed that half of the patronage increase would be the result of conversions from road and half would be generated patronage.

Comfort

Although the 1972 evaluations of rolling stock included improved comfort as a benefit item[1], none of the corridor evaluations took account of this item. However, two of the corridor projects evaluated in the current review[2] conferred a significant improvement of comfort (by way of increased probability of obtaining a seat). For such projects, excluding the comfort benefit would make them appear less attractive relative to other projects with insignificant comfort benefits, than they really are. Excluding a value for improved comfort would imply that the best estimate is that people attach no value to the increased probability of obtaining a seat, which is contrary to passengers' observed behaviour and attitudes[3].

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(1) 1972 Report, p.D19.

(2) Granville-Penrith Quadruplication, New South Wales and Kensington-Footscray Quadruplication, Victoria.

(3) 'The passengers will nearly always in the first place occupy the seats in the express bus (50% of the capacity of the buses is seats). In the second place they occupy the seats in the ordinary bus before the standing places in the express bus. Thus the passengers have clearly shown us that they prefer a seat to a fast ride'. R.S. Pederson in discussion at 39th Meeting of the International Union of Public Transport, Rome 1971.

See also:

- C.D. Foster and M.F. Beesley, 'Estimating the social benefits of constructing an underground railway in London', Journal of Royal Statistical Society, Vol. 126, 1963
- T.F. Golob et al., 'An analysis of consumer preferences for a public transportation system', Transportation Research, Vol. 6, 1972, p.91
- D. Hensher, The Consumer's Choice Function: a Study of Traveller Behaviour and Values, unpublished Ph.D. thesis, University of N.S.W., 1972
- G. Hoinville, 'Evaluating community preferences', Environment and Planning, 1971, p. 44.

Accordingly, for these two corridor projects, a benefit has been included to reflect the value passengers place on the increased probability of obtaining a seat. The value has been calculated on the same basis as that used by Foster and Beesley in their Victoria Line study in the UK(1).

Financial Analysis

In designing the model used for the economic evaluation of projects included in the 1972 Report, time did not permit incorporation of a financial analysis.

The financial analysis in this Report is confined to the period ending at the 20th year after a proposed improvement would become operational. The changes in capital and operating costs due to the project and attributable to public transport authorities are taken directly from the base case and project case input to the corridor model(2). The corresponding changes in fare revenues are calculated from the patronage forecasts and the recorded weighted fare for travel between each corridor section and the central city. The weighted fare accounts for seasonal tickets, child concessions and welfare concessions not covered by reimbursements. A standard trip length frequency distribution (for the city) for each mode is applied to the forecast trip ends, for each year, in each corridor section. Fare revenue is then calculated using the fare schedules for each mode.

A.2 ROLLING STOCK PROJECTS

In the rolling stock evaluations, a comparison was made between a project case of immediate replacement of part of the fleet and a base case of deferring replacement for ten years(3). Benefits from earlier replacement include maintenance savings, better travel

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(1) Foster and Beesley, op. cit.

(2) The financial evaluations reflect the impact on public finances. They would reflect the impact on public transport authorities accounts only if the authorities were financing the entire project.

(3) In the case of Hobart buses, the more realistic base case is believed to be deferring replacement for 5 years.

conditions for existing passengers, and increased patronage due to having more modern rolling stock (with concomitant savings in road transport costs on account of reduced car usage). The procedures and assumptions used to estimate these benefits were substantially the same as those used in the 1972 evaluations(1). Only two changes of any substance were made. Data obtained since the previous evaluations enabled the BTE to estimate a generalised bus maintenance-age relationship which was applied to all bus replacement projects(2). The second change relates to the assumption regarding the source of new patronage attracted by more modern rolling stock. Evidence obtained since the 1972 evaluations led the BTE to reduce the proportion of new passengers assumed to come from cars. The effect of this was to lower benefits slightly.

A number of reservations apply to the evaluations. The BTE did not have time to research cost and behavioural relationships as well as it would have liked. In some respects, this may well be leading to an understatement of benefits. No benefits by way of pollution savings from conversion of car users to public transport have been included. Also, bus maintenance cost savings may be conservative on two counts. As mentioned above, these savings have been estimated throughout using a general relationship based on the maintenance costs of the same bus at different ages. In fact, introduction of new buses incorporating new features may mean moving on to an altogether lower maintenance cost curve, rather than merely moving back along the estimated curve(3). A further reason for expecting that the estimated relationship understates bus maintenance savings is that it is based on direct costs only, and ignores indirect costs, some of which would also be a function of maintenance work done.

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(1) 1972 Report, Annex D, pp. D16-D21.

(2) The relationship which has been estimated takes the form

$$y = 6.83 + 0.155x$$

where y is maintenance cost per vehicle kilometre in cents and x is vehicle age in years.

The r^2 was .91 and the t value of the age coefficient was approximately 5, which is significant at the 5 per cent level.

(3) This applies particularly to Hobart, where petrol buses are being replaced by diesel vehicles.

ANNEX B

SUMMARY OF PROJECTS

PROPOSED BY THE STATES

Tables B.1.1 to B.1.6 - Summaries of Benefit-Cost Evaluations

Table B.2 - Other Projects

TABLE B.1.1 - SUMMARY OF BENEFIT-COST EVALUATIONS: NEW SOUTH WALES

Project	Expenditure proposed by State ($m)			Cost used in evaluation	Benefit-cost ratio		Internal rate of return	Net present value at 7%	Remarks
	1973-74	Subsequent years	total	($m)	7%	10%	(%)	($m)	
RAILWAY									
Additional Tracks									
N1. Granville-Penrith quadruplication - additional two tracks for 27.6km	0.60	16.60	17.20	19.80	1.4	1.1	12	7.13	Benefits not estimated for the complex Granville-Parramatta section.
N2. Strathfield-Hornsby increased trackage									
(i) Strathfield-Hornsby - additional two tracks for 11.6km; one track for 10.5km	2.07	15.20	17.27	27.06	0.7	0.5	5	-7.09	A more detailed examination of inter-urban benefits might improve results.
(ii) Strathfield-Epping - additional two tracks for 11.6km				16.01	1.4	1.0	10	4.85	
Electrification									
N3. Blacktown-Riverstone - electrification of 11km of single track	0.60	0.65	1.25	1.25	3.7	2.9		3.1	No converted or generated patronage benefits included.
Signalling									
N4. Sydney station area	0.02	4.48	4.50	5.18	1.2	0.9	9	1.04	No benefits from improved safety or patronage growth included.
Rolling stock									
N5. Train purchases - 106 double-deck cars in 1973-74	18.00		18.00		1.7	1.5	23		Evaluated in 1972 Report as Project 23.
N6. Double-deck trailer controls - provide driver controls in 22 trailer cars	0.22	0.22	0.44	0.44	1.2	1.0	10	0.2	
Miscellaneous									
N7. Glenbrook Tunnel widening	0.40		0.40	0.40		>1			
Busways									
N8. Randwick-Darlinghurst	0.32		0.32			>1			
Rolling Stock									
N9. Bus Replacement - purchase of 252 buses	3.36	2.36	5.72		1.4	1.3	19		

TABLE D.1.2 SUMMARY OF BENEFIT COST EVALUATIONS: VICTORIA

Project	Expenditure proposed by State - $m			Cost used in evaluation	Benefit-cost ratio		Internal rate of return	Net present value at 7%	Remarks
	1973-74	Subsequent years	total	($m)	7%	10%	(%)	($m)	
RAILWAY									
Additional Tracks									
V1. South Kensington-Footscray quadruplication - additional two tracks for 2km and bridge over Maribyrnong River	1.80	3.20	5.0	5.92	1.6	1.2	12	2.97	Omits benefits through conversion from road as a result of reduced crowding on trains.
V2. Caulfield-Mordialloc third track - an additional track for 15.5km	0.70	8.80	9.50	9.24	1.7	1.2	12	4.35	
V3. Sunshine-Deer Park West									
(i) duplication and electrification	1.60	0.80	2.40	2.81	1.2	0.8	8	0.45	Initial evaluation.
(ii) duplication only				1.91	1.5	1.0	10	0.99	Final evaluation.
V4. Macleod-Greensborough duplication - additional 5km of electrified track	0.70	0.50	1.20	1.21	1.6	1.2	14	0.64	Benefits from passenger growth not included.
Electrification									
V5. Newport-Werribee - electrify 18.5km of double track	2.10		2.10	3.31	1.0	0.8	7		Cost used in evaluation includes $1.5m for rolling stock.
Signalling									
V6. Frankston Line	1.10	4.40	5.50	3.52	4.7	3.0)	20	11.4	Expenditure proposed by State includes work additional to Projects V6 and V7.
V7. Oakleigh Station				0.33	1.7	1.3)		0.24	
Rolling Stock									
V8. Train replacement	10.70		10.70		1.7	1.5			Evaluated in 1972 Report as Project 25.

TABLE B.1.2 (Contd)

Project	Expenditure proposed by State ($m)			Cost used in evaluation	Benefit cost ratio		Internal rate of return	Net present value at 7%	Remarks
	1973-74	Subsequent years	Total	($m)	7%	10%	(%)	($m)	
New Routes									
V9. Eastern Railway Stage 1	14.60	21.50	26.10						State expenditure program includes land acquisition for Stage 2.
- two new electrified tracks for 8km									
(i) Total Stage 1				16.05	1.2	0.8	8	2.38	Only Case (ii) is relevant to a decision on continuing the project.
(ii) Disregarding sunk costs				13.85	1.4	0.9	9	4.58	
BUS									
Rolling Stock									
V10. Bus replacement - purchase 30 buses	0.81		0.81		1.3	1.2			
TRAMWAY									
Rolling Stock									
V11. Tram replacement	0.23		0.23		1.3	1.1			

TABLE B.1.3 - SUMMARY OF BENEFIT-COST EVALUATIONS: QUEENSLAND

Project	Expenditure proposed by State ($m)			Cost used in evaluation	Benefit-cost ratio		Internal rate of return	Net present value at 7%	Remarks
	1973-74	Subsequent years	total	($m)	7%	10%	(%)	($m)	
RAILWAY									
Additional Tracks									
Q1. Brunswick Street-Northgate third track - additional track for 8km	0.74	1.38	2.12	1.55	3.4	2.5	22	2.35	Evaluated in 1972 Report as Project 14. 1972 evaluation cost estimates. Cost used in evaluation was reduced by $0.7m for saving in rolling stock.
Electrification									
Q2. Suburban network									
(i) Total network	1.31	23.27	24.58						
(ii) Northern corridor				16.75	2.4	1.7	14	17.46	Evaluated in 1972 Report as Project 13. 1972 evaluation cost estimates. Costs used in evaluation $8.66m for rolling stock.
(iii) Ferny Grove-Darra				19.28	2.6	1.9	18	28.43	Costs used in evaluation include $9.74m for rolling stock.
New Routes									
Q3. Cross River Link	1.20	7.17	8.37	8.63	2.4	1.7	15	10.3	Evaluated in 1972 Report as Project 17. 1972 cost estimates increased, reducing benefit cost-ratios. $1.86m of total cost is for standard gauge.

TABLE B.1.4 - SUMMARY OF BENEFIT-COST EVALUATIONS: SOUTH AUSTRALIA

Project	Expenditure proposed by State ($m)			Cost used in evaluation	Benefit-cost ratio		Internal rate of return	Net present value at 7%	Remarks
	1973-74	Subsequent years	Total	($m)	7%	10%	(%)	($m)	
RAILWAY									
Electrification									
S1. Adelaide-Christie Downs									
- electrify 30.4km of double track	1.90	4.10	6.00)	14.00	3.1	2.4	23	28.06	Cost used in evaluation includes $8.4m for rolling stock.
- new electric trains	2.00	8.80	10.80)						
New Routes									
S2. Brighton-Christie Downs									
- additional single track for 10km and double track for 4km	3.00	3.00	6.00	6.63	4.7	3.4	26	22.59	Cost used in evaluation includes $1.37m for rolling stock.
TRAMWAY									
S3. Glenelg Tramway upgrading	0.30	0.50	0.80	0.81	2.3	1.7	17	0.95	
BUS									
Rolling Stock									
S4. Bus acquisition									
- purchase 71 buses	1.30	0.90	2.20	0.45	0.9	0.8		0.05	Maintenance cost function used may underestimate benefits.

TABLE B.1.5 - SUMMARY OF BENEFIT-COST EVALUATIONS: WESTERN AUSTRALIA

Project	Expenditure proposed by State ($m)			Cost used in evaluation	Benefit-cost ratio		Internal rate of return	Net present value at 7%	Remarks
	1973-74	Subsequent years	total	($m)	7%	10%	(%)	($m)	
BUS									
Busways									
W1. Mitchell Busway Stage 1 - busway from freeway to Central Bus Station and special bus ramps	0.09	2.26	2.37	2.93	5.3	4.0	30	11.42	Evaluated in 1972 Report as Project 21.
W2. Adelaide Terrace bus lane	0.01		0.01	0.01		>1.0			
W3. Central Bus Station access busway	0.24		0.24	0.24	12.0	9.6		2.7	
Rolling Stock									
W4. Bus replacement - purchase 50 buses	1.35			1.35	1.4	1.3	22		Evaluated in 1972 Report as Project 26.
FERRY									
W5. Terminal upgrading - replace existing jetties and terminal buildings	0.11	0.32	0.43	0.43	1.4	1.1	12	0.12	
PASSENGER INTERCHANGE									
W6. Central Bus Station pedestrian access	0.95			0.95	1.4	1.0	10	0.13	
W7. Bus Transfer Stations									
(i) Amelia Street	0.02			0.02	5.2	4.0	37	0.08	
(ii) Innaloo	0.02			0.02	8.5	6.6	55	0.14	
(iii) Whitfords	0.02			0.02	3.4	2.6	27	0.04	

TABLE B.1.6 - SUMMARY OF BENEFIT-COST EVALUATIONS: TASMANIA

Project	Expenditure proposed by State $m		Cost used in evaluation	Benefit-cost ratio		Internal rate return	Net present value at 7%	Remarks
	1973-74	Subsequent years	Total ($m)	7%	10%	(%)	($m)	
BUS								
Rolling Stock								
T1. Bus replacement - purchase 56 buses	1.50	1.50	1.01	0.91	0.86		0.08	Evaluation for buses costing $19,500 each. Buses costing $30,000 each not evaluated.

TABLE B.2 - OTHER PROJECTS

Project	Expenditure proposed by State ($m)		
	1973-74	Subsequent years	Total
NEW SOUTH WALES			
Railway			
N10. Gosford-Newcastle electrification	0.50	26.60	27.10
N11. Strathfield area signalling	0.01	4.24	4.25
N12. New routes: Eastern suburbs	8.10		
N13. Sydney City Circle - information transmission improvements	0.40	0.05	0.09
N14. Electricity substation modernisation - modernise equipment in 5 substations	0.08	1.38	1.46
Bus			
N15. Provision of autofare equipment	0.50	1.84	2.34
Ferry			
N16. Ferry wharf improvements	0.30	1.20	1.50
N17. New ferries - two 800 passenger ferries	1.55		1.55
N18. Ferry graving dock	0.33		0.33
Passenger interchange			
N19. Parking areas at railway stations	0.30		0.30
N20. Bus/rail/ferry transfer facilities	0.25	9.75	10.00
N21. Remodel railway stations	0.40	1.60	2.00
Miscellaneous			
N22. Train and bus interior improvements	0.25	0.75	1.00

TABLE B.2 - OTHER PROJECTS (Continued)

Project	Expenditure proposed by State ($m)		
	1973-74	Subsequent years	Total
VICTORIA			
Railway			
V12. Ringwood corridor	1.2	3.0	4.2
(i) Ringwood station - third platform			
(ii) Ringwood-Bayswater duplication - additional track for 5km			
(iii) Ringwood-Croydon duplication - additional track for 5km			
(iv) Signalling Croydon-Lilydale and Bayswater-Ferntree Gully			
V13. Huntingdale-Ferntree Gully - two new electrified tracks for 19km	2.20		
V14. Frankston-Lyndhurst	1.1		
Passenger interchange			
V15. Additional railway stations - construct 6 new stations	0.20	0.50	0.70
V16. Station rebuilding - reconstruct 50 stations	1.40	2.10	3.50
V17. Railway station interchange facilities - provision of facilities for car/rail and bus/rail interchange	2.2	12.3	15.5
Planning and research			
V18.	0.5		

TABLE B.2 - OTHER PROJECTS (Continued)

Project	Expenditure proposed by State ($m)		
	1973-74	Subsequent years	Total
QUEENSLAND			
Planning and research			
Q4.	0.24		
SOUTH AUSTRALIA			
Bus			
S5. Miscellaneous bus capital items	0.70	0.80	1.50
Planning and research			
S6.	0.60		
WESTERN AUSTRALIA			
Planning and research			
W8.	0.24		
TASMANIA			
T2. Bus ticket issuing machines	0.40		
Passenger interchange			
T3. Bus shelters - 40 shelters	0.02		

ANNEX C

RESULTS OF BENEFIT-COST EVALUATIONS

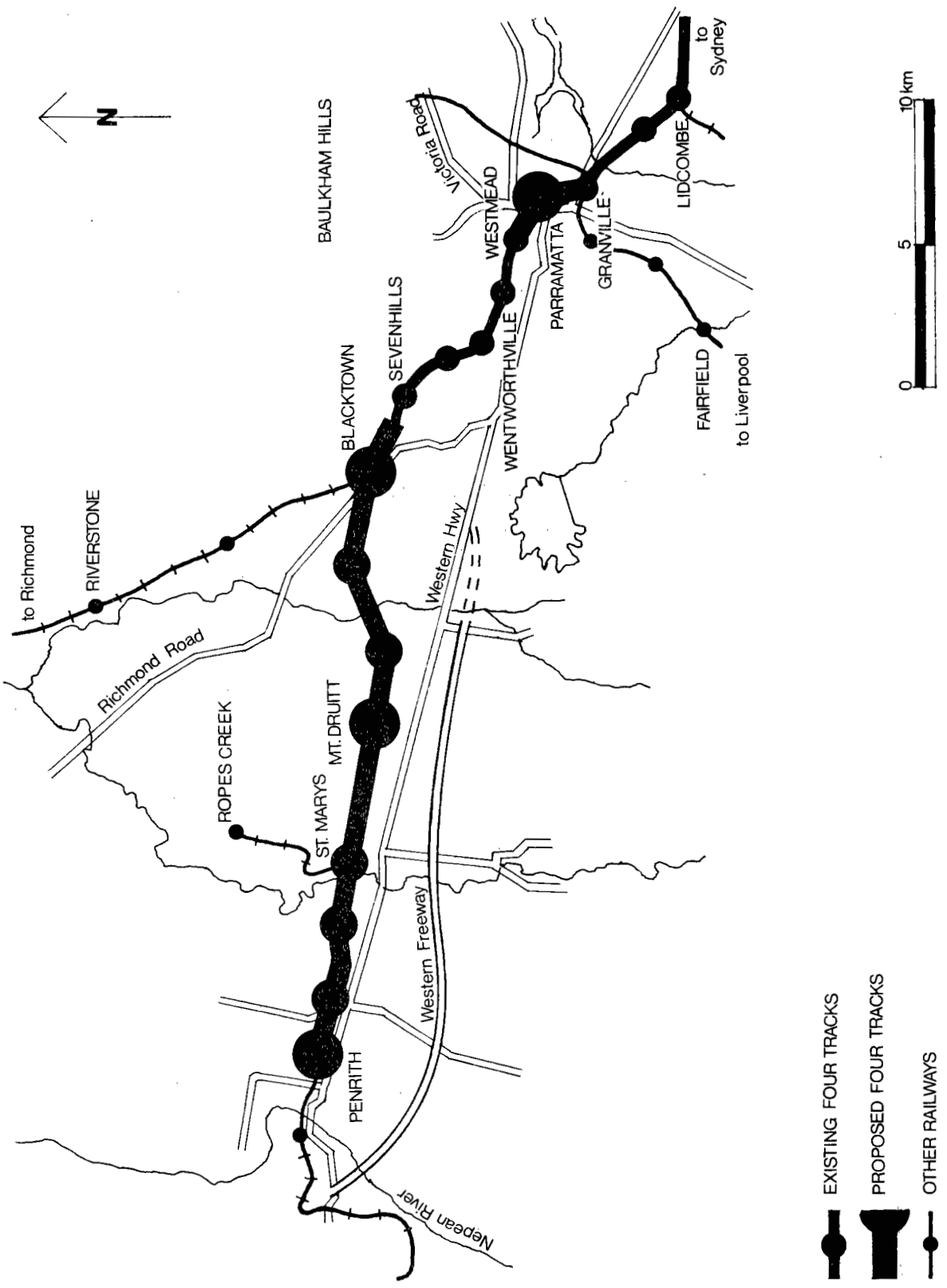

FIGURE N.1.
GRANVILLE – PENRITH RAILWAY QUADRUPLICATION

PROJECT N1

GRANVILLE-PENRITH RAILWAY QUADRUPLICATION

Description

The project would involve the quadruplication of the suburban electrified railway from Granville to Westmead and from Seven Hills to Penrith. The railway and the more important roads are shown in Figure N1. Most of the earthworks and overhead electricity supply structure exist for the additional lines. The Granville to Westmead section would be completed first.

The section of existing two-track railway extending from Granville on the Sydney side of Parramatta to Westmead on the Penrith side of Parramatta is at present not capable of taking additional trains in the peak, so new services cannot be provided to the growing Penrith corridor, or to any other rail corridors which may be proposed for Parramatta.

Present planning proposes that Parramatta be developed into a city with a work force of 100,000 by the year 2000. Estimates of the planned patronage for the Parramatta sections of track will not be available until a study of the possibility of additional lines to Maraylya and Hoxton Park areas is completed by the Sydney Area Transportation Study. The result of the SATS study may alter the priority for implementation of the Seven Hills-Penrith part of this project. Seven Hills-Penrith was included in the evaluation because it is representative of present development plans and indicates benefits likely to be provided to trip makers using the Parramatta centre, by removal of the two-track constriction either side of Parramatta.

Costs

The capital costs of quadruplication from Granville to Westmead and Seven Hills to Penrith are estimated to be $6.8m and $10.4m respectively, totalling $17.2m. As this estimate is

preliminary, a contingency allowance of 15 per cent was added to the capital cost.

Benefits

Benefits would accrue to existing rail travellers in the project case through travel time savings and improved comfort resulting from an increased probability of obtaining a seat. The quadruplication would allow the running of express trains, which would result in an average 8 per cent improvement in origin to destination journey time for rail patronage. There would also be benefits through conversion of road users to rail.

Table N.1 provides a breakdown of the present value of benefits for a 7 per cent discount rate.

TABLE N.1 - DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefit
	$'000
Railway operation	-11,024
Existing public transport users (comfort)	7,307
Existing public transport users(time savings)	13,753
Conversions from road	5,000
Residuals after first 15 years	9,154
TOTAL	24,190

Owing to the complexity of the impact of increased capacity over the Granville-Parramatta section of track on the entire rail network in the western suburbs, it was not possible to estimate the benefits from improvements in this section. All benefits in Table N.1 were calculated for the Parramatta-Penrith section.

Travel Estimates

The travel estimates were obtained from the Sydney Area Transportation Study. Rail patronage at present is 20,000 trip ends per day at the Parramatta end and is expected to rise to 110,000 trip ends by the year 2000.

Based on the travel time savings, an average conversion from road of 4 per cent of the existing rail patronage was estimated using a standard elasticity. Conversions as a result of comfort improvements were not included.

Evaluation

As the section of line through Parramatta cannot take additional trains in the peak period, the base case was structured as the deferment of the quadruplication for 15 years with the additional patronage due to urban growth in the corridor carried on the existing services with increased crowding and with some additional use of private cars. This represents a more conservative base case than that used for the Seven Hills-Penrith project (1972 Report, Project 10), where the growth in trips in the base case was assumed to be made by road resulting in a large converted road user benefit.

To account for the change in crowding on the peak period trains between the base case and project case, a comfort benefit was assessed. This was based on the change in the probability of getting a seat for the journey due to the introduction of additional trains, as described in Annex A. The values used ranged from 0.125 cents per trip kilometre at the beginning of the study period to 0.5 cents per trip kilometre at the end of the study period.

The assumptions used in establishing the base case are expected to result in a conservative evaluation. No benefits were included for other rail corridors which may be proposed for the Parramatta growth centre other than the

Parramatta-Penrith corridor. Benefits were not quantified for the Granville-Parramatta section of the initial Granville to Westmead quadruplication which is approximately 30 per cent of the initial project cost.

Conclusion

The calculated benefit-cost ratios for the project are 1.4 at a 7 per cent discount rate and 1.1 at a 10 per cent discount rate. The net present value at a 7 per cent discount rate is $7.13m. The internal rate of return is 12 per cent.

The above benefit-cost ratios would be increased if the likely benefits from upgrading Granville-Parramatta could have been estimated. The Granville to Westmead section of existing track will constrain the growth in rail services to Parramatta and warrants immediate quadruplication as this is a prerequisite for any upgrading of rail services to Parramatta. The merits of the Seven Hills to Penrith quadruplication could be determined more accurately when the Sydney Area Transportation Study is complete.

Figure N2.

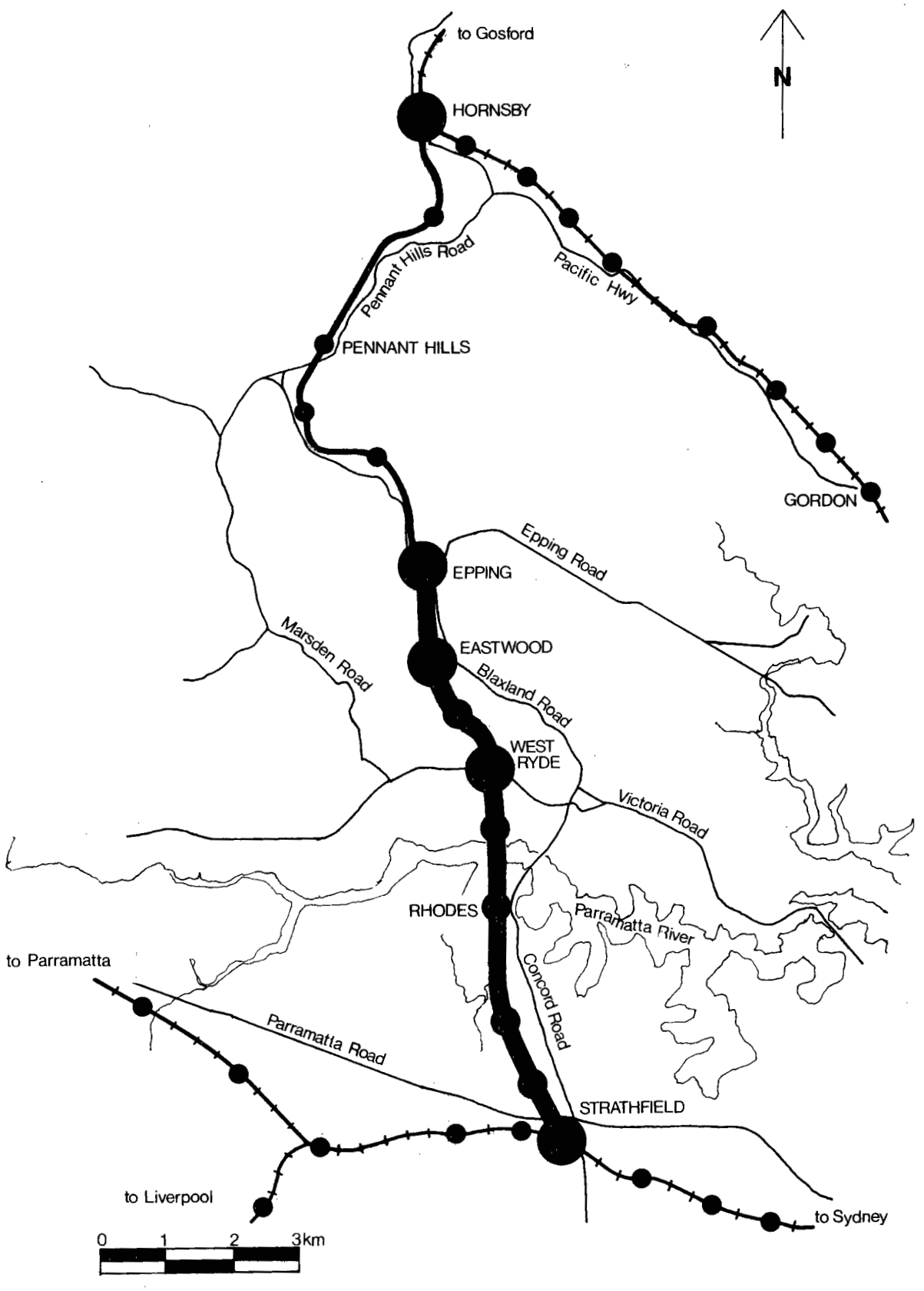

FIGURE N.2.
STRATHFIELD-HORNSBY RAILWAY

PROJECT N2

STRATHFIELD-HORNSBY RAILWAY: ADDITIONAL TRACKS

Description

The project would consist of completion of quadruplication of the track from Strathfield to Epping, a distance of 11.6 kilometres and triplication of the track between Epping and Hornsby, a distance of 10.5 kilometres. Figure N2 shows the more important railway and road services.

Some existing installations between Strathfield and Epping could be incorporated in the quadruplication works, including tracks to Concord West, stations (which would need extending), and the substructure for a four-track bridge across the Parramatta River.

The line carries suburban, inter-urban and freight traffic. Freight traffic is usually kept out of the peak period and does not influence the need for increased track capacity. Present NSWPTC policy is that inter-urban expresses have priority and this results in delays for suburban trains.

Two evaluations were made. The first was for the complete works from Strathfield to Hornsby and the second was for the Strathfield-Epping section only.

Costs

The capital costs used in the first evaluation were $16.06m for the Strathfield to Epping section, and $8.34m for the Epping to Hornsby section, for a total cost of $24.40m. This is a revision of the investment program estimate for the project of $17.27m.

The increase in capital cost of some $7.0m results from an improved estimate after completion of some preliminary design. The cost of signalling, the major bridge crossing at the Parramatta River and a change in the track configuration have contributed to the increase. The BTE has added a contingency of 15 per cent to the capital cost.

For the evaluation of the Strathfield-Epping section, the staging of construction and the amount of construction to be undertaken were revised. The revised estimate of capital costs was $14.56 to which a 10 per cent contingency was added.

Benefits

The additional track would allow suburban express operation and would enable the operating speed of the inter-urban trains to be increased. This would result in time savings to existing patronage and some benefits through conversions from road.

TABLE N.2 - DISCOUNTED BENEFITS

Item	Benefit	
	Strathfield-Hornsby	Strathfield-Epping
	$'000	$'000
Existing public transport users(time savings)	16,370	12,291
Conversions from road	5,552	3,370
Railway operator	-8,524	-758
Residuals after first 20 years	3,757	3,251
TOTAL	17,155	18,154

Travel Estimates

The travel estimates were based on results from the Sydney Area Transportation Study. The suburban rail patronage is expected to increase from the present 44,000 trips per day at Strathfield to 50,000 trips per day in 1998. The growth in patronage will mostly be a result of residential development in the West Pennant Hills area. The inter-urban rail patronage to the Gosford and Wyong regions is expected to grow from 5,500 trips per day in 1973 to 17,000 trips per day in 1998.

The overall average time improvement of 14 per cent is expected to yield only a 2 per cent increase on existing patronage as a result of conversions from road. This is because of the high captive component of existing patronage.

Evaluation

The base case assumed the same increase in train services,

with increased delays to suburban trains because of the policy of inter-urban train priority, along with some delays to the inter-urban trains due to track capacity limitations. The project case allows the introduction of suburban express services. After 1978, when all of the old rolling stock has been replaced, the line could be signalled to take advantage of the higher maximum speed of the new trains. Because of the need to mix all-stops trains with expresses, very little advantage could be taken of the enhanced new train performance without additional tracks.

Conclusion

The benefit-cost ratios calculated for the complete project from Strathfield to Hornsby are 0.7 and 0.5 at 7 and 10 per cent discount rates respectively and the net present value at 7 per cent discount rate is -$7.0m. The internal rate of return is 4.8 per cent.

The benefit-cost ratios for the Strathfield-Epping project are 1.5 and 0.97 at 7 and 10 per cent discount rates respectively. The corresponding net present values are $4.85 and $-0.37m. The internal rate of return is 9.7 per cent.

The Strathfield-Epping project is estimated to have a net present value to public finances of -$14.0m at a 7 per cent borrowing rate.

Figure N3

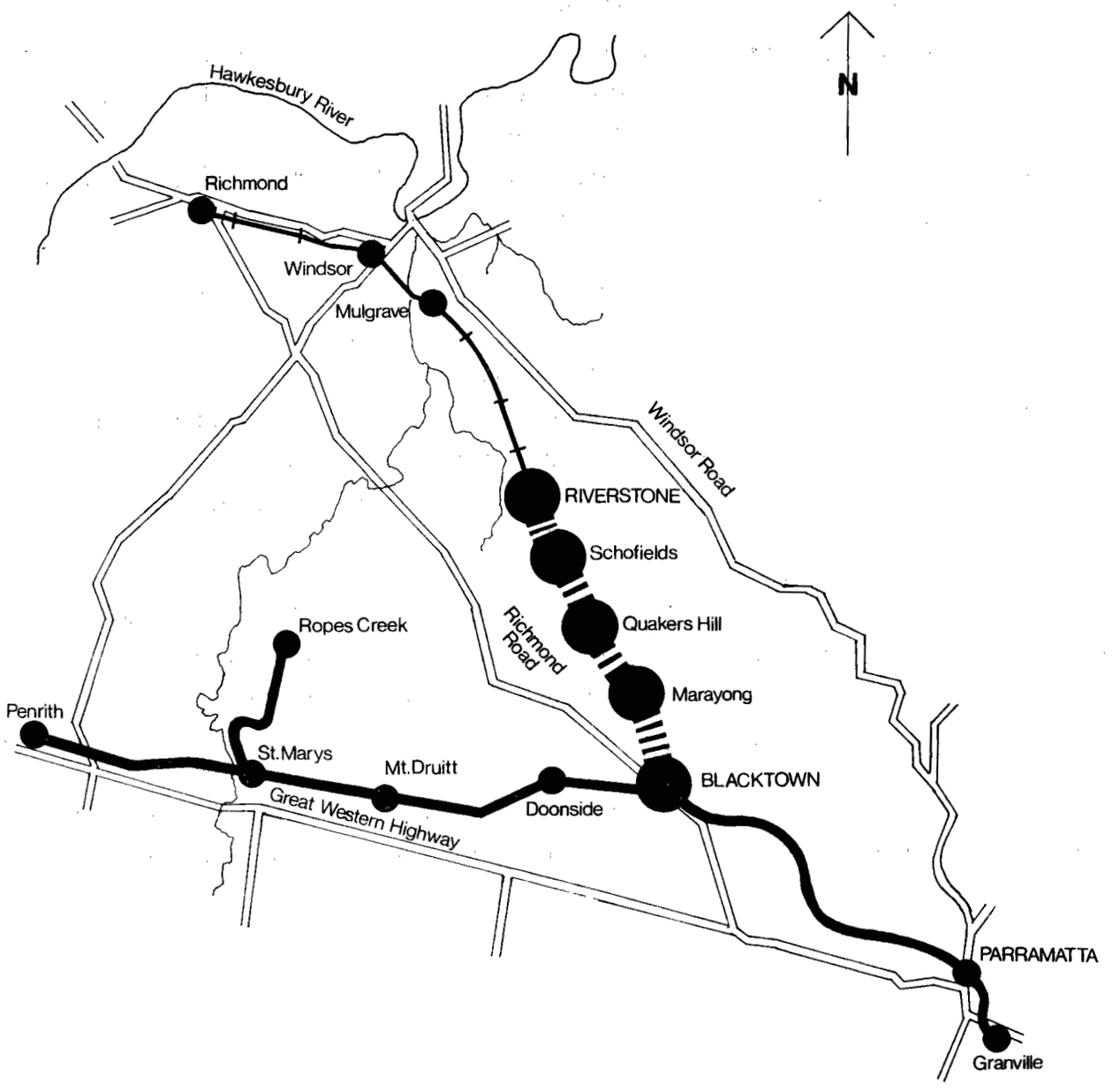

FIGURE N.3.
ELECTRIFICATION OF
BLACKTOWN - RIVERSTONE RAILWAY

PROJECT N3

ELECTRIFICATION OF BLACKTOWN-RIVERSTONE RAILWAY

Description

The Blacktown to Richmond line, a distance of twenty-six kilometres of single-line track, is served by five units of 1929 vintage rail motors and four two-car self propelled diesel units. These units are operated as shuttle services to main line electric trains at Blacktown. In addition, three diesel locomotive-hauled carriage trains run direct to the abattoirs and the city. Figure N3 shows the main features of the rail and road network.

The project would provide for the electrification of eleven kilometres of single track between Blacktown and Riverstone. This would enable electric trains to continue 'through' from the city to Riverstone, with a two-car diesel train providing a connecting service from Riverstone to Richmond.

Costs

The cost of electrification was estimated to be $1.25m. Initially, no expenditure would be required for electric rolling stock as the extension would improve the peak utilization of existing rolling stock.

Benefits

The project would provide benefits to existing passengers who currently transfer from the shuttle service to the electric service at Blacktown. This transfer time averages nine minutes. Approximately 40 per cent of the patrons using the line would have an interchange time saving, after making provision for those who currently do not interchange and those in the project case who would continue to interchange, although the interchange point would have shifted from Blacktown to Riverstone. In addition, the NSWPTC would receive considerable benefit as the cost of operating electric rolling stock is little more than half that for the diesel units used for the shuttle service. There would also be significant rolling stock replacement savings.

Travel Estimates

Currently 1,422,000 passengers per year interchange between the shuttle service and the electric trains. The average weekday patronage on the route at Blacktown is 5,400 trips. The improvement could be expected to result in some converted and generated rail passengers but, as benefits to the NSWPTC and existing passengers are more than adequate to justify the expenditure, no attempt has been made to estimate converted and generated patronage.

Evaluation

The total operating and maintenance costs amount to some $557,000 in the base case and $443,000 in the project case. The existing rail motors and trailers were assumed to be replaced in 1973-74 in the base case. The electric rolling stock was assumed to be replaced in 1986 in the project case. These replacements are consistent with the relative lives of the existing rolling stock. The evaluation results include no converted or generated patronage benefits.

Conclusion

The benefit-cost ratios are 3.7 and 2.9 at 7 per cent and 10 per cent discount rates respectively. The project has a net present value of $3.1m at a 7 per cent discount rate. The internal rate of return is not a satisfactory measure because of the characteristics of the vehicle replacement profiles.

Assuming no increase in fare revenue, the project is estimated to have a financial net present value of $2.2m at a 7 per cent borrowing rate.

PROJECT N4

SIGNALLING IMPROVEMENTS SYDNEY STATION AREA

Description

All train movements in the City Underground System and the Central Station area, including suburban and country services amounting to a daily average of 1,650 trains, are controlled by the Sydney Station area signalling system. The existing system, consisting of four separate signal boxes, was installed between 1916 and 1924. It is approaching the end of its useful life and some replacement parts are unobtainable.

At present the station platform indicators in the area are set by station staff following the timetable order of train arrival. It is very difficult to transpose trains if one train is delayed, so other trains are forced to wait unnecessarily.

The project investment would refurbish the signalling system with up-to-date equipment centralized at one location. A centrally controlled system would also allow the introduction of automatic platform indicators enabling trains to be brought through the system in order of arrival.

Costs

The installation of new signalling equipment and the automatic platform indication setters is estimated to cost $5.18m, including 15 per cent for contingencies.

Replacement of the existing equipment is considered essential by the railways. The estimated cost of the project is considerably less than replacing the existing equipment with equipment of the same type.

Benefits

Centralisation of signal operations would result in an annual labour cost saving of $170,000. Delays caused by signalling malfunctions were estimated to be an average of 5 minutes per passenger delayed. This is a conservative estimate as

existing station records do not account for the delays of all trains affected when a major delay occurs.

The introduction of central platform destination control is estimated to save 13 per cent of the daily peak patrons an average of 2 minutes each.

Evaluation

The new signalling equipment would be progressively introduced over four years. Operation and travel time benefits were assumed to increase linearly. Growth of daily patronage was not included, although this is expected and it would further increase benefits.

During evening peak periods platforms of the central area stations are heavily loaded, and train delays can lead to dangerous crash loading conditions. The project would significantly reduce this occurrence. However, safety benefits are not included in the evaluation.

Conclusions

The project is expected to have benefit-cost ratios of 1.2 and 0.9 at 7 and 10 per cent discount rates respectively, and a net present value of $1.04m at a discount rate of 7 per cent. The internal rate of return is 9 per cent.

If benefits from improved safety and patronage growth were included, the benefit-cost ratios would increase.

PROJECT N5

SYDNEY TRAIN PURCHASES

The BTE previously evaluated the returns from replacing 281 forty-five year old sets of one motor car and one trailer car over the period 1973-74 to 1977-78(1). The benefit-cost ratio was estimated to be 1.7 at 7 per cent and 1.5 at 10 per cent discount rate. This was based on an initial capital cost of $320,000 per set, or an average of $160,000 per car.

The program submitted for 1973-74 includes $18m for 106 double-deck cars, an average of $169,800 each. This represents a 6 per cent increase on early 1972 prices, which does not alter the conclusion of the previous evaluation result.

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(1) Economic Evaluation of Capital Investment in Urban Public Transport, Bureau of Transport Economics, June 1972.

SYDNEY DOUBLE-DECK TRAILER CAR CONTROLS

Description

At present four-car single deck trains are used for off-peak service. As off-peak patronage seldom exceeds the seating capacity of these trains, economies could be achieved by off-peak running of two-car double deck trains. This would require the addition of driving controls to some existing double deck trailer cars. The project concerns the conversion of an additional 22 trailer cars.

Costs

The cost of driving facilities for double deck trailer cars is estimated at $20,000 per car, giving a total of $440,000 for the project.

Benefits

Use of the additional 22 converted trailer cars for two-car off-peak running is estimated to save 1.6 million car kilometres per annum. Two-car double deck trains would have about 200 seats instead of the 240 seats in a four-car single deck train. The seating lost by the use of the two-car double deckers would have little adverse effect as it would be seldom used. However, passengers would have more riding comfort in the double deckers, which have better bogie design.

Conclusions

The project is estimated to have benefit-cost ratios of 1.2 and 1.0 at 7 and 10 per cent discount rates respectively and a net present value of $0.2m at a discount rate of 7 per cent over an evaluation period limited to 20 years. The internal rate of return is estimated to be 10 per cent. As all the benefits are in financial terms, the results for the economic and financial evaluations are identical.

Figure N 7

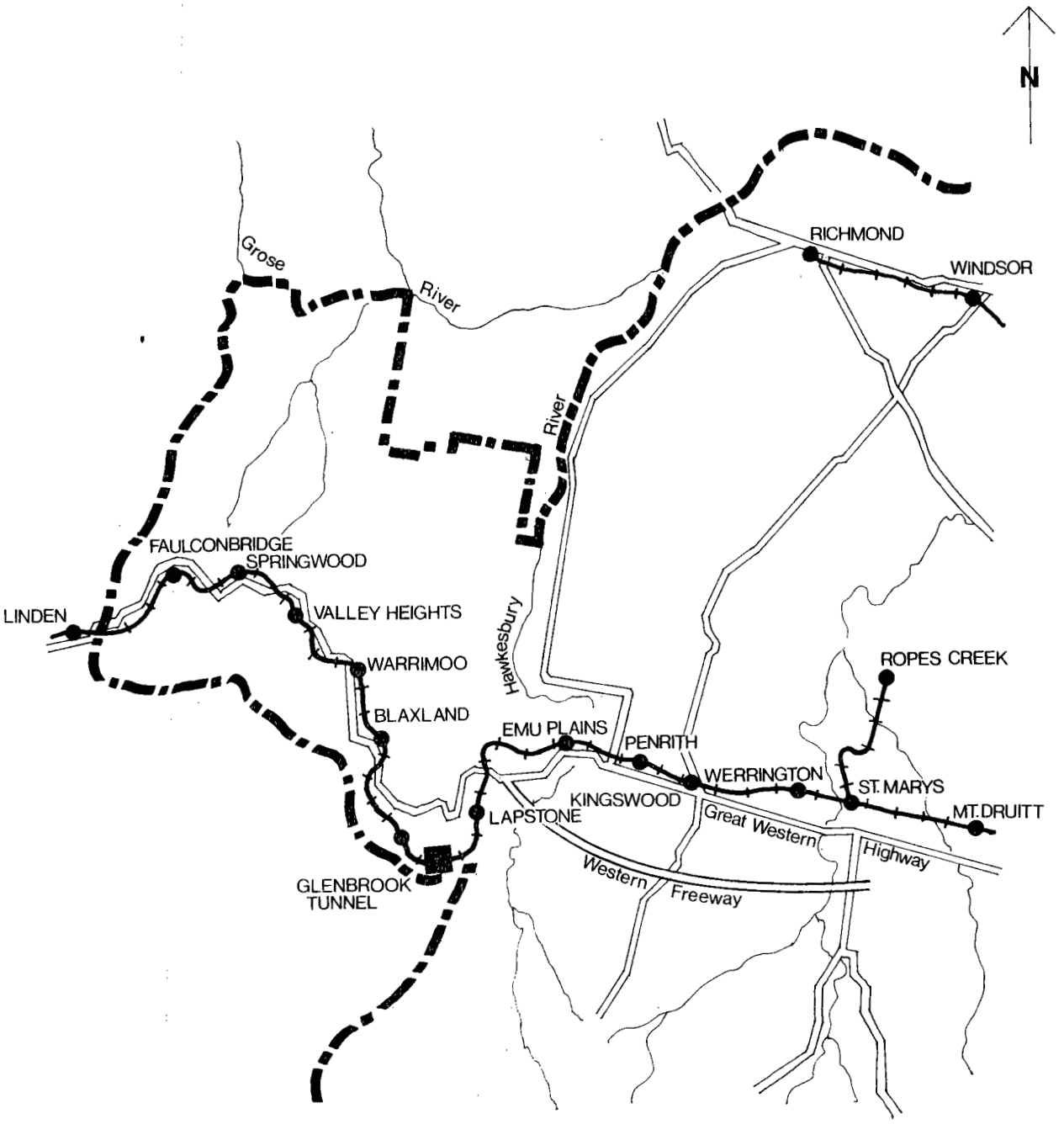

FIGURE N.7.
GLENBROOK TUNNEL

PROJECT N7

GLENBROOK TUNNEL WIDENING

Description

The project would involve the widening of the Glenbrook tunnel on the Blue Mountains Line, at a cost of $0.4m, to allow double-deck stainless steel trains to be used on the service to Mt Victoria. The location of the Glenbrook tunnel is indicated in Figure N7. At present the service is operated by a mixture of single-deck inter-urban motor/trailer units and steam era carriages hauled by electric locomotives.

The boundary of the Sydney Statistical Division lies to the west of Springwood. Seventy per cent of the passengers on the Mt Victoria service use stations between Springwood and the Glenbrook tunnel and are thus urban travellers. However, as this is one of the longest Sydney suburban lines, inter-urban rolling stock is used. Travelling time between Springwood and Sydney is 72 minutes on the main commuter train. The NSWPTC plans to replace the loco-hauled rolling stock used on this service with inter-urban rolling stock purchased from its own resources.

Costs

The costs of the project are detailed in Table N.7. In order to make the best use of resources for assembling data, only the morning services were considered for evaluation.

TABLE N.7 - COST OF ALTERNATIVES FOR MOUNTAINS SERVICES

Item	Annual cost	Capital cost
	$'000	$'000
Base Case		
Running and maintenance cost of morning services	661	
Project Case Alternatives		
(a) single-deck cars		
Running and maintenance cost of morning services	407	
24 single-deck cars, 1974		3,960
(b) double-deck cars		
Running and maintenance cost of morning services	334	
Widening Glenbrook tunnel, 1973-4		400
14 double-deck cars, 1974		3,000

Evaluation

Table N.7 shows that the double-deck alternative would be cheaper in both capital and annual costs than new single-deck carriages (even though the latter would avoid the need for tunnel widening). Operation with new double-deck vehicles would also be preferable to the base case of continuing with existing rolling stock. If double-deck rolling stock were used, the running and maintenance cost savings (compared with the base case), for the morning services only, would amount to $327,000 per annum. The present value of such an annual savings for 20 years is $3.46m for a 7 per cent discount rate. This exceeds the $3.4m combined cost of the new rolling stock and tunnel widening for morning services alone, and with no allowance for the increased comfort to passengers. If the benefits associated with the afternoon service were also taken into account the benefit-cost ratio would exceed 1.0 at 10 per cent discount rate.

Figure N° 8

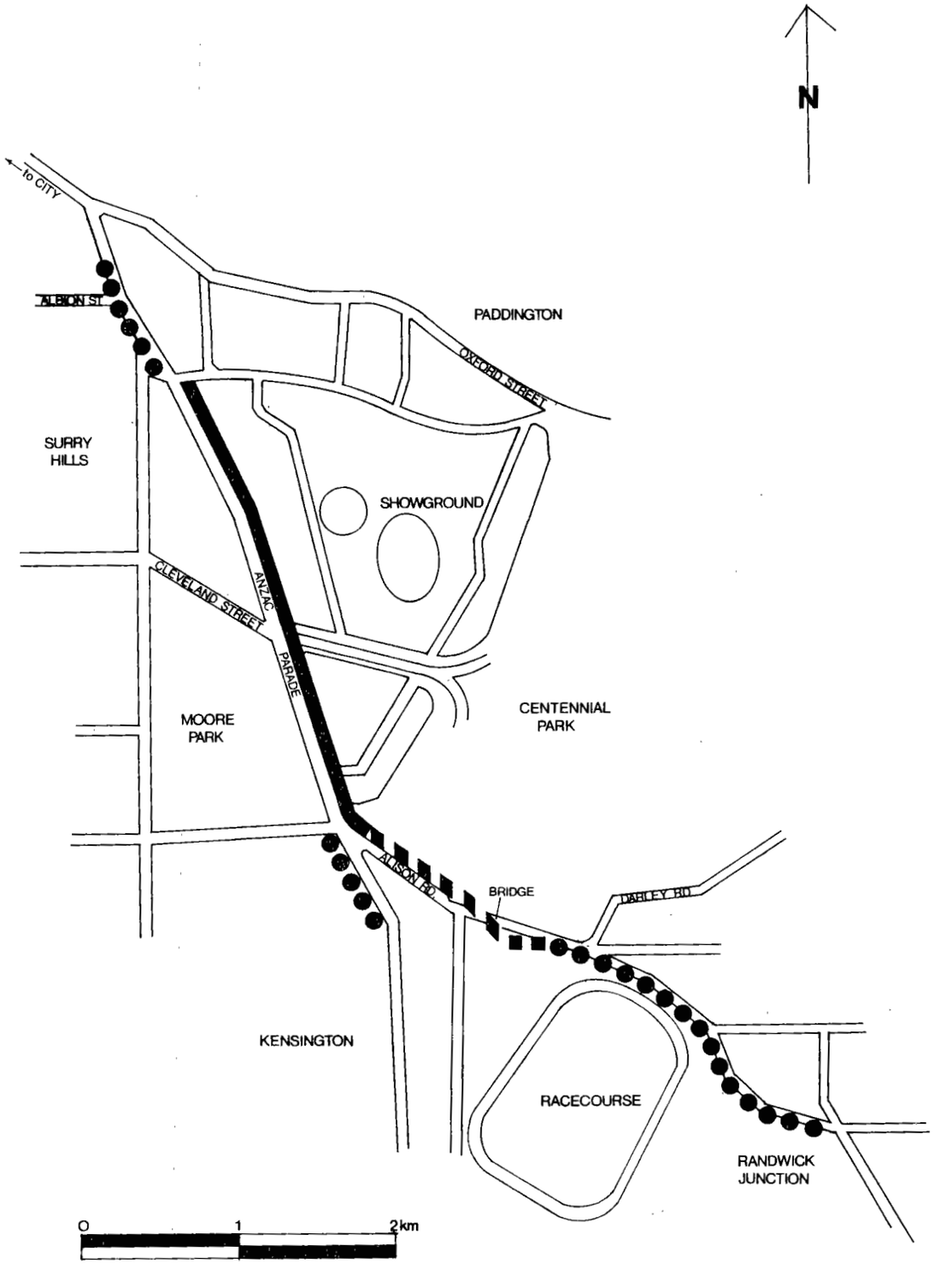

FIGURE N.8.
RANDWICK-DARLINGHURST BUSWAY

PROJECT N8

RANDWICK-DARLINGHURST BUSWAY

Description

The project is envisaged as an extension of the priority now accorded buses by the existing exclusive bus roadway running parallel to Anzac Parade between Moore Park Road and Alison Road/ Dacey Avenue. Inbound buses would be assigned their own kerbside lane in Alison Road between Randwick Junction and a point approximately midway between the main vehicular entrance to Randwick Racecourse, to a bridge across Alison Road and descend on the northern side of Alison Road to a bsuway. This busway would be constructed along the line of the former Clovelly-Coogee tramway and would lead to the existing Anzac Parade bus roadway. Buses would follow a kerbside lane in Flinders Street to Albion Street and thence to Taylor Square, Darlinghurst. Figure N8 shows the location.

Other buses travelling from Kingsford towards the City would gain access to the busway at Anzac Parade with the aid of an exclusive bus phase in the traffic signalling arrangements at the intersections of Dacey Avenue and Albion Road with Anzac Parade.

Costs

The estimated costs of the project are detailed in Table N.8.

TABLE N.8 - COST ESTIMATES

Item	Cost
	$'000
Roadworks	46
Bridge	50
Traffic control signal	144
Land acquisition	80
TOTAL	320

It is planned to incur all of the expenditure in 1973-74.

Evaluation

The benefits from this project would accrue largely to bus passengers but there would also be substantial bus operator savings (estimated to be $40,000 per annum by the NSWPTC). Estimation of passenger benefits is dependent on the detailed design of the intersections and traffic signals and the effect of these measures on bus travel time. This information is not available at present.

PROJECT N9

SYDNEY BUS REPLACEMENT

The NSW program shows $3.360m in 1973-74 and $2.363m in 1974-75 for new Sydney buses. This represents remaining payments within an existing contract, under which 252 vehicles are to be delivered after 30 June 1973. The NSWPTC advised that the current contract price is $23,000 per bus(1), as in the BTE 1972 evaluation. Thus, although the purchases represent a slightly faster replacement rate than assumed previously(2), the results are still applicable.

In the 1972 Report the evaluation of the replacement of Sydney buses was Project 22. The benefit-cost ratios calculated were 1.4 and 1.3 at 7 per cent and 10 per cent discount rates respectively. The internal rate of return was 19 per cent.

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(1) Dividing the outstanding payments of $5.723m by the outstanding deliveries of 252 yields a cost per bus slightly less than $23,000. The explanation is that by June 30 payment will have been made for some chassis amongst the 252 complete vehicles remaining to be delivered.

(2) The 1972 evaluation assumed a replacement rate of 100 buses per annum.

Figure V1

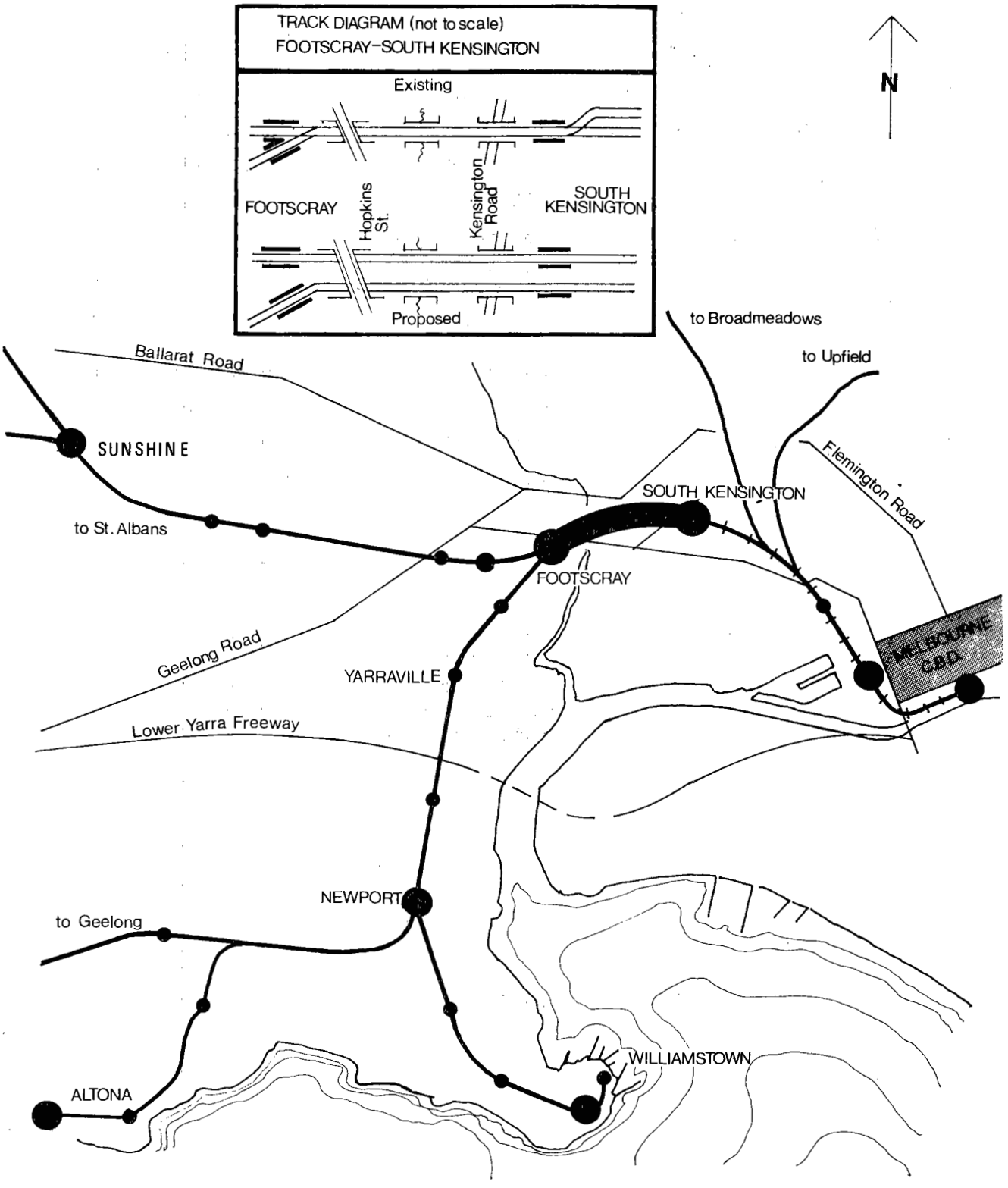

FIGURE V.1.
SOUTH KENSINGTON–FOOTSCRAY RAILWAY QUADRUPLICATION

PROJECT V1

SOUTH KENSINGTON-FOOTSCRAY RAILWAY QUADRUPLICATION

Description

The western suburbs of Melbourne are serviced by the electrified suburban railway lines to St Albans and Williamstown/ Altona. They have a common section from Footscray to the City, a distance of 5.5 kilometres. These lines also carry passenger and freight traffic for the country rail services to Geelong, Ballarat and Bendigo. Figure V1 outlines the main railway and road features associated with this project.

The existing route from the City has six tracks to North Melbourne (junction for the Broadmeadows and Upfield lines) and four tracks to South Kensington. The remaining two kilometres to Footscray have double tracks. This section of double track line crosses the Maribyrnong River and is a bottleneck for the traffic to the western suburbs with trains in each direction converging from two to one track , only to diverge again a mile further on.

The project is to quadruplicate the remaining section of double track between the City and Footscray.

Two evaluations were completed by the BTE. The first was based essentially on the data originally provided. The second was performed after more detailed investigations of costs, train delays and potential scheduling improvements. This evaluation also based more detailed information on future commuter traffic from areas outside Melbourne.

Costs

The project would commence in 1973 and be completed in 1975. The estimated costs appear in Table V.1.1.

TABLE V.1.1- COST ESTIMATES

Item	Cost	
	Initial evaluation	Final evaluation
	$'000	$'000
Earthworks	200	200
Trackwork	620	500
Electrification - signals	90	675
Maribyrnong River - bridging, retaining walls	2,600	2,600
Building, services, etc.	390	390
Rolling stock		1,125
Contingency	490	435
TOTAL	5,390	5,925

The cost of the bridge over the Maribyrnong River is about half the estimated cost of the project, excluding rolling stock.

Work has already begun on this project. Expenditure to June 1973 was $400,000.

Benefits

The quadruplication of the tracks between South Kensington and Footscray would allow an increase in the number of trains serving the western suburbs, and reduce delays to trains at Footscray and South Kensington. Benefits would accrue to existing rail users, due to improved travel times and reduced crowding on peak hour trains. There would be an added cost to the railways for increased track maintenance, and the provision of an increased number of trains to operate the service. However, this cost would be partly offset by the elimination of the Footscray signal box and more efficient train scheduling. There would be a benefit to road users converted to rail as a result of the travel time improvements. Table V.1.2 provides a breakdown of the present value of the benefits for a 7 per cent discount rate.

TABLE V.1.2- DISCOUNTED BENEFITS AT 7 PER CENT

	Benefit	
	Initial evaluation	Final evaluation
	$'000	$'000
Existing public transport users - time savings	4,053	3,869
Existing public transport users - comfort benefits		1,561
Converted road users	851	1,713
Construction work avoided	1,963	1,974
Railway operation	-2,481	-1,213
TOTAL	4,386	7,931

Travel Estimates

The travel estimates for the Sunbury, Deer Park West, Werribee, Williamstown and Altona services were derived from the Melbourne Transport Study 1985 traffic assignment. The rail patronage at Footscray in 1985 is expected to be 20,700 trips per day on the Sunshine line and 26,300 on the Newport line.

In the final evaluation, commuter traffic from Clarkefield, Kyneton, Melton/Bacchus Marsh and Geelong was estimated at 6,000 trips per day in 1975 and 13,500 in 1985. This was based on current patronage, recent patronage growth, population estimates and the Geelong Transportation Study.

The converted patronage resulting from travel time improvements was estimated at 380 trips per day in 1985 in the preliminary evaluation and 700 in the final evaluation. No estimate was made of the conversion due to improved comfort on peak hour trains.

Evaluation

The evaluation was based on the quadruplication being done now (project case) or delayed to 1996 (base case). In the project case extra trains would be required to meet the increased patronage. In the base case extra trains could not be run, which would cause overcrowding of trains.

Travel time improvements used in the preliminary evaluation were based on current peak hour train delays on the section Footscray/South Kensington. For the final evaluation allowance was made for improved express running for commuter trains and a limited number of suburban trains. The project would allow trains to be scheduled to better suit passenger demand rather than being constrained by the limited capacity of the Footscray/South Kensington section. Suburban and commuter trains serve seven destinations. The project would reduce average waiting times for passengers on these trains.

In the initial evaluation the calculated benefit-cost ratios for the project without the full conversion benefits are 0.8 and 0.6 at a 7 per cent and 10 per cent discount rate respectively. The net present values are $-1.1m and $-2.5m. The internal rate of return is 6 per cent.

Both evaluations are conservative as, in the base cases, they assume that no passengers would divert from rail to bus or car travel because of overcrowding on trains. A guide to the effect of this diversion can be shown by an evaluation in which half the future traffic growth between Sunshine and the city was assigned to the Tramways Board bus routes. The assigned bus volumes at Footscray were 1,000 per day in 1975 and 3,250 in 1985. This test evaluation had benefit-cost ratios of 3.0 and 2.3 at a 7 per cent and 10 per cent discount rates respectively.

Conclusion

The benefit-cost ratios calculated in the final evaluation of the project are 1.6 and 1.2 at a 7 per cent and 10 per cent discount rate respectively . The net present values are $2.97m. and $0.93m. The internal rate of return is 12 per cent.

The project has a financial net present value at a 7 per cent borrowing rate of $-3.64m over 20 years.

The evaluation is conservative as the benefits of conversion from road to rail, as a result of improvement in comfort, were excluded.

FIGURE V 2

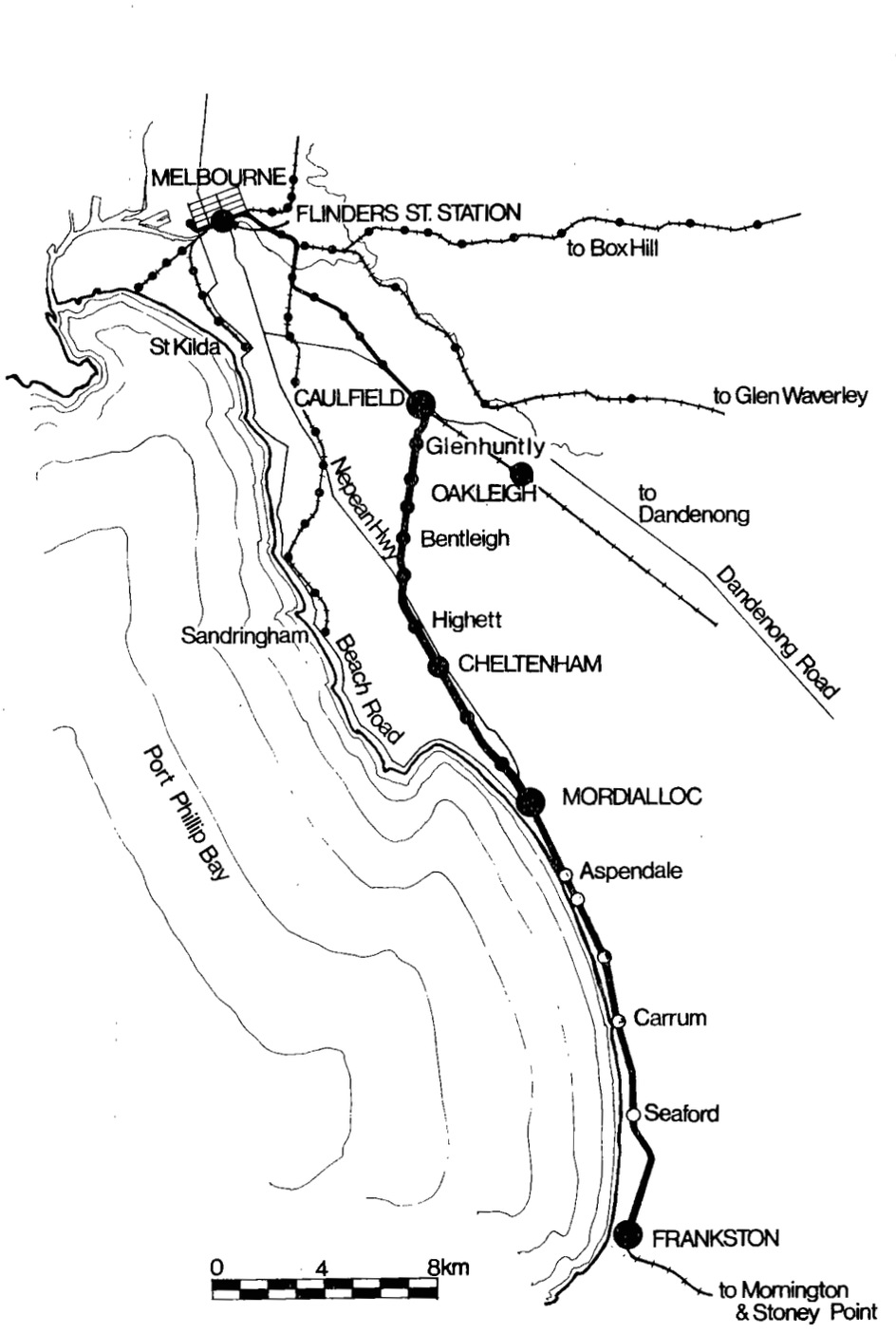

FIGURE V.2.
FRANKSTON CORRIDOR

PROJECT V2

CAULFIELD-MORDIALLOC RAILWAY THIRD TRACK

Description

The railway between Caulfield and Frankston provides a passenger service for residents on the eastern side of Port Phillip Bay. The line also carries limited passenger and freight traffic from the Mornington and Stony Point Lines. The railway and road services in the corridor are shown in Figure V2.

At present the electric suburban services suffer from congestion in peak hours resulting in little travel time advantage from the operation of express trains. Although the capacity of the present line between Caulfield and Mordialloc can be increased by improved signalling, there would still be delays to the peak hour trains serving Mordialloc to Frankston.

The project is based on the provision of a third track signalled for two-way operation, between Caulfield and Mordialloc. This would provide significant benefits from improved travel times, and express and local services would be more efficiently combined. The peak hour express trains between Caulfield and Cheltenham/ Mordialloc would save up to six minutes travel time per trip.

Costs

The project would involve construction of 15.5 kilometres of single-track railway, together with the installation of associated signalling and electrical equipment. The capital expenditure on the project would occur between 1973 and 1976 for Caulfield to Cheltenham, and 1976 and 1978 for Cheltenham to Mordialloc. The costs are detailed in Table V.2.1. As the Victorian Railways are currently undertaking similar construction work, reasonable confidence may be placed in the cost estimates. A 10 per cent contingency has been included.

TABLE V.2.1 - COST ESTIMATES

Item	Cost
	$'000
Route construction (Caulfield-Cheltenham)	
Earthworks and trackwork	1,000
Bridges, building, extras	2,000
Electrification	700
Signalling	1,700
Route construction (Cheltenham-Mordialloc)	3,000
Contingency	840
TOTAL	9,240

Benefits

The major benefits of the project would accrue to the existing train travellers and converted road users. There would be a small benefit to the remaining road users due to reduction in road traffic, particularly on the Nepean Highway. Significant additional railway costs would result from maintaining the increased track and from serving a higher patronage. There is a benefit to the railway from reduced signalling improvement costs on the existing tracks between Caulfield and Mordialloc. The composition of the benefits, in present values at a 7 per cent discount rate, is detailed in Table V.2.2.

TABLE V.2.2 - DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefit
	$'000
Existing public transport users	3,800
Generated public transport users	48
Converted public transport users	5,680
Remaining road users	57
Miscellaneous (signalling)	1,225
Residual after 20 years	2,280
Operation	-993
TOTAL	12,097

Travel Estimates

Travel estimates for the project were derived from the Melbourne Transportation Study 1985 traffic assignment and recent transport patronage and road traffic volumes. The 1985 daily patronage from this line is estimated to be 60,000 trips at Caulfield and 38,000 trips at Mordialloc.

The generated and converted patronage resulting from travel time improvements were each estimated at 425 passengers a day in 1976, rising to 680 in 1985.

Evaluation

In the base case it was assumed that it will be necessary to provide track capacity, for the patronage offering, by resignalling the existing tracks to reduce the minimum headways from 4 minutes to 2 minutes. In the project case, the additional capacity offered by use of the third track in the peak direction and by the associated resignalling is an alternative to the resignalling required in the base case. The project case reduces travel times by increased express running. The patronage differences between the base case and the project case are generation and conversion as a result of time savings.

Conclusion

The calculated benefit-cost ratios for the project are 1.7 at 7 per cent discount rate and 1.2 at a 10 per cent discount rate. The net present values of the project are $4.35m at a 7 per cent discount rate and $1.36m at a 10 per cent discount rate. The internal rate of return is 12 per cent.

The project has a financial net present value at a 7 per cent borrowing rate of $-6.00m over 20 years.

Figure V3

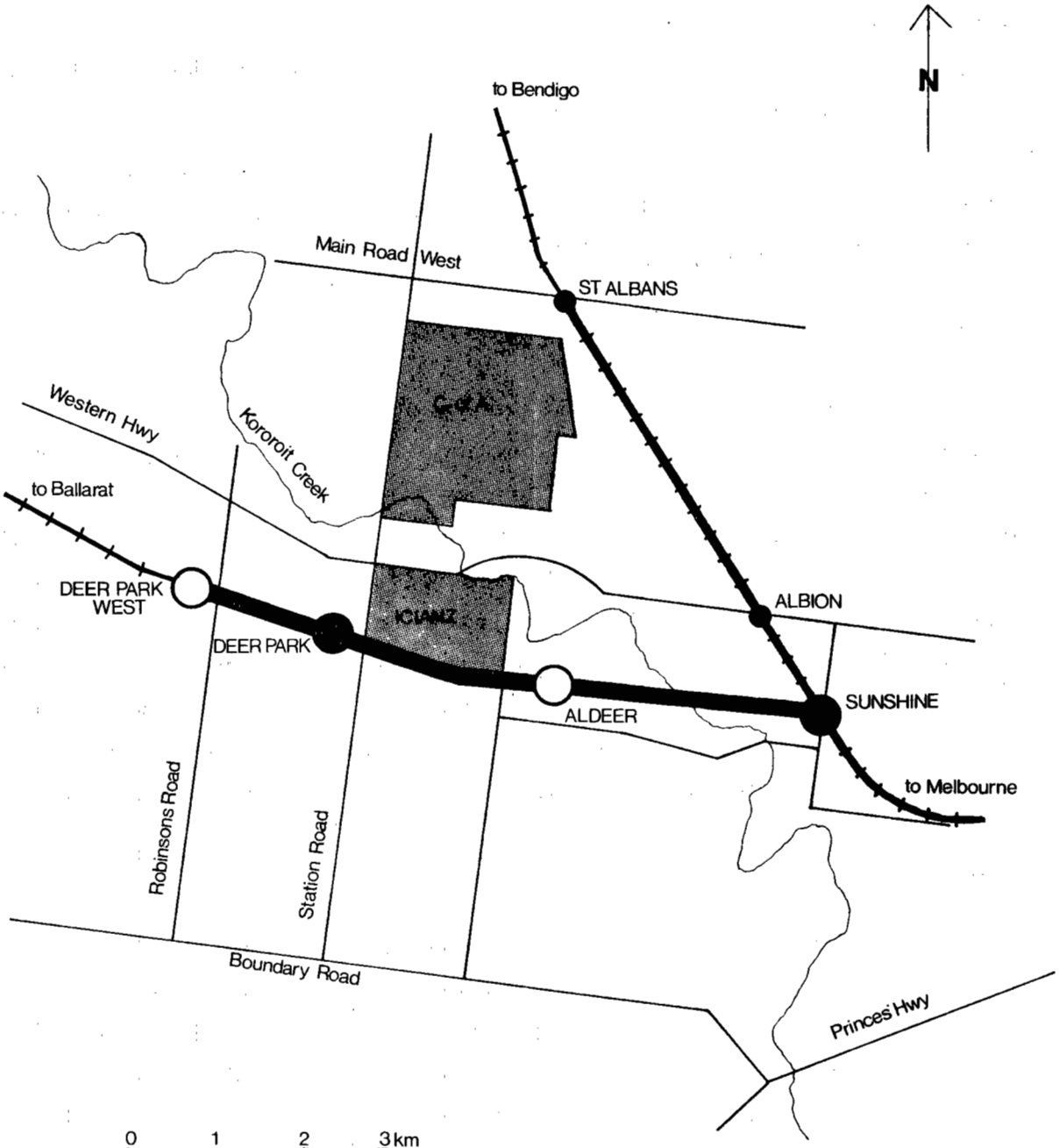

FIGURE V.3.
SUNSHINE - DEER PARK WEST RAILWAY

SUNSHINE-DEER PARK WEST RAILWAY

Description

The Melbourne western suburbs of Ardeer, Deer Park, and Deer Park West are served by bus routes of the Melbourne and Metropolitan Tramways Board, as well as by private operators. All of the bus routes serve Sunshine Station, where a bus-rail interchange is proposed to replace the existing limited bus terminal facilities. The MMTB bus routes at present continue on to the city but function mainly as a local bus service, because the Sunshine to the City running time by bus is 17 minutes longer than by train. The more important railways and roads are shown in Figure V4.

Sunshine is at the junction of the main Ballarat and Bendigo railway lines. The Ballarat line is single track with a station and crossing loop at Deer Park. This station is served by only a limited number of short distance country trains.

The project is to duplicate and electrify the existing railway to Deer Park West, and to introduce a suburban passenger service. This would involve the construction of a second track for about 7 kilometres and electrification of 14 track kilometres. New stations would be built at Ardeer and Deer Park West and the existing station at Deer Park would be rebuilt.

Two evaluations were completed. The first included the immediate electrification as well as the duplication. The second was on the basis of immediate duplication of the track, but deferment of electrification for ten years. The initial service would be provided by a shuttle service, using reconditioned railcars, between Deer Park West and Sunshine. This service would be supplemented by the existing Melton/Bacchus Marsh commuter trains.

Costs

For each evaluation the capital expenditure would occur during 1973 and 1974. The costs are detailed in Table V.3.1.

TABLE V.3.1 - COST ESTIMATES

Item	Cost	
	First evaluation	Second evaluation
	$'000	$'000
Earthworks, trackwork, bridges	730	730
Electrification	450	
Signalling	450	450
Building, services	470	470
Contingency	210	165
Rolling stock - new electric	500	
- renovation of railcars		100
TOTAL	2,810	1,915

At Sunshine Junction the signal box is scheduled for replacement by power signalling in the near future. An allowance was made for the modifications which would be required as a result of the project, but not for the complete replacement of the signal box.

Benefits

The project would provide benefits to existing rail and bus passengers and to converted road users. There would be a reduced operating cost to public transport operators. The composition of the benefits, in present values at a 7 per cent discount rate, is detailed in Table V.3.2.

TABLE V.3.2 - DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefits	
	First evaluation	Second evaluation
	$'000	$'000
Existing public transport users	552	592
Generated public transport users	14	15
Converted road users	505	504
Public transport operators	1,091	747
Residual after 20 years	904	948
TOTAL	3,066	2,806

Travel Estimates

Travel estimates for the project were derived from the 1985 travel assignments developed by the Melbourne Transportation Study, recent public transport patronage records and road traffic counts. The 1985 daily rail patronage at Sunshine was estimated at 3,144 trips.

The generated and converted patronage resulting from the travel time improvement were each estimated at 45 passengers a day in 1975 and 150 passengers a day in 1985.

Evaluation

The base case represented the present service by feeder bus to Sunshine Station. The project case extended the suburban train operation to Deer Park West. Travel time improvements were estimated at six minutes.

The service envisaged in the first evaluation was a two-car shuttle connecting with St Albans trains at Sunshine, with a limited amount of through running during peak hours. The amount of through running would increase as patronage in the area grew.

The benefit-cost ratios calculated for the first evaluation were 1.2 and 0.8 at a 7 per cent and 10 per cent discount rate respectively. The net present values were $0.45m and $-0.57m. The internal rate of return was 8 per cent and the project would have a financial net present value at a 7 per cent borrowing rate of $-1.15m over 20 years.

Conclusion

The benefit-cost ratios calculated in the second evaluation are 1.5 and 1.0 at a 7 per cent and 10 per cent discount rate respectively. The corresponding net present values are $0.99m and $0.02m. The internal rate of return is 10 per cent.

The project has a financial net present value at a 7 per cent borrowing rate of $-0.84m over 20 years.

Figure V4

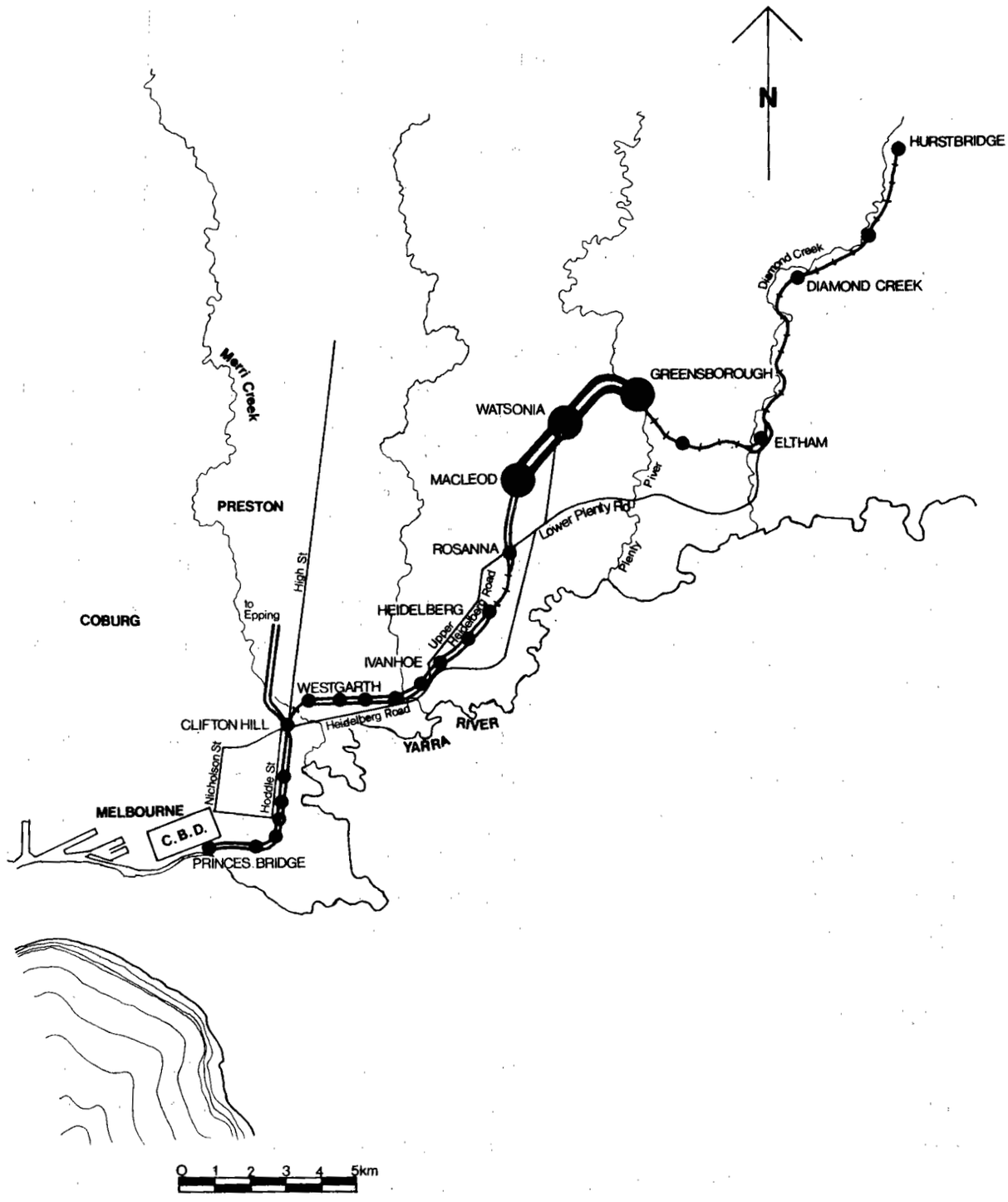

FIGURE V.4.
MACLEOD-GREENSBOROUGH
RAILWAY DUPLICATION

PROJECT V4

MACLEOD-GREENSBOROUGH RAILWAY DUPLICATION

Description

The Hurstbridge Line is an electrified suburban railway in Melbourne serving the north-eastern suburbs of Ivanhoe, Heidelberg and Eltham, and the Diamond Creek valley to Hurstbridge. The more important railways and roads are shown in Figure V4.

The line is double-track for the first 16.5 kilometres to Macleod, except for single-track sections across the Merri Creek Bridge (Clifton Hill-Westgarth) and Heidelberg-Rosana. Beyond Macleod the line is single-track for the remaining 20.5 kilometres with crossing loops at Greensborough, Eltham and Diamond Creek. The basic service is for alternate trains to Eltham and Hurstbridge, with extra trains to Heidelberg and Macleod during peak hours.

The numerous sections of single track, particularly between Clifton Hill and Eltham, considerably constrain the frequency of service which can be provided on this line without incurring excessive delays at crossing loops. The project is to extend the double track from Macleod to Greensborough, a distance of about 5.5 kilometres. The Merri Creek Bridge and Heidelberg-Rosana single-track sections are expensive to duplicate and have not been included in the project.

Costs

The project would commence in 1973 and be completed early in 1975. The estimated costs of the project are detailed in Table V.4.1.

TABLE V.4.1 - COST ESTIMATES

Item	Cost
	$'000
Earthworks, trackwork	420
Bridging	220
Electrification	80
Signalling	275
Buildings, platforms and services	110
Contingency	105
TOTAL	1,210

Benefits

The benefits of the project would be reduced delays at crossing loops, and a reduction in the number of trains required to provide the service for any particular level of patronage. The composition of the benefits, using a 7 per cent discount rate, is shown in Table V.4.2.

TABLE V.4.2 - DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefit
	$'000
Existing public transport user	288
Railway operation	611
Vehicle replacements	612
Residual after 20 years	268
TOTAL	1,779

Travel Estimates

Travel estimates for the project were derived from the Melbourne Transportation Study 1985 traffic assignment and recent public transport patronage. The 1985 daily patronage on the line is estimated to be 19,500 trips at Macleod and 6,200 trips at Greensborough.

Evaluation

The benefits from reduced delays at crossing loops were evaluated for off-peak patronage only. Peak hour trains in the peak flow direction are usually not delayed. However, trains that run in the counter-peak direction have lengthy delays at each crossing loop. This usually affects only a small number of people and was not evaluated.

The evaluation considered only the operating benefits possible with the existing timetable. One train set can be eliminated. This is a conservative evaluation as the section Macleod to Greensborough and beyond is showing a steady growth in patronage.

The patronage from Watsonia, for example, has increased by 25 per cent over the past four years. With the project operational, part of the expected increase can be carried by improved utilisation of the train sets, and by extending local trains from Macleod to Greensborough. Without the extension of the double track, extra train-sets would be required.

Conclusion

The calculated benefit-cost ratios for the project are 1.6 at a 7 per cent discount rate and 1.2 at 10 per cent. The net present value is $0.64m at a 7 per cent discount rate. The internal rate of return is 13.7 per cent.

The project is estimated to have a financial net present value of $82,000 to the NSWPTC at a 7 per cent borrowing rate over 20 years.

Figure V5

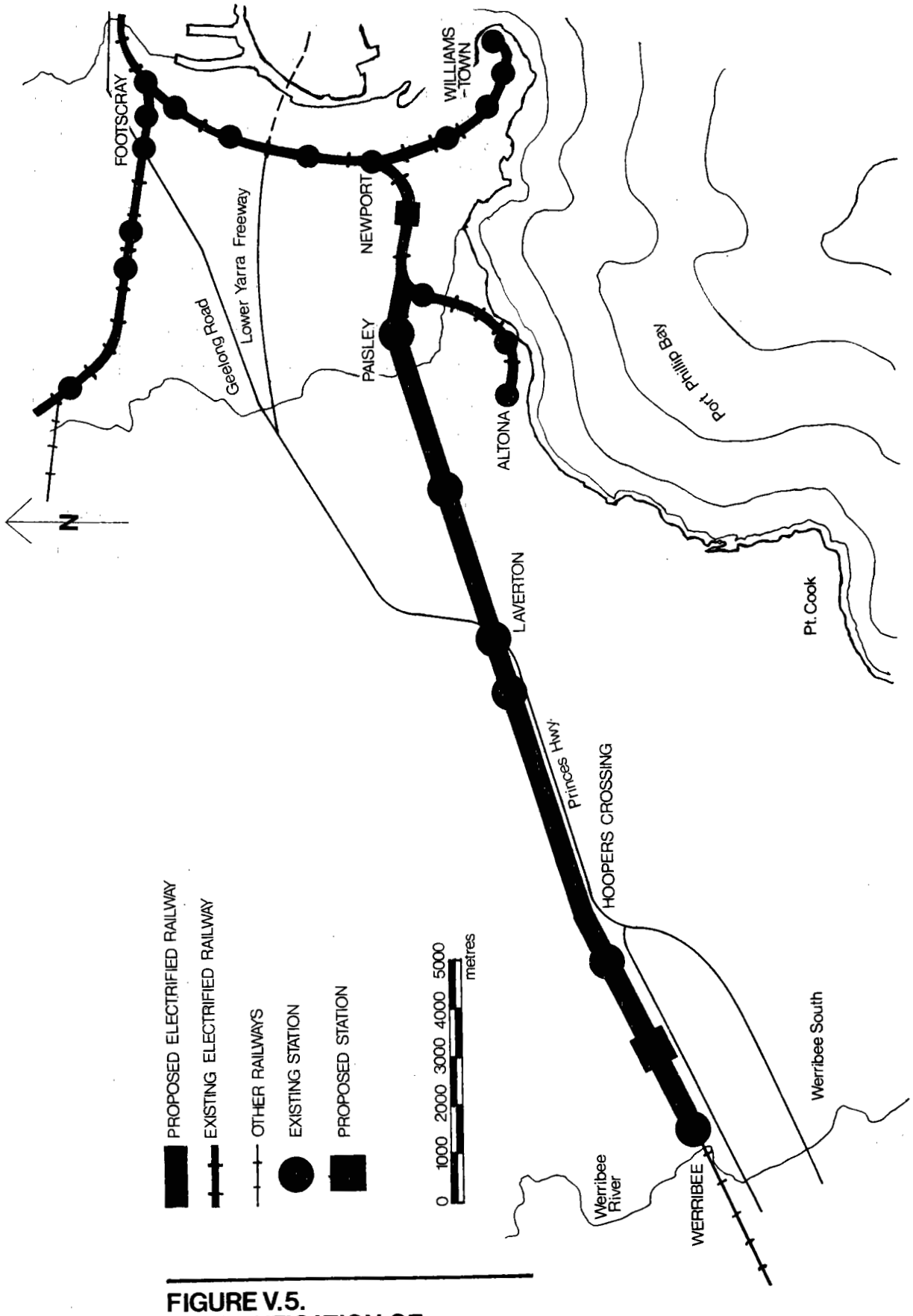

FIGURE V.5.
ELECTRIFICATION OF
NEWPORT-WERRIBEE RAILWAY

PROJECT V5

ELECTRIFICATION OF NEWPORT - WERRIBEE RAILWAY

Description

The Geelong railway provides services for the Western Suburbs of Melbourne. The services to Altona and Williamstown operate over the electrified section between Altona Junction/ Newport and the city. A diesel service operates to Werribee. The more important railway and road services are shown in Figure V5.

The population in the area between Newport and Werribee is growing rapidly and so is the demand for suburban rail travel. The project provides for the electrification of the 18,5 kilometres of double track between Altona Junction and Werribee, allowing the service to be integrated with the electrified suburban system.

Cost

The estimated costs of the project are shown in Table V.5.

TABLE V.5 - COST ESTIMATES

Item	Cost
	$'000
Electrification	1250
Signalling modifications	300
Other items	100
Rolling stock	1500
Contingency	165
TOTAL	3315

The project would be commenced in 1973 and would be completed by the end of 1974. New stations are proposed at Newport West and Tarneit at an estimated cost of $100,000 each. These should be part of a separate evaluation and were considered as built in both the project case and the base case.

Benefits

The main benefit to train passengers would be improved access to the city with electric trains running through to Flinders Street and eventually to the underground loop. (The present diesel service terminates at Spencer Street Station and electrification would avoid the need to change trains to get access to the loop). In addition the Victorian Railways would receive considerable benefits as the cost of operating electric rolling stock is lower than the existing diesel trains. Some of the existing rolling stock must be replaced in the near future and this expenditure would be avoided by the project.

Travel Estimates

Travel estimates for the project were derived from the Melbourne Transportation Study 1985 traffic assignment. The 1985 patronage was estimated to be 4,170 trips at Laverton and 7,170 trips at Paisley. The patronage was the same in both project case and base case. Although the elimination of a transfer at Spencer Street Station might attract extra patronage, this was neglected as being insignificant compared with possible errors in forecasting the impact of the Westgate Bridge on patronage levels.

Evaluation

The electrified service would be integrated with the Williamstown and Altona services. The operating costs were based on the cost per kilometre to operate the various types of trains. In the base case and the project case the standard of service provided was the same. The estimated operating savings were $36,000 in the operational year rising to $99,000 in 1985.

Conclusions

The project is estimated to have benefit-cost ratios of 1.0 and 0.8 at 7 and 10 per cent discount rates. At these discount rates the net present values are zero and -$0.67m respectively. The internal rate of return is 7 per cent.

The project has a financial net present value at a 7 per cent borrowing rate of -$1.02m over 20 years.

FRANKSTON RAILWAY RESIGNALLING

Description

The Frankston Line provides a passenger service to the residents on the eastern side of Port Phillip Bay. The line also carries the limited passenger and freight traffic from the Mornington and Stoney Point lines. The location of the Frankston line is shown in Figure V2.

The present signal capacity on the Caulfield-Frankston section of this line is only sufficient to carry the existing number of peak hour trains. The double line block telegraph system of signalling is still in use between Glenhuntly and Bentleigh, and between Highett and Frankston, a distance of nearly 27 kilometres. This system is labour intensive and is not readily modified for the close headways usually required on urban railways.

The project would be the replacement of the existing double line block telegraph system between Frankston and Mordialloc to increase track capacity and improve reliability. The minimum headway would be reduced from 6 minutes to 3 minutes.

Costs

The estimated costs of the project appropriate for this economic evaluation are detailed in Table V.6.1.

TABLE V.6.1- COST ESTIMATES

Item	Cost
	$'000
Mordialloc-Frankston signalling	1,300
Caulfield-Mordialloc signalling	1,500
Flinders Street Station re-arrangement	400
Contingency	320
TOTAL	3,520

Resignalling between Caulfield and Mordialloc was included in the cost estimate, although this work would only be required if the Caulfield-Mordialloc third track were not provided. The capacity which would be provided by Project V6 is the base case

capacity used in the Caulfield-Mordialloc third track evaluation reported as Project V2.

Flinders Street Station is also at capacity. The evaluation includes the cost of alterations at Flinders Street to allow the St Kilda line to through run to Sandringham, which would enable more trains to be accepted from the Frankston line.

Benefits

The project would provide benefits through adding sufficient railway capacity to meet demand, thus saving the difference between bus service costs and railway service costs for the demand in excess of existing railway capacity. There would be a benefit to the Victorian Railways from reduced signal staff requirements, although this would be partly offset by the increased cost of track maintenance. There would also be savings to road users because of the reduced number of buses on the roads. Table V.6.2. provides a breakdown of the present value of benefits for a 7 per cent discount rate.

TABLE V.6.2- DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefit
	$'000
Public transport operators	6,676
Remaining road users	3,187
Residual after first 20 years	4,555
TOTAL	14,418

Travel Estimates

The travel estimates were derived from the Melbourne Transportation Study 1985 traffic assignment. The rail patronage, at present 40,000 trips per day at the city end, is expected to rise to 70,000 by 1985. The base case was that 2,400 trips in 1976 and 13,200 trips in 1985 would be carried by bus.

Evaluation

The assumptions used in establishing the base case and the project case are expected to result in a conservative evaluation. The increased crowding of the trains under the assumptions of the base case would cause discomfort costs but these were not quantified. Those who could not be fitted into the trains were assumed to travel by bus. For simplicity, the bus travel times were assumed to be the same as the train travel times, but in reality, bus travel times could be expected to be longer. Some project case train travellers could be expected to travel by car in the base case which would result in greater base case costs than under the assumption of bus travel used in the evaluation.

Conclusion

The calculated benefit-cost ratios for the project are 4.7 at a 7 per cent discount rate and 3.0 at 10 per cent. The corresponding net present values are $11.4m and $5.8m. The internal rate of return is 20 per cent.

The project has a financial net present value at a 7 per cent borrowing rate of $3.6m over 20 years.

PROJECT V7

SIGNAL IMPROVEMENTS - OAKLEIGH STATION

Description

The Dandenong Line is one of a number of railway lines serving the south-eastern suburbs of Melbourne. The line also carries the Gippsland rail traffic.

Oakleigh is the mid-point of the line, being 15.5 kilometres from Flinders Street Station and 14.5 kilometres from Dandenong. Its location is indicated in Figure V2. During the peak hours, additional trains are run between the city and Oakleigh to supplement the Dandenong trains. Adjacent to Oakleigh Station there is a small goods yard and stabling facilities for suburban trains.

At either end of Oakleigh Station there are manually operated signal boxes. These control the section through Oakleigh Station, this being the only remaining section of manual signalling between Caulfield and Dandenong. These signal boxes also control entry of trains to the goods yard, suburban trains storage sidings and the movements of terminating suburban trains.

The project would replace the two existing signal boxes with one consolidated box within the station building. The design of the new signal box would be compatible with the proposed third track between Caulfield and Huntingdale.

Costs

The cost of the project is estimated at $330,000, which includes an allowance of 10 per cent for contingencies.

Benefits

The project would result in a staff saving of $26,000 per year by removing one signal box. The new signal box could be operated by the regular station staff during the slack hours. This would give an extra $15,000 in annual staff savings. The maintenance cost of the new signal box would be slightly lower than the two existing signal boxes, but no allowance was made for this saving. The signal boxes have been listed for replacement

for some time, and if replacement is not done soon, an estimated $10,000 would need to be spent to overhaul the present equipment. The benefits of the project discounted over 40 years are $569,000 at 7 per cent and $415,000 at 10 per cent.

Conclusions

The project is estimated to have benefit-cost ratios of 1.7 and 1.3 at 7 and 10 per cent discount rates respectively and a net present value of $239,000 at a 7 per cent discount rate. As all benefits are in financial terms, the results for the economic and financial evaluations are identical.

PROJECT V8

MELBOURNE TRAIN REPLACEMENT

The Victorian program for 1973-74 includes $10.7m for replacement trains, which were evaluated as Project 25 in the 1972 Report. The results of the evaluation were benefit-cost ratios of 1.7 at 7 per cent and 1.5 at 10 per cent discount rate.

In view of some adverse press comment about seating on the one new train which has come into service since the 1972 evaluation, it is noted here that a sensitivity test of the evaluation was made in which passenger benefits were halved. The benefit-cost ratio reduced tc 1.3 at 7 per cent and 1.14 at 10 per cent. This indicates that the project would be justified even with the proposed seating. However, in response to the press criticism the Victorian Minister for Transport now has arranged for improved seating to be incorporated in the new trains.

The cost of the trains has increased 7 per cent since 1972 but the results of an evaluation would still be favourable (even if passenger benefits were halved), especially if benefits were also converted to current prices, which would be appropriate.

Figure V9

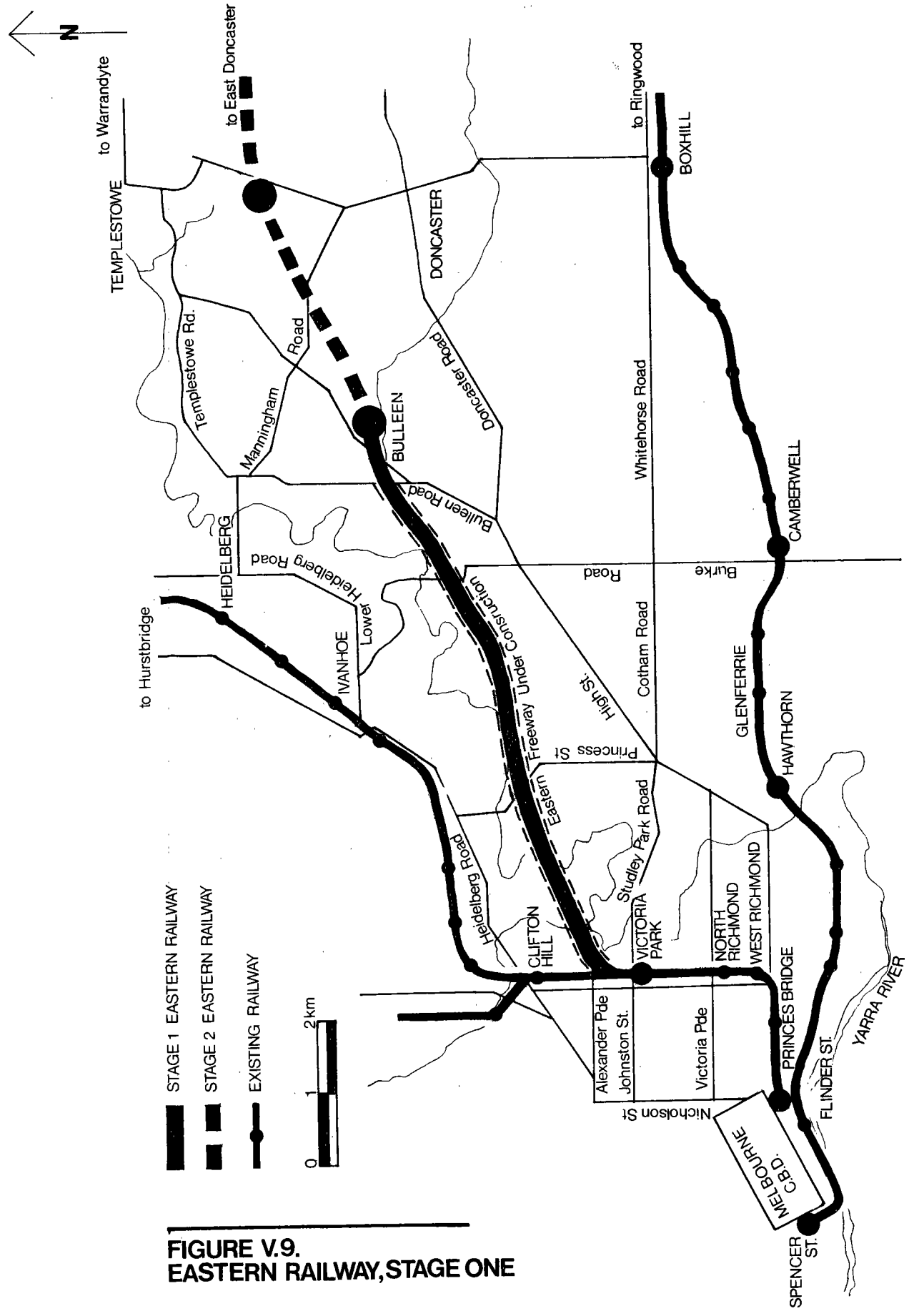

FIGURE V.9.
EASTERN RAILWAY, STAGE ONE

MELBOURNE EASTERN RAILWAY - STAGE ONE

Introduction

In the 1972 Report this project was included as Project 12. The 1972 evaluation was based on limited data available at that time on costs and patronage. Also the evaluation was based on the construction of the railway first and the Eastern Freeway at a later date. As the Eastern Freeway is at present being constructed, together with earthworks for the railway, and additional information is now available for costs and patronage, a new evaluation was necessary.

Description

The section of the Eastern Freeway at present under construction is between Alexandra Parade, Collingwood and Thompsons Road, North Balwyn. This section of the freeway provides a central reserve for the proposed Eastern Railway. The railway would link Doncaster and Templestowe with central Melbourne. Figure V9 shows the more important railway and road services.

The railway is planned to be constructed in two stages. Stage One would construct the railway a distance of 8.5 kilometres to a station near Thompsons Road, Bulleen. The railway would branch from the Hurstbridge and Epping Lines at Victoria Park and use the railway reserve provided by construction of the Eastern Freeway. The only station on the new line would be at Bulleen, where interchange facilities would be provided for buses and cars.

Stage Two would extend the railway from Bulleen through Doncaster to East Doncaster.

Two evaluations were made of the project. Following an initial evaluation, some variations were made in the originally proposed staging. This produced a small improvement in the results.

Costs

The costs of the project are detailed in Table V.9.1.

TABLE V.9.1 - COST ESTIMATES

Item	Cost	
	Initial	Final
	$'000	$'000
Additional track capacity Victoria Park - Princes Bridge	2,100	
Relocation of Victoria Park Station	1,400	1,400
Earthworks constructed with freeway	5,200	5,200
Additional earthwork, structures	1,500	1,500
Trackwork, signalling electrification	2,300	2,300
Bulleen Station	800	800
Other items	600	1,800
Rolling stock	2,250	1,750
Contingency	1,400	1,300
TOTAL	17,550	16,050

The project would be constructed between 1973 and 1977. In the initial evaluation, added rail capacity required between Victoria Park Station and Melbourne was assumed to be provided as part of the project. In the final evaluation it was assumed that this capacity would be provided by 1985 in both the base case and the project case. In the meantime schedules would be slower and there would be reduced benefits to public transport users.

Included in the above costs are $2.2m for work already completed.

Benefits

The new railway would benefit existing public transport passengers who would otherwise travel by bus to the Box Hill Railway. Additionally there would be benefits from passengers converted to the railway from private cars. There would be an overall operating saving to the various public transport services in the area. Table V.9.2 provides a breakdown of the present value of the benefits for a 7 per cent discount rate.

TABLE V.9.2- DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefit	
	Initial	Final
	$'000	$'000
Existing public transport users	3,971	3,765
Public transport operators	5,033	5,493
Converted road users	2,290	2,073
Remaining road users	843	843
Residuals after 20 years	4,961	4,780
TOTAL	17,098	16,954

Travel Estimates

The travel estimates for the railway were derived from the Melbourne Transportation Study 1985 assignment. The patronage on the line was estimated at 14,500 passengers per day in 1977 and 21,800 passengers per day in 1985. The base case was obtained by a special assignment in which the railway was assumed not constructed and a bus service was provided between Bulleen/Templestowe and the city. It was assumed that those who would travel by rail in the project case would, in the base case, travel by bus via the freeway, the Box Hill Railway, or private cars.

Evaluation

The evaluation assumed that the modal interchange facilities at Bulleen would allow convenient interchange between bus and train. Also the access to the station for buses and cars was assumed not to be affected by congestion on roads leading to the Eastern Freeway.

In the initial evaluation, if the sunk costs of $2.2m are disregarded, the benefit-costs ratios are 1.3 and 0.9 at 7 per cent and 10 per cent discount rates respectively. The corresponding net present values are $4.19m and -$1.35m. The internal rate of return is 9 per cent.

The results of the final economic evaluations are presented in two forms. The first is hypothetical, and assumes that no freeway construction has been performed. The second is relevant

to the real situation where part of the earthworks have been completed and the community faces the decision as to whether or not the railway should be completed.

If sunk costs are included the benefit-cost ratios estimated in the final evaluation are 1.2 and 0.8 at 7 per cent and 10 per cent discount rate respectively. The corresponding net present values are $2.38m and -$3.05m. The internal rate of return is 8.1 per cent.

Conclusion

The evaluation results most appropriate to the circumstances of the project are benefit-cost ratios of 1.4 and 0.93 at 7 per cent and 10 per cent discount rate respectively. The corresponding net present values are $4.58m and -$0.85m. The internal rate of return is 9 per cent.

MELBOURNE BUS REPLACEMENT

Description

Of the 260 buses operated by the Melbourne and Metropolitan Tramways Board (MMTB), 135 are over 20 years old. It is intended to purchase 30 buses in 1973-74 to replace an equal number of 22 year old AEC Regal Mk III buses. The MMTB believes the new vehicles - integral construction National buses fully imported from UK - would have an economic life of approximately 15 years. Accordingly, the evaluation assumes a project case of replacing the 22 year old Leyland buses in 1973-74, followed by 15 year replacement cycles thereafter. This is compared with a base case of retaining the existing buses for a further 10 years and replacing them again after another 32 years. As in previous rolling stock evaluations (see 1972 Report), the analysis is extended over 50 years.

Costs

The capital cost of the project would be 30 buses at $24,600 each[1], less salvage value of $800 each for the replaced buses, giving a total cost of $714,000.

The cycles of bus purchases and disposal, other than the initial investment in the project cases, were treated in the calculation of benefits. For this purpose, 15 year old buses were assumed to have a salvage value of $3,500, 22 year old buses a value of $800 (as above), and 32 year old buses zero salvage.

Benefits

The new buses would have advantages, compared with the buses being replaced, of reduced maintenance costs, better design, increased comfort and better vehicle performance. Other technical improvements would include increased vehicle safety and reduced driver fatigue. Passenger benefits, which would include forced air ventilation, smoother ride due to improved transmission and suspension systems, better braking and demisting equipment, automatic

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(1) The purchase price of $27,000 includes $2,400 import duty, which has been deducted to arrive at real resource cost.

doors and a low floor height, have been valued as explained in the 1972 Report[1]. It was assumed that there is an underlying tendency for patronage per bus to decline by 4 per cent each decade, for a fleet of constant age.

The superior performance of the new vehicles[2] could also reduce travel times slightly but this benefit was not included in the evaluation.

Purchase of new buses would result in reduced maintenance costs as a result of:

(i) a lowered requirement for maintenance and mechanical components during the earlier years of operation;

(ii) the avoidance of costly major body overhauls; and

(iii) the avoidance of very significant increases in maintenance costs which would result if the present buses remain in service after factory replacement spare parts cease to be available[3].

The capital expenditure program is designed to progressively establish regular replacement of buses at fifteen-year intervals. It is believed that the previous practice of buying large numbers of buses at one time has important disadvantages. Because workshop capacity is reasonably constant, it has been necessary to carry out major body overhauls earlier and later than desirable. It has also been found that, where mechanical failure occurs due to fatigue, rectification is more expensive because of the amount of activity in that particular area. The regular purchase of replacement buses will facilitate the incorporation of improvements and rectification of design faults by the supplier.

Maintenance cost savings were estimated using the general relationship mentioned in Annex A. Due to the foregoing reasons, the estimated maintenance saving is probably conservative.

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(1) See Annex D, pp D19-D21.

(2) The new vehicles will have average schedule speeds of 23 km/h in the peak and 26 km/h in the off-peak, compared with 19 and 21 km/h respectively for the vehicles they are replacing.

(3) Senior representatives of the supplier have advised MMTB that this is expected to occur soon.

Conclusion

Table V.10 shows the relative importance of each benefit item in present value terms. The benefit-cost ratios are 1.2 at a 7 per cent discount rate and 1.1 at 10 per cent. The respective net present values are $150,000 and $39,000 .

TABLE V.10 - DISCOUNTED COSTS AND BENEFITS

($'000)

Item		Discount Rate	
		7 per cent	10 per cent
Initial Capital Costs		667.3	649.1
Benefits			
Bus purchase	70.6	92.3	
Maintenance savings	382.1	308.5	
Benefits to existing passengers	304.7	248.0	
Benefits to new passengers	3.1	2.7	
Road savings	39.3	32.0	
Residual value	17.9	4.5	
Total		817.7	688.0
Net Present Value		150.4	38.9

PROJECT V11

MELBOURNE TRAM REPLACEMENT

Description

The rolling stock of the MMTB consists of 696 trams of which 70 per cent were built before 1939. The MMTB have indicated that over the next five years they intend to purchase 205 new trams, of which 100 have already been ordered. The evaluation in the 1972 Report relied on data not directly supplied by the MMTB. Recent consultation with the MMTB has produced new data. As a result of this, as well as the singificant escalation in cost, a re-evaluation was carried out.

The evaluation considers two alternative courses of action:

(i) retaining the existing W2 trams for another 10 years and then replacing 115 of the oldest trams with 100 new trams and running these trams to the end of the 50 year study period; or

(ii) immediately replacing 115 oldest trams with 100 new trams and running these for the entire study period.

Costs

The capital cost of the project would be 100 trams at $125,000 each[1] giving a total of $12.5 million. The replacement costs in the base case were treated in the calculation of benefits, leaving the whole evaluation to be compared against the initial capital outlay.

Benefits

The likely benefits resulting from the new trams would include reduced maintenance costs, greater comfort, improved loading and unloading, increased efficiency in fare collection[2], greater capacity, increased speed and less traffic congestion to private vehicles.

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(1) Includes $5,000 for the value of work to be done by MMTB. No salvage value is expected for the old trams.

(2) This is a financial benefit and accordingly was not included in the economic evaluation. However, MMTB advised that from overseas experience fare collection should increase by at least 6 per cent with seated conductors, as proposed in the new trams. On this basis the extra revenue per item would be $2,500 per annum.

Passenger benefits, and road savings attributable to higher usage of the more modern trams, were calculated on the same basis as in the 1972 evaluation. After the first 10 years in the study period all benefits would be negative because the trams in the base case would be younger.

Maintenance cost savings were substantially revised since 1972. The new trams would cost around $2,000 a year each to maintain in the first decade rising to $8,000 a year each in the fifth decade. This maintenace figure for the fifth decade would still be 20 per cent lower than the maintenance cost of the present old trams. The difference is attributable to the fact that body overhaul costs would be substantially less than those for the trams being replaced, which are of wooden construction. Typical labour-intensive operations which are currently undertaken are waterproofing of roofs and the repairing and repainting of wooden window frames.

The materials costs of new tram maintenance would be significantly less than for W2 class trams, because new trams would not require brake shoes, brake rigging and air equipment.

Further savings are likely to accrue from the operation of new trams through:

(i) lower crew requirements because of a decrease in the number of trams required to operate a service at the existing level; and, perhaps,

(ii) crew reductions through one-man operation during off-peak periods.

The effect of reducing the total number of trams in peak periods by one tram could reduce depot requirements by two crews, but the need to balance straight and broken shifts at the depot would decrease the effective reduction to about 1.5 crews for each tram removed from both peaks.

Extra power costs appear as negative benefits in the first 10 years, and replacement costs in the base case appear as a positive benefit in the evaluation.

Conclusions

Table V.11 shows the relative importance of each benefit item in present value terms. The benefit-cost ratios are 1.3 at 7 per cent rate of discount and 1.1 at 10 per cent. If one-man operation were to be carried out during off-peak periods, the ratios would be 1.3 and 1.2 respectively.

TABLE V.11 - DISCOUNTED COSTS AND BENEFITS

($'000)

		Discount Rate		
		7 per cent		10 per cent
Initial Capital Costs		11,682.2		11,363.6
Benefits				
Tram Purchases	5,938.7		4,381.3	
Maintenance savings	5,325.7		4,983.0	
Operating savings - two man	533.8		467.0	
Additional savings - one man	(477.6)		(417.8)	
Benefits to -				
existing passengers	2,771.2		2,705.0	
new passengers	55.4		54.1	
Road savings	325.9		318.1	
Total Benefits - two man		14,950.7		12,908.5
Total Benefits - one man		(15,428.3)		(13,326.3)
Net Present Value - two man		3,268.5		1,544.9
- one man		(3,746.1)		(1,962.7)

BRUNSWICK STREET-NORTHGATE RAILWAY THIRD TRACK

The provision of a third track between Brunswick Street and Northgate is included in the 1972 Report as Project 14. The proposal in the capital expenditure program is unchanged from that evaluated previously and the revised estimate of the capital cost ($2.104m in 1973 values) is almost the same, in 1973 values, as the previous estimate if the 15 per cent contingency allowance is deleted(1). The provision of a third track would offer a substantial capital saving in reduced rolling stock purchases as a result of the potential for increased rolling stock utilisation. This capital saving was previously estimated as $700,000.

The 1972 evaluation indicates that the project would provide a very satisfactory return on capital. The calculated benefit-cost ratio (3.4 at 7 per cent) would be slightly reduced for the current proposal because expenditure is now planned to be spread over three years instead of the two years used in the previous evaluation.

The 1972 central analysis took no account of any patronage increase as a result of this improvement. Thus, there is no increased revenue to be incorporated in determining the financial result, which is purely the operational benefit (estimated in 1972 to be a net present value of $0.612m).

The project would offer attractive returns on investment whether or not the suburban system were electrified. If it were decided that the electrified system should be standard gauge, the timing of the project would need reconsideration.

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(1) The cost estimate for the 1972 evaluation was approximate, so the BTE added 15 per cent for contingencies.

Figure Q2

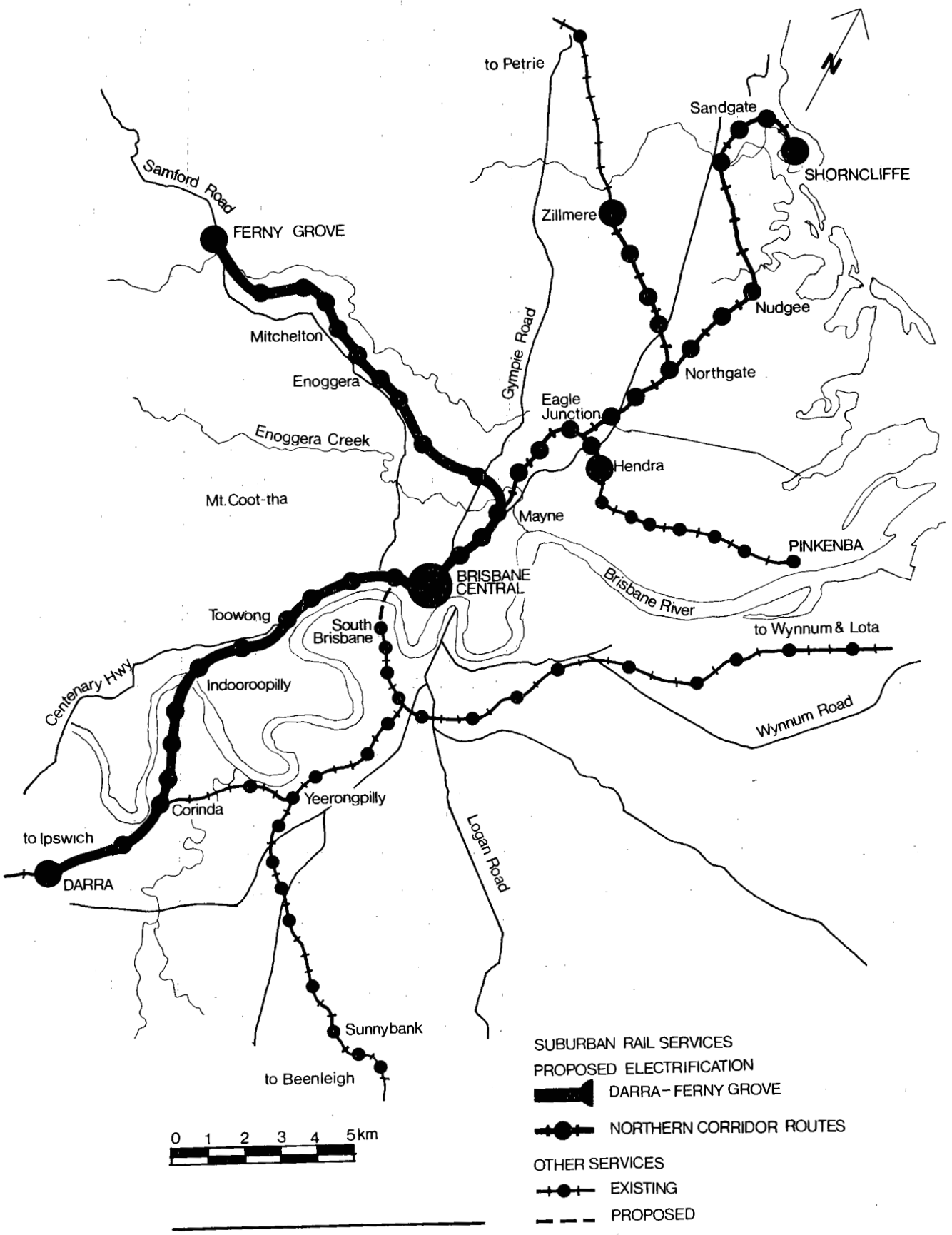

FIGURE Q.2.
ELECTRIFICATION OF BRISBANE SUBURBAN RAILWAY NETWORK

ELECTRIFICATION OF BRISBANE SUBURBAN RAILWAY NETWORK

Introduction

To gauge the likely merits of electrification of the Brisbane suburban network, a Northern corridor was evaluated for the 1972 Report. This corridor was based on the Central-Shorncliffe section of route. Figure Q2 shows the more important railway and road services in the region.

The estimated cost of electrifying the Brisbane suburban railways network has increased some 20 per cent on the value previously provided, partly due to the conversion from 1972 to 1973 prices, and partly due to a more accurate estimating procedure. The work is the same as originally envisaged.

The report of the 1972 evaluation contained an error. The analysis including both generation and conversion should have shown benefit-cost ratios of 2.4 at a 7 per cent discount rate and 1.7 at a 10 per cent discount rate, instead of 2.9 and 2.1 respectively. The correct internal rate of return is 14 per cent. These corrections do not change the conclusions of the previous evaluation and, after adjusting for the revised cost estimate, the project is still economically justified.

A financial analysis of the project showed that it would not be financially attractive to the public transport authorities. The present value of losses to public finances through railway operations for the 20 years following completion of the project would be $6.69m. In addition, bus revenue losses would be $0.35m more than bus operating savings. Hence the combined net present value of public finance losses would be $7.04m. If capital costs are excluded, there would be a bus and rail operating surplus of net present value $5.83m.

In the proposed State expenditure program the Ferny Grove-Darra section of the suburban rail system would be the first to be electrified. This would alter the capital expenditure profile from that used in the previous evaluation and it would also vary the expected patronage benefits. The results of an evaluation of electrifying this section are reported below.

Description

Ferny Grove-Darra has a route length of 32 kilometres. This route passes through Mayne Junction, which gives access to the carriage workshops and stabling facilities at Mayne. The project is to electrify the track between Ferny Grove and Darra and to provide the necessary rolling stock, workshops, electrical supply and other facilities required to make this section of track operational. It would be feasible to operate the section as an electric railway irrespective of whether or not the remainder of the system were electrified.

Costs

The estimated capital costs of the project are detailed in Table Q.2.1.

TABLE Q.2.1- COST ESTIMATES

Item	Cost
	$'000
Earthworks	596
Structures	535
Track	128
Electrical fixed installation	4,739
Signalling and communication	1,186
Electrical servicing facilities	667
Design and supervision	96
Rolling Stock	1,589
Contingencies	9,740
TOTAL	19,276

The estimates were based on electrification using a catenary wire and the existing track gauge. As the project has not been designed in detail, a 20 per cent contingency was applied to all construction costs. Rolling stock costs were increased to $250,000 per motor-trailer unit (approximately the current cost of Melbourne trains - although Brisbane trains are shorter), to make provision for additional facilities likely to be incorporated by the time designs are finalised.

Benefits

A substantial portion of the benefits from this project would accrue to the Queensland Railways through reduced operating and maintenance costs. Existing rail users would receive benefits through travel time savings. The travel time savings also indicate that there would be conversions from road resulting in savings to both converted passengers and remaining road users.

The composition of benefits at a 7 per cent discount rate is detailed in Table Q.2.2.

TABLE Q.2.2 - DISCOUNTED BENEFITS AT 7 PER CENT

Item	Benefit
	$'000
Railway operations	10,274
Existing public transport users	14,732
Converted public transport users	8,054
Remaining road users	2,394
Residual beyond 20 years	10,415
TOTAL	45,869

The benefits in the first year of operation were estimated to total $2.5m.

Travel Estimates

The project case patronage is based on the forecasts made by Wilbur Smith and Associates, in the South East Queensland-Brisbane Region Public Transport Study, for an electric railway without a central loop. The base case patronage was based on the forecasts, made in the same study, for continuing diesel-electric operations. For the purpose of the evaluation, a constant land use was assumed and all of the increase in rail patronage was assumed to be the result of conversions from road. The Wilbur Smith forecasts, used in both the base case and the project case, assumed that bus operations would be re-routed to perform largely a rail feeder function. Examples of the project case rail patronage figures used in the evaluation are provided in Table Q.2.3.

TABLE Q.2.3 -PROJECT CASE PATRONAGE

Location	Year	
	1976	2000
Ferny Grove-Central		
Ferny Grove	6,100	12,100
Central	14,800	26,900
Central-Darra		
Central	22,300	44,100
Darra	6,800	20,600

The conversion from road, estimated by use of the Wilbur Smith forecasts, was consistent with figures obtained by applying standard time elasticities to the base case forecasts. The actual level of the base case rail patronage depends to some extent on the future development of the Brisbane central business district. However, the evaluation results indicate that the patronage forecasts could be greatly reduced yet the project would still provide a satisfactory benefit-cost ratio.

A significant portion of the patronage on the Central-Darra section would not be CBD oriented. In fact, by the year 2000, the patronage at Darra is predicted to be higher than at some stations closer to Brisbane because of travel to the industrial area near Wacol.

Evaluation

In the project case, it was assumed that any passenger travelling beyond Darra would be served for the entire journey by a diesel-electric service, that is diesel-electric trains would continue to run to the city as well as electric trains.

Time savings were estimated on the basis of operating procedures which would be consistent with current practice and vehicles of only moderate performance. Until the precise acceleration and speed characteristics of the vehicles are known, together with detailed timetable information -particularly the running of express services -accurate time savings cannot be estimated. The time savings used are considered conservative, and with reasonable vehicle design and timetabling, improved figures could be achieved.

The evaluation was based on costs estimated for an electrification scheme similar to that in use in other Australian capital cities. This was designed to demonstrate whether or not electrification of the rail network would provide satisfactory benefits. There are a number of design alternatives which could eventually be adopted. Some of these would increase capital costs, but all of them would have a marginal benefit-cost ratio greater than 1.0.

Project Implementation

Attention could be drawn to some aspects affecting the implementation of the project. The economic evaluation was designed to provide the economic evidence required before a financial commitment is made to the project. Once a commitment is made further study should be directed towards determining the system design which would optimise the total rail system, before proceeding with construction.

The project involves advancing into a new technological era in rail transport in Brisbane, whereas other projects evaluated are essentially incremental improvements on existing technologies. The detailed design should be based on the best information available in 1973. Conclusions drawn in earlier years could now be superseded by recent technological innovations.

The most urgent features to decide are the track gauge, the loading gauge and whether to use a third rail or catenary supply. Once these have been decided, construction may commence although many other design features may not be fully resolved.

While it is considered essential to undertake a system optimisation study to ensure that performance is optimised and that the system is unlikely to become prematurely obsolescent, this should be arranged such that there is no unnecessary delay in the time to make the system operational. A twelve month deferment in commencing operations would cost $2.5m in net benefits on the Ferny Grove-Darra section, and this amount could be more than doubled if the effects on the total network were considered.

Conclusion

The benefit-cost ratios for electrifying the Ferny Grove-Darra section of track are estimated to be 2.6 and 1.9 at 7 and 10 per cent discount rates respectively. The net present value is calculated to be $28.43m at a 7 per cent discount rate and the internal rate of return is estimated to be 18 per cent.

The project has a financial net present value at a 7 per cent borrowing rate of $-12.23m over 20 years.

The limited importance of the accuracy of the patronage estimates is indicated by the combined benefits to railway operation and to existing PT users, which would cover all capital charges within 11 years. Electrification would be justifiable if there were no patronage increases.

The special needs for a system optimisation study and the large loss in benefits through any delays make it desirable to give special consideration to the means of implementing this project.

Figure Q3

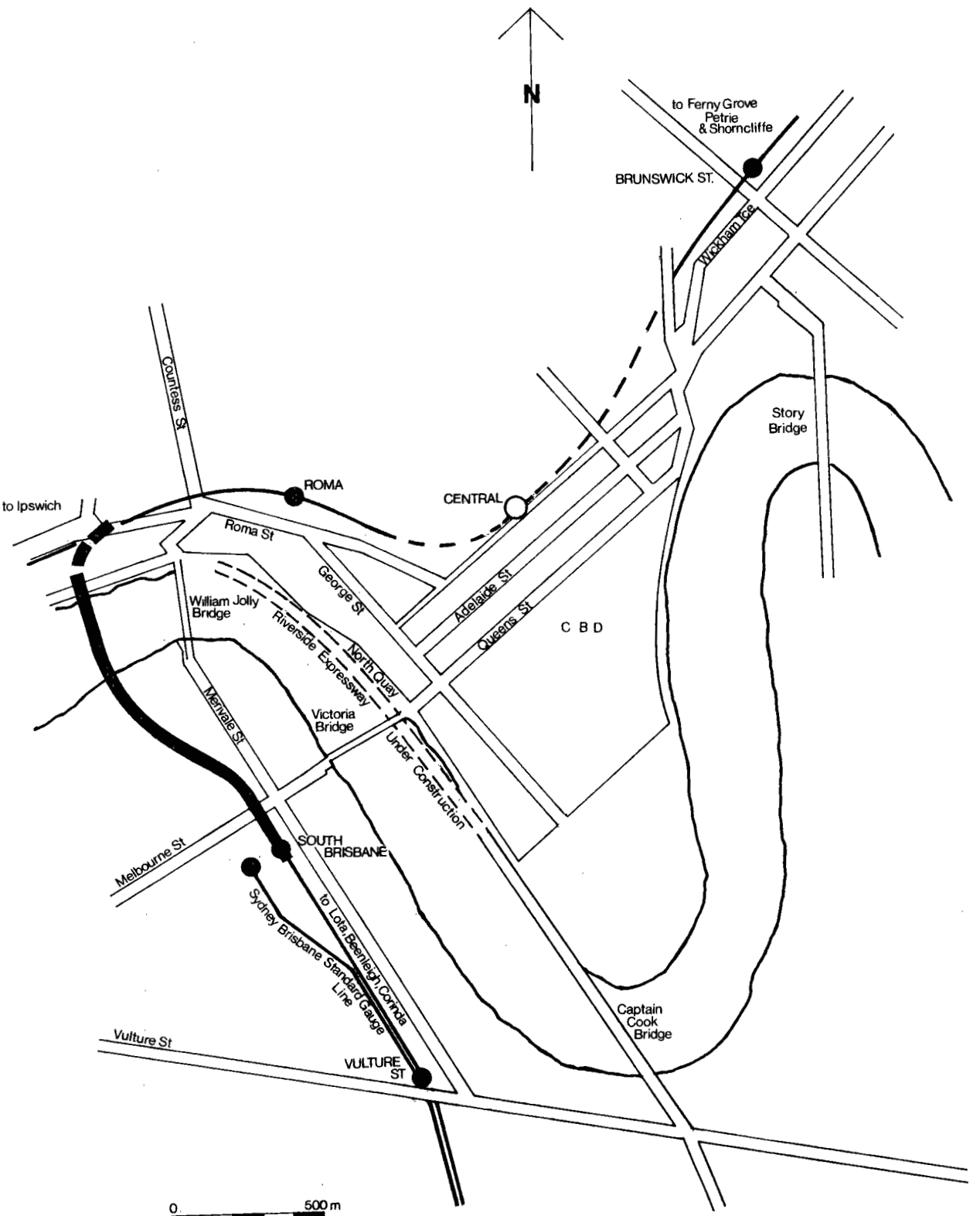

FIGURE Q.3.
BRISBANE CROSS RIVER RAIL LINK

PROJECT Q3

BRISBANE CROSS RIVER RAILWAY LINES

The Brisbane Cross River Railway Link was reported as Project 17, Merivale Street Bridge in the 1972 Report. Figure Q3 shows its location.

In 1972 the project was estimated to cost $8.63m. Taking account of 1973 values and additional information available from more detailed design work, the project is now estimated to cost $10.239m.

The increased costs do not significantly affect the conclusions reached in the previous evaluation. The benefit-cost ratio would change from about 2.4 to 2.0 at a 7 percent discount rate.

The previous evaluation incorporated only those benefits which could be readily estimated. The actual benefits could be expected to be larger if converted road user benefits were included. However, this would require the evaluation of the entire transportation network south of the Brisbane River and this was not considered warranted.

Of the total expenditure, $1.865m was estimated as the marginal cost of making provision for a standard gauge track.

The previous report may give the impression that benefits to existing users would not be very substantial as the average net time saving would be only three minutes. However, this is three minutes walking time which the behaviour of travellers indicates should be valued at twice in-vehicle time. Further, it is an overall average and some users would receive walk time savings in excess of twelve minutes.

The project is estimated to have a financial net present value to the public finances of $1.45m at a 7 per cent borrowing rate.

It is considered that although costs have increased, the previous evaluation is adequate to demonstrate that expenditure on this project would be a satisfactory community investment.

Figure S1

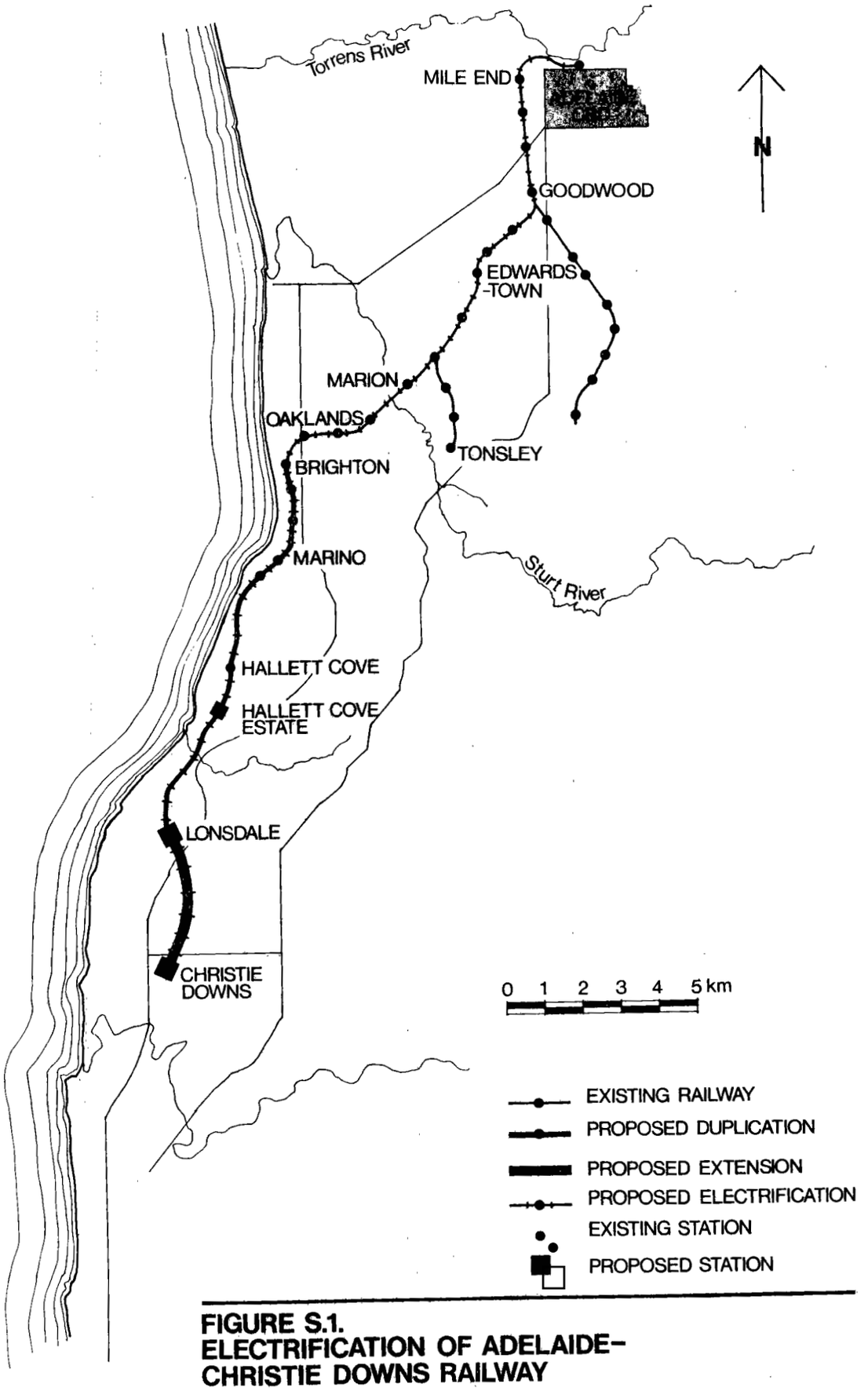

FIGURE S.1.
ELECTRIFICATION OF ADELAIDE-CHRISTIE DOWNS RAILWAY

PROJECT S1

ELECTRIFICATION OF ADELAIDE -CHRISTIE DOWNS RAILWAY

Description

The Christie Downs railway line is being constructed to extend an existing rail service to a rapidly developing coastal area on the southern fringe of Adelaide. Figure S1 shows details of the railway and the main roads in the area. Electrification of this line is now proposed. This would provide a faster and more aesthetically pleasing system than the proposed diesel service. Early implementation would enable its use to expand with development of this rapidly growing area.

Power supply for the project would be available from the local electric supply authority. Maintenance facilities would include the provision of a repair and maintenance building at the Islington Workshops located some 6 kilometres north of Adelaide, and alterations within the Adelaide Station yard to enable the housing, cleaning and minor maintenance of rail vehicles. Although major maintenance would be undertaken at the Islington Workshops, electrification between Adelaide and Islington would not be necessary as the electric cars could be hauled by diesel locomotives to the workshops.

Costs

The estimated costs of the project are detailed in Table S.1.

TABLE S.1 - COST ESTIMATES

Item	Cost
	$'000
Islington Workshops	350
Storage sheds, Adelaide yard	125
Catenary, signalling and power supply	3,587
Engineering and supervision	604
Rolling stock	8,400
Contingencies	933
TOTAL	13,999

As the route would be served by a mixture of express and stopping trains, it is estimated that track capacity would be reached in the mid-1980's. A third existing line would then be electrified between Mile End and Goodwood. The cost of this work has been included.

Since the project has not been designed in detail a 20 per cent contingency was applied to the estimated construction costs.

Benefits

The benefits from the project would be the reduced operating costs of the proposed Adelaide-Christie Downs Line, avoiding purchasing some 40 diesel rolling stock units for that line, and the faster service. The faster service would be beneficial to the existing users of the line and would divert people from roads giving benefits to converted passengers and remaining road users. The reduction in travel time would be principally due to the improved acceleration of the electric vehicles.

Travel Estimates

The patronage on the line would be dependent upon the growth of the south-western area of the Adelaide metropolitan area. Estimates have been derived using 'Report on the Metropolitan Area of Adelaide', Town Planning Committee of South Australia, and 'Metropolitan Adelaide Transport Study' (MATS). Patronage estimates thus obtained could be optimistic due to the recent decision of the South Australian Government to limit the size of Adelaide to 1.3 million people. However, as this population should not be reached until the early 1990's, the policy would have little effect on this project during the study period.

Estimates of the number of people who would convert from road to rail were obtained by applying the travel diversion curve in 'Report on the Metropolitan Area of Adelaide' to the MATS forecasts of car travel. As benefits from generated travel would be small in comparison with the benefits from conversion, no attempt was made to estimate generated travel.

Evaluation

The operating cost of the electric vehicles was estimated directly from data for a similar type of vehicle used in the NSW railways. As Sydney and Adelaide operating conditions are different, the sensitivity of the evaluation to operating costs was gauged by increasing the operating cost of electric vehicles by 25 per cent.

The accuracy of the estimates of conversion from road is uncertain and they may be optimistic. In particular, the applicability of the diversion curve used for forecasting modal split in this particular corridor has not been demonstrated. The proportion of road traffic with origins and destinations within the area of influence of the railway is also poorly defined in available data. A conservative sensitivity test was performed, therefore, by assuming no conversion of trips originating between Brighton and the CBD.

As in Project Q2, it was not practicable to base evaluation on detailed train schedules. Also it was considered appropriate to assume moderate train performance characteristics.

Project Implementation

The comments on project implementation in the report on Project Q2 also apply to this project. The simultaneous proposals for rail electrification in two capital cities suggests the need for some national consideration of the system design characteristics. There may well be areas where the results of design studies would be equally applicable to both cities. There would also be opportunities for standardisation of the components of these two systems, and possibly also with the systems existing in other cities.

As with the Brisbane electrification proposal, although a thorough systems design study could be considered essential, delays in commencing the project would also be expensive.

Conclusion

The benefit-cost ratios for electrifying the Christie Downs railway are estimated to be 3.1 and 2.4 at 7 per cent and 10 per cent discount rates respectively. The net present value is calculated to be $28.06m at a 7 percent discount rate and the internal rate of return is estimated to be 23 per cent.

Increasing the operating cost of electric vehicles by 25 per cent resulted in a benefit-cost ratio of 2.9 at 7 per cent and 2.3 at 10 per cent.

The sensitivity test with reduced converted patronage resulted in benefit-cost ratios of 1.9 and 1.3 at 7 per cent and 10 per cent discount rates respectively. The corresponding net present values are $10.94m and $3.68m, while the internal rate of return is 13 per cent.

PROJECT S2

BRIGHTON-CHRISTIE DOWNS RAILWAY

Description

The present suburban rail line to the south-western suburbs is double-track to Brighton (15.5 kilometres) and single-track thence to Port Stanva (25.4 kilometres). The regular off-peak rail service operates as far as Marino (18.2 kilometres) with a few trains a day extended as far as Hallett Cove (21.7 kilometres). The project would duplicate the existing track between Brighton and Port Stanvac (approximately 10 kilometres) and extend the line southwards for 4 kilometres to terminate at the new Christie Down regional centre on Beach Road. Figure S1 shows the proposed route.

This proposal was included in the 1972 Report as Project 18. The estimated benefit cost ratios were 4.7 and 3.4 and 7 per cent and 10 per cent respectively.

Costs

The latest cost estimates are $3.0m in 1973-74 and $3.0m in 1974-75 for the project. These figures exclude electrification and rollingstock costs.

Evaluation

The cost estimate is higher than in 1972 and there are some indications that the previous forecasts of patronage were optimistic. However, the benefit-cost ratios calculated in 1972 were so high that the variations would not affect the conclusion that the project is economically warranted.

Figure S3

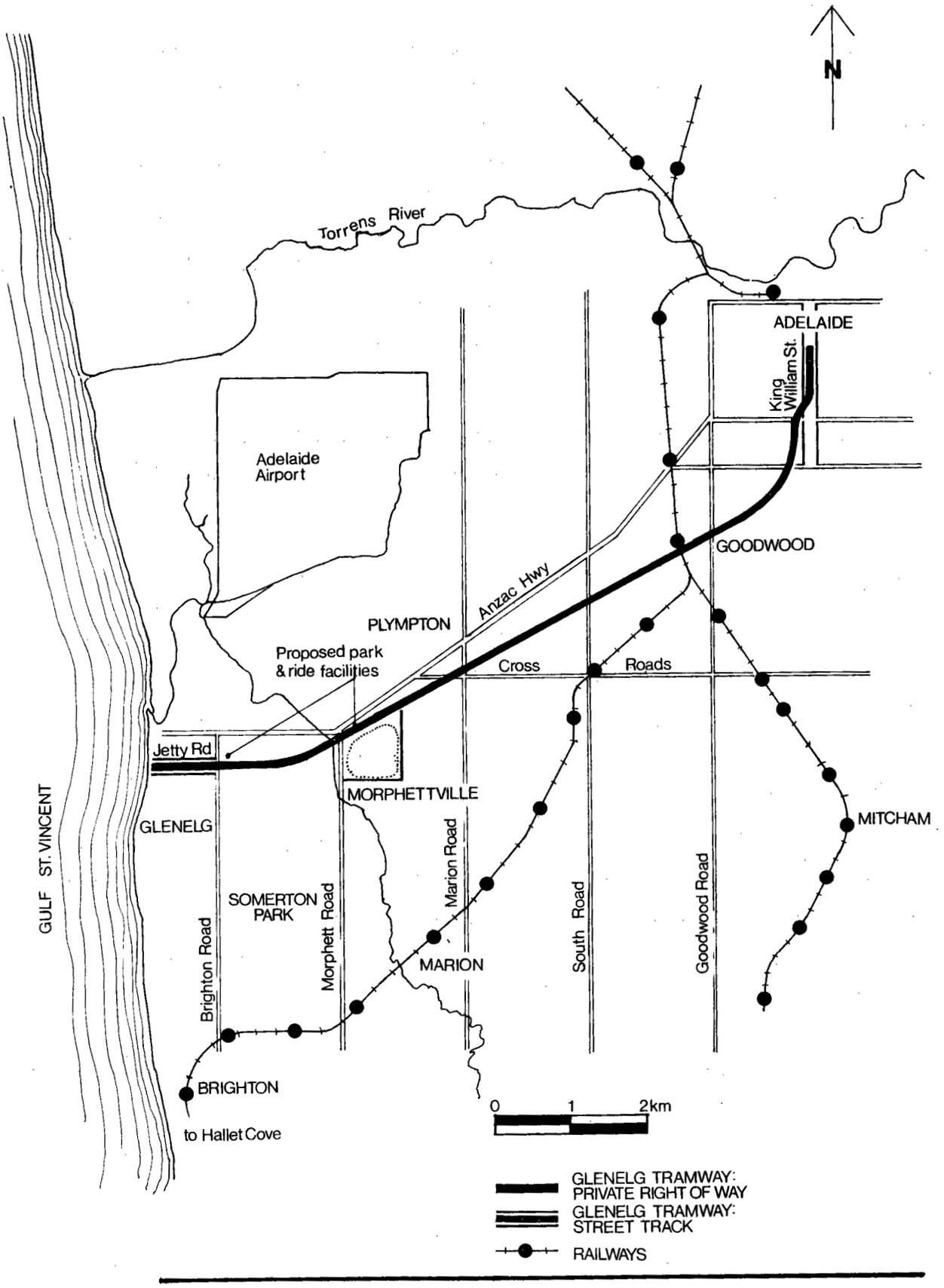

FIGURE S.3.
GLENELG TRAMWAY UPGRADING

GLENELG TRAMWAY UPGRADING

Description

The Glenelg tramway is a dual-track line, mainly in separate right-of-way, which operates between the city and the seaside suburb of Glenelg. Improvements to this service were reported as Project 19 of the 1972 Report. Very extensive changes have been made in the proposed improvements, necessitating a new evaluation. Figure S3 shows the tramway and more important roads.

The project would now consist of improved level crossing protection at six road crossings, relocation of stops and the provision of car parks at Morphett Road and Brighton Road for a total of 500 cars. If route reconstruction were complete, the speed limit for the trams would be increased from 55km/h to 70 km/h and the compulsory stops at level crossings would be eliminated. Express runs between Brighton Road and Morphett Road and the city would be made in peak hours.

Costs

The estimated costs of the project are shown in Table S.3 The project would be constructed between 1973 and 1975.

TABLE S.3 - COST ESTIMATES

ITEM	COST
	$'000
Crossing protection	286
Relocation of stops	14
Renovation of track and reserve	50
Land for passenger interchanges	360
Passenger interchange construction	100
TOTAL	810

Benefits

The project would have benefits for existing passengers in reduced travel times. There would be substantial benefits from road user converted to 'park and ride' passengers, and to remaining road users. There would be a small benefit from accident reduction at level crossings.

Travel Estimates

The patronage on the tramway is stable at approximately 7,000 passengers per day at the city terminal. The generated traffic resulting from the travel time improvement was estimated at 2 per cent of the base case patronage. The converted 'park and ride' patronage used in the evaluation was 260 passengers per day. This would represent 20 per cent utilisation of the car parks.

No allowance was made for passengers who may be attracted to the tramway by the progressive replacement of existing tramcars by new vehicles.

Evaluation

The evaluation assumed that the existing tram fleet would be replaced by new vehicles between 1975 and 1984. The anticipated additional patronage would require an extra tram car in the fleet when replaced.

The long term future of the tramway is uncertain because of the underground railway proposal and the eventual need to replace the fleet. All current proposals are for continued use of the right-of-way by either trains, buses, or new trams after 1990. If replacement of the existing trams is uneconomic, they could continue in operation until 1990. This would not significantly affect the evaluation results.

Conclusion

The calculated benefit-cost ratios for the project are 2.3 and 1.7 at 7 per cent and 10 per cent discount rates respectively. The corresponding net present values of the project are $0.95m and $0.49m. The internal rate of return is 17 per cent.

The benefits to the existing patronage alone are sufficiently high to give a benefit-cost ratio greater than 1.0 with a 7 per cent discount rate. If benefits are only taken up to 1990, the calculated benefit-cost ratio at a 7 per cent discount is 1.8 and the net present value $0.60m. The benefit from generated passengers is negligible.

The project has a financial net present value at a 7 per cent borrowing rate of - $0.82m. over 20 years.

PROJECT S4

ADELAIDE BUS REPLACEMENT

Description

The South Australian program includes a proposed expenditure of $3.7m of MTT capital works and rolling stock over the next five years. The $1.3m planned for 1973-74 is for 43 new buses; $480,000 of this amount is for replacement of sixteen 1958 Leyland buses. This expenditure is the subject of the evaluation.(1)

The MTT writes buses off over a 12-year period in its books. Accordingly, the evaluation assumed a project case of replacing the 16-year old Leylands in 1973-74, followed by 12-year replacement cycles thereafter. This was compared with a base case of retaining the existing buses for a further 10 years and replacing again after another 26 years. As in previous rolling stock evaluations (see 1972 Report), the analysis was taken over 50 years.

Cost

The capital cost of the project would be 16 buses at $31,500 each(2), less salvage value of $3,500 each for the replaced buses, giving a total of $448,000.

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(1) The remaining 27 buses are either for fleet expansion or for replacement of 9-year old AEC Royal MkVI vehicles. An evaluation of replacing 9-year old buses was not carried out because, on the results of the present evaluation, the results would be unfavourable.

(2) $33,000 less $1,500 import duty, which has been deducted to arrive at real resource cost.

The cycles of bus purchase and disposal, other than the initial investment in the project cases, were treated in the calculation of benefits. For this purpose, 12-year old buses were assumed to have a salvage value of $5,500, 16-year old buses a value of $3,500 (as above), and 26-year old buses a value of $200.

Benefits

The MTT believes that 'the life of a bus should not extend much beyond twelve years' because of rising maintenance cost and because 'developments in transport technology tend to make older buses obsolete. In order to compete with private motor cars and to preserve the image of a progressive system the public must be offered modern and attractive vehicles'.

The BTE attempted to quantify these benefits, along with road savings associated with car users converting to public transport on account of the more modern rolling stock. The general procedures and assumptions used are discussed in Annex A. There are periods in the analysis when buses in the base case (longer replacement cycles) are younger than in the project case. For such periods, maintenance, passenger and road benefits are negative.

In calculating passenger benefits, it was assumed that there is an underlying tendency for patronage per bus to decline by 5 per cent each decade, for a fleet of constant age.

Conclusions

Table S.4 shows the relative importance of each benefit item in present value terms. The benefit-cost ratios calculated are 0.9 at 7 per cent rate of discount and 0.8 at 10 per cent. The respective net present values are $-55,100 and $-94,400.

TABLE S.4 - DISCOUNTED COSTS AND BENEFITS

($'000)

Item		Discount Rate	
		7 per cent	10 per cent
Initial Capital Costs		418.7	407.3
Benefits			
Bus purchase	-19.5	15.2	
Maintenance savings	159.6	127.0	
Benefits to existing passengers	191.4	152.0	
Benefits to new passengers	1.4	1.2	
Road savings	17.8	14.3	
Residual value	12.9	3.2	
Total Benefits		363.6	312.9
Net Present Value		-55.1	-94.4

In interpreting the results of this evaluation particular attention should be paid to the reservations on the evaluation techniques expressed in Annex A. The particular maintenance function used may not adequately represent the maintenance costs for Adelaide buses.

Figure W2

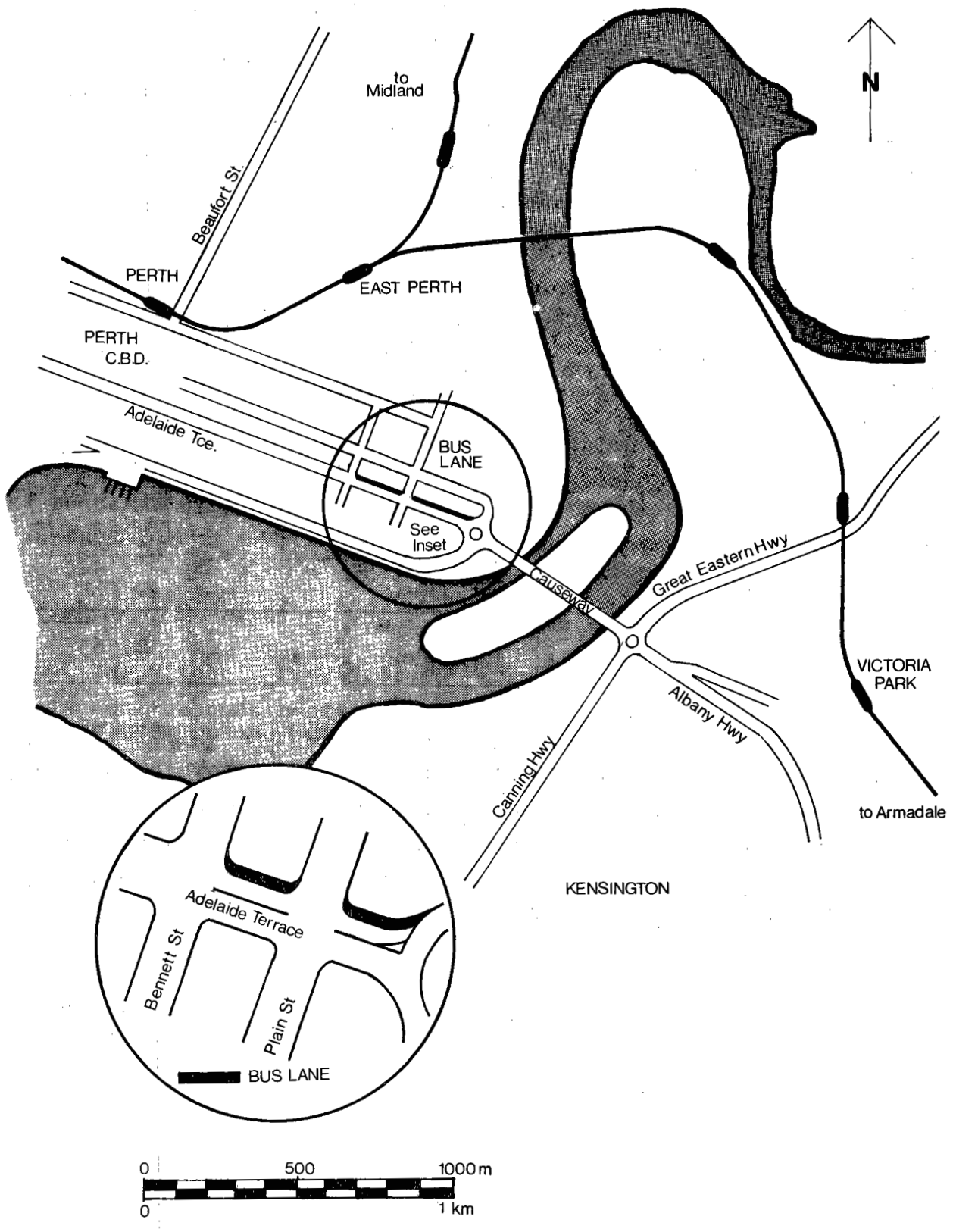

FIGURE W.2.
ADELAIDE TERRACE BUS LANE, PERTH

PROJECT W2

ADELAIDE TERRACE BUS LANE

Description

A 'bus only' lane is proposed on the north side of Adelaide Terrace between Bennett Street and the Causeway. Its purpose would be to enable buses to bypass the queue of traffic that builds up on the approach to the Causeway rotary. It would operate during the evening peak hours only. The bus lane is illustrated in Figure W2.

Costs

The estimated cost of the project is $10,000.

Evaluation

The benefits of the project would comprise time savings of 2-4 minutes to 19 buses which presently suffer delays in the evening peak hour. These bus time savings would be achieved at the expense of private cars.

On the basis of the 1971 passenger count figures, the number of cars now using the three available eastbound lanes on Adelaide Terrace between 4 p.m. and 6p.m. would be approximately 2,200. The kerbside lane is estimated to take 15 per cent of the car traffic.

The additional costs of operating cars in two lanes instead of three lanes was calculated as $2,000 per annum. The benefits of time savings to bus passengers was estimated as $44,000 per year. The net benefit of $42,000 per year is very high relative to the total project cost of $10,000.

Figure W3

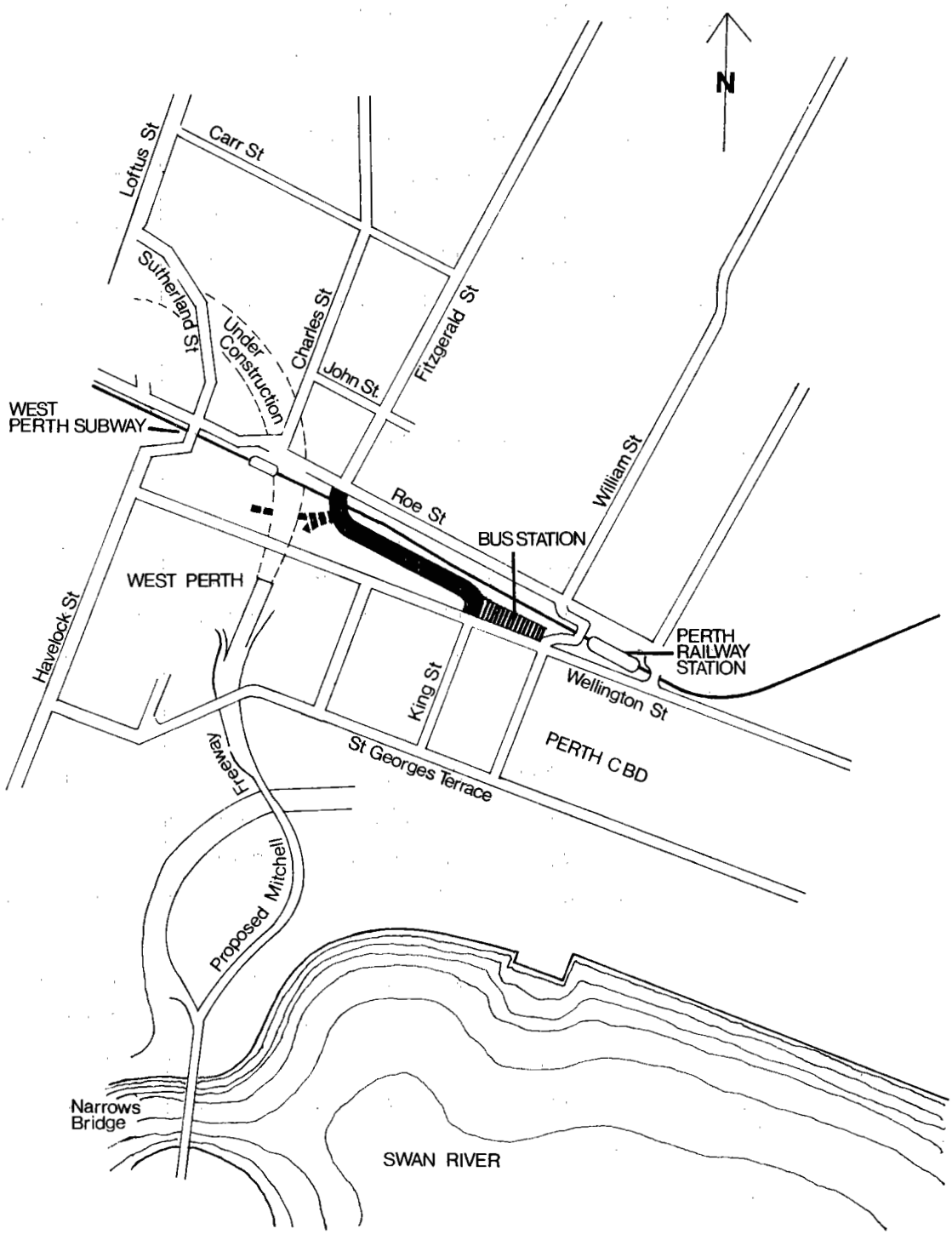

FIGURE W.3.
PERTH CENTRAL BUS STATION ACCESS BUSWAY

PROJECT W3

PERTH CENTRAL BUS STATION ACCESS BUSWAY

Description (1)

A 'bus only' access road is proposed to connect the south end of Fitzgerald Street with Perth Central Bus Station via a level crossing of the railway. The layout of the busway is shown in Figure W3.

The objective of this project is to alleviate traffic delays to buses approaching Perth CBD via West Perth Subway. At present buses from a wide sector of the north-west of the Metropolitan Region, from Wembley Downs to Balga, converge upon Loftus Street and Charles Street and then enter the CBD via Sutherland Street Subway, Havelock Street and Wellington Street. This is a congested traffic route and buses suffer considerable delays, especially in peak periods. Outbound buses, for example, can be delayed up to 10 minutes at the junction of Wellington Street and Havelock Street where they must make a right turn to reach the Subway.

Buses would take advantage of the proposed facility by proceeding east along Carr Street, south along Fitzgerald Street, over the level crossing and along the access road to the Bus Station. During the morning peak hours, 120 inbound buses carrying 5,300 passengers would take advantage of the facility in this way.

The proposal includes the installation of traffic signals and other road works on Carr Street and Fitzgerald Street to give priority to buses. The widening of Fitzgerald Street between John Street and Roe Street would provide a separate bus lane on the approach to the traffic signals at the Roe Street/Fitzgerald Street intersection. This lane would be controlled by a separate signal which would not allow buses to proceed unless the rail crossing boom gates were open.

Cost

The estimated cost of the proposal is $241,300.

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(1) The project description follows closely the wording of Western Australian Urban Public Transport Improvement Programme, Office of the Director General of Transport, Perth, April 1973, p.9.

Benefits

The benefits from the project would be savings in bus operating costs and in passenger travel time. The bus operating cost savings were estimated as $76,900 per annum and passenger time savings in buses were estimated as $220,800 per annum. Six per cent of passengers would have longer walk times with the project. As out-of-vehicle time was valued at double in-vehicle time, these travel time savings were reduced to take account of the substitution of out-of-vehicle time for in-vehicle time. Passenger travel time savings would then become $206,700 per annum, and the total benefits (including savings in bus operating costs, less maintenance costs on the road and associated works) $273,600.

Conclusions

The present value of the net benefit stream over 20 years from 1974-75 is $2.7m at a 7 per cent discount rate and $2.1m at a 10 per cent discount rate. Set against a discounted capital cost of $226,200 at 7 per cent and $220,000 at 10 per cent, the respective benefit-cost ratios are 12.0 and 9.6, and the respective net present values are $2.5m and $1.9m. These results ignore the residual value of the road after 20 years, and to this extent are conservative.

PROJECT W4

PERTH BUS REPLACEMENT

Western Australia proposed to purchase 318 buses over the five year period 1973-74 to 1977-78, of which 185 would be for replacement purposes and the remaining 133 for fleet expansion.

The merits of fleet expansion were not evaluated, but the 50 buses proposed for purchase in 1973-74 could be considered as replacements, although constituting a more rapid rate of replacement than the 37 buses per annum assumed in Project 26 of the 1972 Report.

The cost per bus is now estimated to be $27,000, $1,000 more than assumed in 1972. However, this increase does not materially alter the outcome of the previous evaluation, bearing in mind that benefits would also be higher in 1973-74 prices.

The 1972 evaluation calculated the benefit-cost ratios to be 1.4 and 1.3 at 7 per cent and 10 per cent discount rates respectively. The internal rate of return was 22 per cent.

PROJECT W5

PERTH FERRY TERMINALS UPGRADING

Description[1]

A program of works is proposed to replace the existing timber jetties and terminal buildings at Mends Street, South Perth and at Barrack Street, Perth. The existing structuresare of timber and are in a very poor state of repair. These structures are the ones used by the existing ferry service operated by the Metropolitan (Perth) Passenger Transport Trust between South Perth and Perth.

The existing jetties are in such a poor state of repair that if the proposed program of works is not carried out, the ferry service will have to be discontinued.

In recent years this ferry service has been operating particularly successfully. Patronage has been increasing and the total ferry operation, including cruises, hires, and charter work has been operating at a profit. In 1971-72, the total revenue was $78,000, producing a surplus (after all operating expenses, depreciation and interest had been met) of $8,600.

The two ferries operating scheduled services carry an average of 360 passengers into the CBD during the morning peak hour, and patronage is increasing. There are already several blocks of flats within easy walking distance of the South Perth jetty and more are expected to develop. Accordingly the ferry patronage is expected to increase in the future.

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(1) Quoted from Western Australia Urban Public Transport Improvement Programme, Office of the Director General of Transport, Perth, April 1973, p.21.

Costs[1]

The total cost of this program of works is estimated as follows:

Year	Item	Cost ($)
1973-74	Mends Street Jetty	80,000
	Mends Street terminal building	30,000
	Total 1973-74	110,000
1974-65	Barrack Street Jetty (No. 1)	120,000
	Barrack Street terminal building	30,000
	Total 1974-75	150,000
1975-76	Barrack Street Jetty (No. 2)	120,000
	Barrack Street-Mends Street dredging	50,000
	Total 1975-76	170,000

Benefits [2]

If this ferry service was to be discontinued, it would have to be replaced by a bus service requiring five buses. The costs of such a bus service have been calculated, and it has been found that the net present value of these costs including the cost of the additional passenger time exceeds the net present value of the costs of continuing the ferry operation.

Evaluation

The evaluation provided by Western Australia is reasonable, accepting the proposition that if the proposed program of works were not carried out, the ferry service would have to be discontinued. However, the BTE rearranged the calculations to bring out more clearly the economic effects of the terminal improvement. The results are provided in Table W.5.

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(1) Ibid.,p.21.

(2) Ibid.,p.21.

TABLE W.5 - DISCOUNTED COSTS AND BENEFITS

Item		Discount Rate			
		7 per cent		10 per cent	
		$'000			$'000
Cost of terminal improvements		332			314
Benefits					
- bus costs avoided	1,016		796		
- less cost of ferry operations (including dredging)	567		448		
		453			348
Net present value		121			34

Table W.5 treats the $50,000 for dredging as maintenance cost, rather than a capital cost as in the Western Australian evaluation.

Conclusions

The benefit-cost ratios are estimated to be 1.4 and 1.1 at 7 per cent and 10 per cent discount rates respectively. The corresponding net present values are $121,000 and $34,000. The internal rate of return is 12 per cent.

PROJECT W6

PERTH CENTRAL BUS STATION PEDESTRIAN ACCESS

Description

The Western Australian program proposes two alternative projects concerning pedestrian access to the Central Bus Station, namely:

(i) construction of steel roofs over two existing spiral ramps at a cost of $60,000, or

(ii) construction of a pedestrian bridge with escalators connecting the east end of bus station to the south side of Wellington Street at a cost of $950,000.

For the expenditure program the projects are to be considered as alternatives, although they are not mutually incompatible. A sum of $480,000 is proposed for 1975-76. This would provide a second bridge and escalator crossing to the west of the crossing proposed for 1973-74. The evaluation is limited to item (ii) above.

Costs

The capital cost of the overbridge and escalators is estimated as $300,000. In addition, two properties (valued at $650,000) on the south side of Wellington Street would need to be acquired to permit construction of the project. However, the escalators would only take up a small proportion of the land acquired (110 square metres of a total 2,300 square metres). The BTE considers that after the bridge and escalators were constructed the remaining property would have a value equal to the initial property acquisition cost. Accordingly, the cost of acquisition was included as a capital cost, but the same amount (in undiscounted terms) was included as a cost credit in 1976-77. Taking account of discounting, the effect of this procedure is to charge to the project the opportunity cost of occupying the acquired property for two years, 1974-75 and 1975-76, until theredevelopment of the entire property (not only that portion accounted for by the escalators) is complete.

Benefits

The main benefits of the project would be a time savings of 36 seconds per passenger for 15,000 passengers per day. These savings were valued at 2 cents per person minute. Escalator operating and maintenance costs of $2,500 per annum were deducted to determine net benefits.

In addition, there would be benefits in reduced delays to cars due to pedestrians crossing Wellington Street but these benefits were not quantified.

Conclusion

Table W.6 shows the present value of the capital costs and the 20-year benefit stream. The benefit-cost ratios are 1.4 and 1.0 at 7 per cent and 10 per cent discount rates respectively; the respective net present values are $126,100 and $8,600. The internal rate of return is 10 per cent.

TABLE W.6 - COMPARISON OF COSTS AND BENEFITS

($'000)

Year	Capital costs	Benefits		Total benefits
		Pedestrian benefits	Operating/ maint. costs	
1974-75	950.0			
1975-76		52.2	-2.5	49.7
1976-77	-650.0	52.2	-2.5	49.7
1977-78 to 1994-95 (per annum)		52.2	-2.5	49.7
Discounted:				
at 7%	333.8			459.9
at 10%	341.1			349.7

PROJECT W7

PERTH BUS TRANSFER STATIONS

Description[1]

It is proposed to construct bus transfer stations at three locations, at Amelia Street, Innaloo and Whitfords. The proposed transfer stations consist of a number of bus bays and passenger shelters off the highway. They are located at suburban shopping centres and are a part of an overall plan to construct transfer stations at shopping centres and other natural transport foci in all parts of the metropolitan area. The purpose of these transfer stations is to consolidate passenger loads so that regular and frequent express services can be provided between the transfer stations and the CBD. It is also proposed that services should be provided linking the transfer stations to each other circumferentially, thus laying the foundations for a public transport system not entirely orientated towards the CBD.

Costs

Each transfer station is estimated to cost $20,000. All expenditure is programmed for 1973-74.

Benefits

The estimated transfer time savings, costed at 2 cents per passenger minute, are shown in Table W.7.1.

TABLE W.7.1 - TRAVEL TIME SAVING

($'000 per annum)

Transfer station	Travel time saving
Amelia Street	11.4
Innaloo	18.1
Whitfords	7.8

(1) Quoted from Western Australia Urban Public Transport Improvement Programme, Office of the Director-General of Transport, Perth, April 1973, p.17.

These savings would be reduced by $1,000 per annum for each station to allow for cleaning and maintenance.

The consolidation of bus loads at transfer stations may also yield operator benefits in the form of reduced rolling stock and labour requirements. Also, the above passenger benefits were calculated on present patronage levels. To the extent that patronage grows they may be conservative, although patronage growth may also mean that the need for, and benefits from consolidation of bus loads at transfer stations would diminish. For this reason, it is probably important for projects of this nature to produce sufficient benefits in about the first five years of their lives to justify the costs. The proposed projects satisfy this criterion.

Conclusions

Each of the projects yields attractive returns, as shown in Table W.7.2.

TABLE W.7.2 - COMPARISON OF COSTS AND BENEFITS

Station	Discount rate	Capital cost	20-year benefits	Present value	B/C ratio	Internal rate of return
	%	$'000	$'000	$'000		%
Amelia Street	7	18.7	96.2	77.5	5.2	37
	10	18.2	73.2	55.0	4.0	
Innaloo	7	18.7	158.2	139.5	8.5	55
	10	18.2	120.3	102.1	6.6	
Whitfords	7	18.7	62.9	44.2	3.4	27
	10	18.2	47.8	29.6	2.6	

HOBART BUS REPLACEMENT

Description

The Tasmanian submission proposes spending $1.5m on 56 replacement buses in 1973-74. Twenty-six of these would be Hinos at $19,500 each (covered by an existing contract) and the remaining 30 would be superior buses "comparable to those being introduced in the mainland Capital cities". The value and specific design of the 30 more expensive buses (estimated to cost $34,000 each) has not yet been determined. Due to lack of sufficient data and time to evaluate the benefits from investing in this more expensive bus, the BTE evaluation assumes that all 56 buses are Hinos at $19,500 each.

The evaluation assumes a project case of replacing 56 13 year old Bedfords in 1973-74, followed by 15 year replacement cycles thereafter(1). This is compared with a base case of deferring replacement for another 5 years then introducing Hinos every 15 years. As in other evaluations, the analysis is run over 50 years.

Costs

The capital cost of the project is 56 buses at $18,500 each(2), less salvage value of $500 each for the replaced buses, giving a total of $1,008,000.

The cycles of bus purchase and disposal, other than the initial investment in the project case, are treated in the calculation of benefits. For this purpose, 15-year old Hino buses are assumed to have a salvage value of $2000 and 18-year old Bedford petrol buses are assumed to have negligible salvage value.

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(1) Although the Tasmanian submission suggests that it would be desirable to replace all existing Bedfords over 10 years of age, the 56 which it is planned to replace in 1973-74 would actually average over 13 years of age, and the evaluation is based on this replacement age. Because the Hinos are being purchased at least in part because of "the greater economic life...as compared with petrol buses", it seems reasonable to assume they would have a 15 year life.

(2) Actual purchase price of $19,500 includes $1000 import duty which has been deducted to arrive at real resource cost.

Benefits

As with other bus replacement programs, the new vehicles would offer more comfortable conditions to driver and passengers, together with maintenance savings to the operator. The new buses would have automatic transmission, heating and improved seating, ventilation and provision for luggage. In addition, the use of underfloor rather than front engines would lead to more comfortable riding conditions, especially in summer. These comfort improvements and the maintenance cost savings were valued on the same basis as in other bus evaluations (see Annex A) though it is possible that the benefits from replacing old Bedford petrol engine buses would be greater. There are periods in the analysis when buses in the base case would be newer than in the project case. For such periods maintenance, passenger and road benefits would be negative.

In calculating passenger benefits, it was assumed that there is an underlying tendency for patronage per bus to decline by 5 per cent each decade, for a fleet of constant age.

In addition to the above benefits, which are common to other bus replacement projects, new Hobart buses would offer an additional operator benefit, namely lower fuel costs from using diesel fuel rather than petrol. This saving would amount to $4,175 per annum for the first five years of the project (after which diesel buses would come into use in the base case).

Evaluation

Table T.1 shows the relative importance of each benefit item in present value terms.

TABLE T.1 - DISCOUNTED COSTS AND BENEFITS

($'000)

Item		Discount Rate			
		7 per cent		10 per cent	
Initial Capital Costs		942.0			916.4
Benefits					
Bus Purchases	526.9			478.9	
Maintenance savings	112.0			106.8	
Fuel savings	17.1			15.8	
Benefits to existing passengers	173.9			166.2	
Benefits to new passengers	1.8			1.6	
Road savings	15.7			14.9	
Residual value	13.6			3.4	
Total Benefits		861.0			787.6
Net Present Value		- 81.0			- 128.8

Conclusions

The benefit-cost ratios are estimated to be 0.91 and 0.86 at 7 per cent and 10 per cent discount rates respectively. As noted above, these results may be more conservative than for other rolling stock evaluations.

ANNEX D

OTHER PROJECTS

ELECTRIFICATION OF GOSFORD-NEWCASTLE RAILWAY (N 10)

Description

The Sydney-Newcastle line is already electrified as far as Gosford, a distance of 82 kilometres. This project would extend electrification from Gosford to Newcastle, permitting the 'through' working of electric locomotives and rolling stock. This would reduce travel times and improve locomotive and crew utilization.

Costs

The estimated total cost of the project is $27.1m, including $11.6m for locomotives and double deck inter-urban cars. $0.5m is programmed for expenditure in 1973-74.

Evaluation

As this is an inter-urban project, evaluation was deferred.

SIGNALLING IMPROVEMENTS STRATHFIELD AREA (N11)

Description

As in the Sydney Station area (N4) frequent disruptions to the free flow of passenger trains are experienced in the Strathfield area, with consequent delay and inconvenience to passengers.

The signal boxes at Ashfield, Strathfield, Homebush, Flemington Car Sidings, Flemington Goods Junction, Lidcombe, North Strathfield and Concord West control all main western, southern and northern line trains. The interlocking machines in these signal boxes are all about 50 years of age. It is proposed to replace these boxes, in two stages, by one central signal box which will carry out all functions of the existing boxes.

The operation of the existing boxes requires 28 signalmen and 16 junior station assistants. The section of line between Strathfield and Lidcombe at the present time represents a bottleneck to the flow of traffic to the western and southern lines. The provision of a central signal box would reduce railway operating costs and improve traffic flow.

Costs

The estimated total cost of this project is $4.25m of which $10,000 is programmed for expenditure in 1973-74.

Evaluation

The proposed signalling improvements would provide a variety of benefits to the NSWPTC and to passengers. The identifying and quantifying of all these benefits would require considerable investigation. It was not practicable to obtain the data necessary for an economic evaluation of this project in the time available. However, the project is similar to the Sydney area signalling project, and could be expected to confer similar benefits.

SYDNEY EASTERN SUBURBS RAILWAY (N 12)

Description

A double track railway from Bondi Junction to the Illawarra line at Erskineville, with intermediate stations at Woollahra, Edgecliff, Kings Cross, Martin Place, Town Hall, Central and Redfern. Most of the route is underground but there are two viaducts.

Costs

Expenditure to June 1973 is of the order of $53m and a further $8.1m is programmed for 1973-74.

Evaluation

This project will have a significant impact on travel over a wide area of Sydney. Evaluation was deferred because it will require the assembly of extensive data, which was impracticable within the time available for the 1973-74 program review.

SYDNEY CITY CIRCLE INFORMATION TRANSMISSION IMPROVEMENTS (N 13)

Description

This project would provide improved facilities for advising travellers, by recorded messages and indicators, of train service variations and disruptions. The aim is to improve customer relations.

Costs

The estimated cost of the project is $91,000 of which $40,000 is programmed for expenditure in 1973-74.

Benefits

It would be difficult to quantify the benefits.

SYDNEY RAILWAY ELECTRICITY SUBSTATION MODERNISATION (N 14)

Description

In a number of electricity substations in the Sydney railway system important equipment, such as high voltage switchgear and DC circuit breakers, has been in service for nearly 50 years. A continuous program of substation modernisation would considerably improve equipment reliability, particularly under the increased load which is expected to result from improved urban railway services. The substations included in this project are Sutherland, Cabramatta, Lewisham, Sefton and Strathfield.

Costs

The total cost is estimated to be $1.46 of which $80,000 is proposed for 1973-74.

Evaluation

Apart from maintenance cost savings, it would be difficult to estimate benefits from the substation improvements. If the cost of the project is distributed between other related improvement projects, the amount is negligible. For these reasons the project was not evaluated. However it is considered essential if service standards are to be maintained and other projects in the program are to be implemented.

SYDNEY BUSES : PROVISION OF 'AUTOFARE' EQUIPMENT (N 15)

Description

Subject to the satisfactory conclusion of tests being made on a prototype 'autofare' machine, the NSWPTC proposes to purchase machines for installation in 1,800 buses at a cost of $1,300 each, over a period of five years.

The installation of the machines will speed bus services by reducing the time taken by drivers in collecting fares when buses are used as one-man units.

Evaluation

The benefits from this project are very dependent on the time savings actually achieved. Experience elsewhere indicates that improved fare collection equipment would provide very satisfactory benefits. However a formal evaluation is not practicable at present.

SYDNEY FERRY WHARF IMPROVEMENTS (N 16)

The NSWPTC envisages a continuing program of wharf improvements. The proposed expenditure is $0.3m annually. Details were not supplied of the actual improvements to be undertaken but it is considered unlikely that this expenditure would be readily amenable to economic evaluation. The proposal was not evaluated.

NEW SYDNEY FERRIES (N 17)

Two new 800 passenger ferries are currently under construction. The estimated cost totals $1.55m. Details were not provided for an economic evaluation.

SYDNEY FERRY GRAVING DOCK (N 18)

The Sydney Harbour Transport Board wishes to construct a ferry graving dock. The estimated cost is $0.33m. No details were provided for an economic evaluation.

PARKING AREAS AT SYDNEY RAILWAY STATIONS (N 19)

Description

The NSWPTC propose to provide parking areas at selected railway stations in the Sydney metropolitan area. This will act as an inducement for motorists to leave their vehicles at the parking lots and to continue their journeys by train.

It is not envisaged that it would be necessary to acquire additional land. Costs would be incurred on improving parking facility by bituminous sealing and permanent marking.

Costs

The cost of the project is estimated to be $0.3m. All expenditure is proposed for 1973-74.

Evaluation

Evaluations previously performed on the provision or parking areas in the Brisbane Northern Corridor project and on the Glenelg Tramway in Adelaide indicate that very satisfactory benefits can result from the provision of additional spaces, provided a reasonable demand exists. The provision of the proposed parking areas could provide useful data on the response of motorists to such facilities. As no details were given of costs and facilities to be provided at individual locations, the project was not evaluated.

BUS/RAIL/FERRY TRANSFER FACILITIES (N 20)

Description

The NSWPTC is investigating the practicability of providing bus/rail/ferry transfer facilities at a number of locations in the Sydney metropolitan area to allow the speedy transfer of passengers. The NSWPTC considers that every practicable opportunity should be taken to maximise the use of the metropolitan rail services by directing the flow of commuter traffic to the rail system.

Costs

The approximate overall cost estimate of this work is $10m of which it is proposed to spend $0.25m in 1973-74.

Evaluation

The benefits from transfer facilities are very sensitive to the transfer times involved and the facilities offered to passengers. Until the facilities are designed in detail, both with respect to construction items, which determine walking distance and degree of protection from the weather, and fare charging systems, which influence loading and unloading times, it is not practicable to perform an accurate economic evaluation.
It is considered, therefore, that demonstration projects should be installed initially. These projects should be planned to provide data for economic evaluations of this type of investment before the bulk of the proposed expenditure is committed.

REMODEL SYDNEY RAILWAY STATIONS (N 21)

Description

Most Sydney railway stations are very old and aesthetically unattractive to railway patrons. The NSWPTC considers that there is potential to build up customer goodwill by improving the general appearance of many important metropolitan stations and by providing improved facilities to speed up the flow of pedestrians at many locations. The improvements could influence the modal choice of travellers.

Costs

An approximate estimate of the total cost is $2m of which it is proposed to spend $0.4m in 1973-74.

Evaluation

This type of project is not readily amenable to economic evaluation. It was considered to be complementary to the overall improvement program, and not evaluated directly.

SYDNEY TRAIN AND BUS INTERIOR IMPROVEMENTS (N 22)

Description

The NSWPTC proposes to embark on a program of improving the interiors of buses and trains in the Sydney metropolitan area to enhance their general appearance and attractiveness to commuters. It is considered that improving the general comfort of the travelling public will result in patronage increases.

Costs

The estimate of the total expenditure is $1m and an expenditure of $0.25m is proposed for 1973-74.

Evaluation

No details were provided for an economic evaluation and it is considered that the proposed improvements are unlikely to be readily amenable to economic evaluation. The work appears to be complementary to the remainder of the Sydney railway improvement program.

RINGWOOD CORRIDOR (V 12)

Description

The Box Hill-Ringwood Railway is the main railway serving the eastern suburbs of Melbourne. Figure V12 shows the more important railways and roads. There are four tracks over the first 4.5 kilometres to Burnley, the junction of the Glen Waverley Line. The next 10.5 kilometres to Box Hill has three tracks, allowing express trains to operate on this section in peak hours. The remaining 10 kilometres to Ringwood is double track.

Ringwood is the junction for the electrified service to Lilydale (13 kilometres) and Belgrave (16.5 kilometres). Ringwood is also an important terminal station for peak hour trains. The Lilydale line is single track except for the section Croydon-Mooroolbark (3.5 kilometres). The Belgrave line is also single track except for double track between Bayswater and Ferntree Gully (5 kilometres). There are crossing loops at Upper Ferntree Gully and Upwey.

The railway continuing beyond Lilydale to Healesville (25 kilometres) has an infrequent diesel rail car service which connects with the electric suburban service at Lilydale. The railway beyond Belgrave is the narrow gauge (0.76 metre) 'Puffing Billy' Tourist Line.

The railways beyond Ringwood were originally built in the 1880's as low capacity branch lines. They were electrified in the 1920's. The recent growth of the Melbourne urban area into the area served by the lines has increased the demand on the rail service. The improvements are designed to upgrade the railway lines to meet projected demand.

Improvements

The proposed improvements are as follows:

(i) Ringwood Station: Third Platform. The improvement is the provision of a third platform. The estimated cost is $0.7m, which includes associated resignalling.

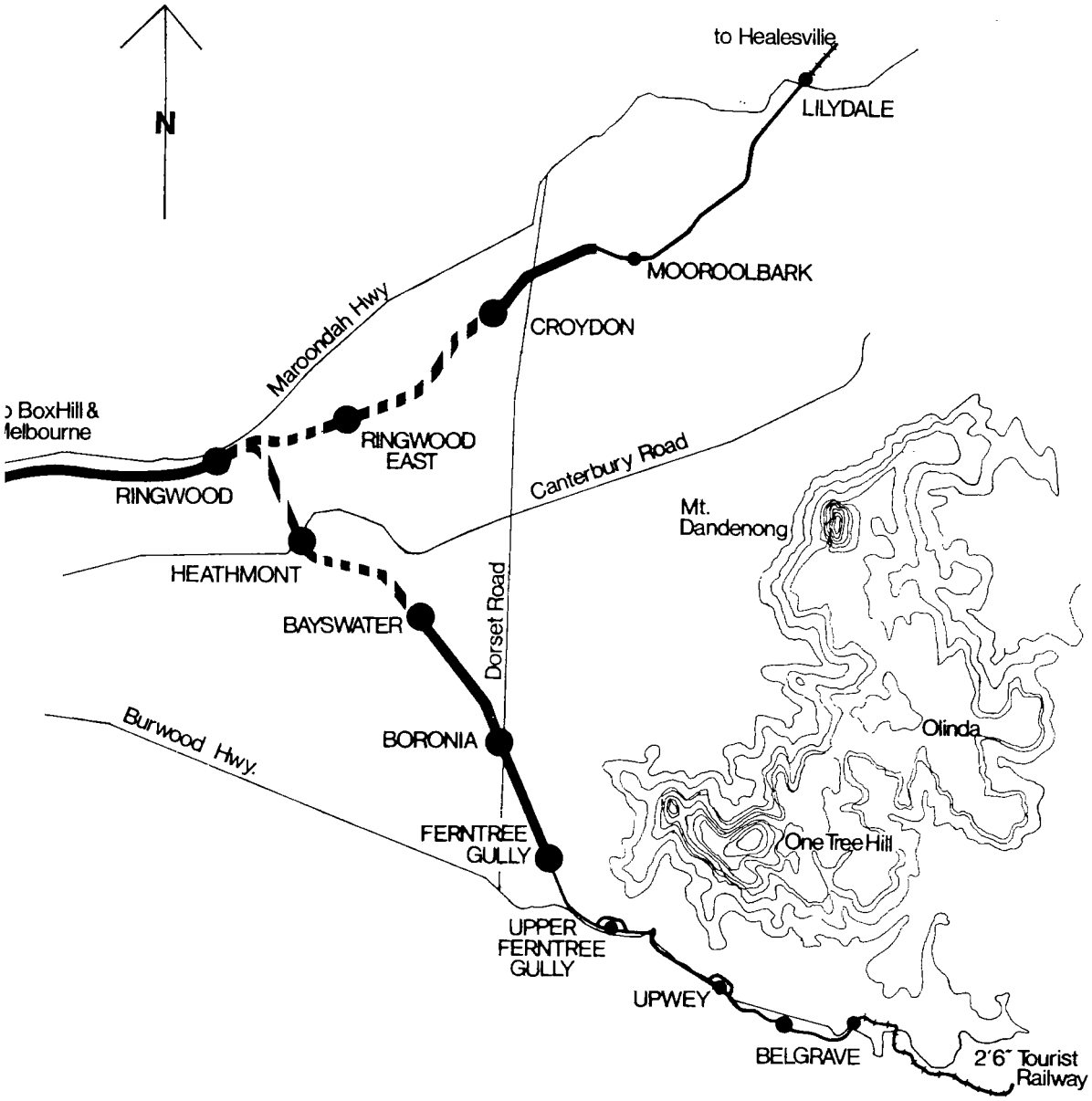

FIGURE V.12.
RINGWOOD CORRIDOR

(ii) Ringwood-Bayswater: Duplication of 5 kilometres. This would complete the duplication between Ringwood and Ferntree Gully. The estimated cost is $1.3m.

(iii) Ringwood-Croydon: Duplication of 5 kilometres. This would complete the duplication between Ringwood and Mooroolbark. The estimated cost is $1.7m.

(iv) Signalling Croydon-Lilydale and Bayswater-Ferntree Gully. The existing signalling on the two existing double track sections is Double Line Block Telegraph System. The single track section between Mooroolbark and Lilydale uses the electric staff system. It is proposed to replace these systems with power signalling at an estimated cost of $1.3m.

The single-track section Ferntree Gully to Belgrave has had power signalling since 1962, when the broad gauge line was opened.

The third platform at Ringwood, the track duplications, and the signal improvements are proposed for commencement in 1973 and completion during 1975. Additionally, it is proposed to build a third track from Box Hill to Ringwood between 1975 and 1978 at an estimated cost of $7.2m.

Benefits

The third platform at Ringwood would reduce delays caused by terminating trains and the effect of the junction. The duplication and signal improvement would increase the capacity of the lines to Mooroolbark and Ferntree Gully. This would permit trains currently operating to Ringwood to continue over these sections of the lines. The schedule of trains could be improved to more closely meet passenger demand, and extra trains could be operated to reduce overcrowding.

Evaluation

The information supplied was insufficient to allow evaluation of the third platform at Ringwood, the Ringwood/Croydon duplication, the Ringwood-Bayswater duplication and the power

signalling. These evaluations would require a comparison of services possible, with and without the improvement, for various patronage levels. From these operationally practicable services, the improvements in travel time, scheduling, comfort, and train utilisation could be determined. Evaluation is not practicable until more complete data are available.

HUNTINGDALE-FERNTREE GULLY RAILWAY (V 13)

The Melbourne Metropolitan Transportation Plan provides for the eventual construction of a railway line between Huntingdale and Ferntree Gully. As residential development is now proceeding along the alignment of the proposed route, the Victorian Government desires to make the land acquisitions necessary for an eventual construction of the railway. Expenditure proposed for 1973-74 is $2.2m. No details were provided for an economic evaluation.

FRANKSTON-LYNDHURST RAILWAY (V 14)

The Melbourne Metropolitan Transportation Plan provides for the eventual construction of a railway between Frankston and Lyndhurst to improve public transport services between Frankston and Dandenong. As residential development is now proceeding along the alignment of the proposed route, the Victorian Government desires to make the necessary land acquisitions. Expenditure proposed for 1973-74 is $1.1m. No details were provided for an economic evaluation.

ADDITIONAL MELBOURNE RAILWAY STATIONS (V 15)

The Melbourne Metropolitan Transportation Plan proposes the construction of a number of additional railway stations. Where these coincide with other rail improvements for a corridor the cost of providing additional stations has been included in the corridor evaluations. There are six additional stations which are not associated with corridor improvements of which two are planned for construction in 1973-74 at an estimated cost of $0.2m. This project was not evaluated.

MELBOURNE STATION REBUILDING (V 16)

Description

It is proposed to reconstruct 50 Melbourne suburban railway stations. These stations are timber structures more than 60 years old, many of which were designed to handle peak traffic volumes much less than current day levels. The reconstruction would be designed to complement, where appropriate, modal interchange improvements, and alterations to platforms and facilities required for the provision of additional tracks.

Station reconstruction would improve the standard of facilities for the public and reduce maintenance costs.

Costs

The average cost of reconstruction is estimated by the Victorian Railways at approximately $60,000 per station. It is proposed to spend $1.4m in 1973-74.

Evaluation

The proposed work is not readily amenable to economic evaluation.

MELBOURNE SUBURBAN RAILWAY STATION INTERCHANGE FACILITIES (V 17)

Description

Provision of suitable facilities for car/rail and bus/rail interchange is considered to be an important part of the implementation of the Metropolitan Transportation Plan. Such facilities are designed to increase railway patronage.

Table V.17.1lists major modal interchange points which are rail termini, or at the end point of express services.

TABLE V.17.1 - MAJOR MODAL INTERCHANGES

Station	MTC Projections of 1985 Requirements		Car Parking Spaces Currently Available
	Bus Bays	Car Parking Spaces at Stations	
Frankston	21	510	442
Box Hill	10	610	127
Dandenong	16	1040	228
Ringwood	11	1100	153
Glen Waverley	8	880	183
Sunshine	12	540	142
St. Albans	7	530	152

Major extensions of parking facilities are also planned for other locations, including the stations listed in Table V.17.2.

TABLE V.17.2 - OTHER INTERCHANGES

Station	MTC Projections of 1985 Car Parking Space Requirements	Car Parking Spaces Currently Available
Croydon	1100	220
Noble Park	1040	286
Jordanville	890	103
Heidelberg	820	59
Greensborough	820	117
Mitcham	610	277
Mordialloc	540	79
Seaford	510	121

Passenger interchanges at suburban stations would be co-ordinated with the planned reconstruction of station buildings where appropriate.

Costs

The total expenditure over a five year period is estimated to be $15.5m with $2.2m being programed for 1973-74.

Evaluation

Details were not provided for an economic evaluation. From evaluation of similar projects in the Brisbane Northern Corridor and on the Glenelg Tramway, the expenditure could be expected to provide attractive benefits if the facilities were successful in attracting patronage. Moreover, they could provide satisfactory benefits even if a relatively low level of utilisation results. The attractiveness of rail interchange construction lies in the relatively low marginal cost (compared with car or bus) of carrying extra rail passengers if an efficient railway servide already exists. The benefits perceived by users in these projects tend to be much smaller than the resource cost savings. To be attractive to travellers, modal interchanges need to be carefully designed to minimise transfer time. The type of fare collection system used can also have an important impact on transfer time and the willingness of travellers to make a mode change.

It is of interest that the major portion of the capital cost associated with rail interchanges in the Brisbane evaluations is the cost of providing additional vehicles to meet increased patronage. The costs of land acquisition and the construction of the interchanges is much smaller.

The relatively small perceived benefits make the actual patronage changes which would result from the establishment of an

interchange, difficult to predict with accuracy. For this reason it would be prudent to schedule the proposed construction program such that results are available from selected facilities before committing expenditure to the full program.

VICTORIA PLANNING AND RESEARCH (V 18)

A planning and research expenditure of $0.5m is program for 1973-74. Details were not provided of actual projects on which expenditure is planned.

QUEENSLAND PLANNING AND RESEARCH (Q 4)

Description

The planning and research envisaged by Queensland falls into two categories. The first is area wide planning in which it is proposed to study aspects such as:

- trends in Brisbane region demography;
- forecasts of possible forms of demographic patterns;
- a test land use transport interaction for various strategic plans;
- trip making characteristics;
- alternative transportation strategies for the Brisbane region; and
- detailed analysis and planning for various transport modes.

The second category comprises specific projects such as:

- the development of a bus simulation program capable of determining the operational characteristics of a bus on a given route;
- the development of design parameters of alternative layouts for electric rail vehicles including demonstration mock-ups; and
- the development of design parameters of alternative layouts for bus vehicles including demonstration mock-ups.

Costs

The estimated expenditure for 1973-74 is detailed in Table Q.4.

TABLE Q.4 - COST ESTIMATES

Item	Cost
	$'000
Area-wide planning	180
Bus simulation	20
Rail vehicle	20
Bus vehicle	20
TOTAL	240

MISCELLANEOUS ADELAIDE BUS CAPITAL ITEMS (S 5)

In addition to the bus replacement program examined in Project S4, South Australia proposes expenditure on a number of other bus capital items. Details of the proposed expenditure in 1973-74 are provided in Table S.5.

TABLE S.5 - OTHER CAPITAL ITEMS AND COSTS

Item			Cost
		$'000	$'000
Supporting vehicles	: trucks, cars etc.		84
Plant and Equipment	: general	30	
	ticket machines	10	
	vending machines	50	
	PABX telephones	30	120
Land and Buildings	: additional land for depots - at Islington	175	
	- south of city	75	
	general building improvements	75	325
Other	: electrical equipment converter stations	58	
	computer time tabling	50	108
			637
			64
			701

Detailed data were not provided for economic evaluation of these items of expenditure.

SOUTH AUSTRALIAN PLANNING AND RESEARCH (S 6)

Description

The Office of the Director-General of Transport has staff employed on a transport planning and development program The Office is responsible for all transport development work in South Australia, including that carried out by Government agencies (Highways Department, MTT, and SAR), consultant firms, universities and other tertiary educational institutions. Projects include feasibility studies, planning studies, basic research into new transport technology and analyses of operational problems. The Branch sponsors a Post-Graduate Studentship program and a Post-Doctorial/ Professional Fellowship program in transport studies.

The following list indicates the types of projects being undertaken:

1. Downtown distributor bus
2. Dial-a-Bus
3. Express buses
4. Busways and reserved lanes
5. Bus monitoring system
6. Automatic timetable compilation
7. Downtown bus operations
8. New suburban bus networks
9. SAR and MTT automatic fare collection
10. Common ticketing project
11. Rundle Street Mall
12. Transit demand data
13. Joint development : transport/land use corridors (Hindmarsh, Modbury, Noarlunga)
14. Public participation program
15. Land acquisition model
16. Staggered hours
17. Air rights
18. Electric vehicles
19. New technology applications

Cost

Expenditure of $0.6m is planned for 1973-74.

WESTERN AUSTRALIAN PLANNING AND RESEARCH (W8)

Description

Western Australia proposed a planning and research programme as detailed in Table W.8.1.

TABLE W.8.1 PLANNING AND RESEARCH PROJECTS AND COSTS

Project	Cost in 1973-74
	$'000
Review of public transport investment priorities	40
Review of parking policy	85
Development of bus priority traffic management measures	20
Study of CBD passenger distribution	50
Design study of bus facilities in SW Corridor	25
Development of improved management systems in MTT	24
Feasibility study of central city railway	260
TOTAL	504

HOBART BUS TICKET ISSUING MACHINES (T 2)

Description[1]

In the past, consideration has been given to the introduction of ticket issuing and change machines and coin sorting equipment, for the Metropolitan Transport Trust fleet, but no action has been taken.

It is considered these mechanised techniques offer the advantages of speedier ticket issue, faster service to commuters, reduced travelling time, and are an aid to drivers and revenue cashiers. It is proposed to phase in the installation of these machines in all Trust buses in the Hobart metropolitan area.

Cost

The first phase would relate to 1973-74, and would cover the conversion of the Moonah Depot (a suburb of Hobart) to mechanised ticket issuing procedures at a total cost of $35,000. This cost includes mechanical aids, installation, and structural modifications required to buses.

Evaluation

Details were not provided for an economic evaluation.

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(1) Quoted from "Urban Public Passenger Transport in Hobart, Proposals for Commonwealth Financial Assistance", Hobart, April 1973, p.14.

HOBART BUS SHELTERS (T 3)

Description[1]

At the present time, sixty one bus shelters have been erected in the Hobart metropolitan area. This covers only 5 per cent of all existing bus stops.

It is estimated at least forty additional bus shelters, of steel construction, are required immediately to provide a reasonable measure of protection along existing routes.

Costs

The estimated cost of these shelters is $425 each. It is proposed to install 40 of these shelters during 1973-74 at a total cost of $17,000.

In 1974-75 it is proposed to install a further 40 of these shelters (total cost $17,000).

Evaluation

Details were not provided for an economic evaluation.

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(1) Quoted from Urban Public Passenger Transport in Hobart, Proposals for Commonwealth Financial Assistance , Hobart, April 1973, p.14.