Economic Evaluation of a Canberra - Yass Rail Link

Report

Subsequent growth in Canberra, particularly in the post-war period, and projections suggesting continued rapid growth, prompted the Minister for Shipping and Transport in 1964 to request from the Commonwealth Railways Commissioner a report on the proposed rail link between Canberra and Yass. That report stated that when the considerable savings are taken into account that would accrue to the various instrumentalities and people located in the Australian Capital Territory as the result of lower freight rates and passenger fares consequent upon the direct linking of Canberra with Yass, construction of the Canberra-Yass railway could be justified on economic grounds. In April this year, the Minister for Shipping and Transport requested the Bureau of Transport Economics to carry out a detailed economic evaluation of the link.

BUREAU OF TRANSPORT ECONOMICS,
CANBERRA

ECONOMIC EVALUATION OF A CANBERRA-YASS RAIL LINK

23 DECEMBER 1971

The Honourable P.J. Nixon, M.P.,
Minister for Shipping and Transport

ECONOMIC EVALUATION OF A CANBERRA-YASS RAIL LINK

In April 1971 you requested the Bureau of Transport Economics to carry out an economic evaluation of a proposal to construct a railway line linking Canberra with Yass.

In response to this request the B.T.E. has carried out a benefit-cost analysis of the proposal. A report on that analysis is attached.

R. W. Cole
Director

23 December 1971

ECONOMIC EVALUATION OF A CANBERRA-YASS RAIL LINK

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CHAPTER 1. BACKGROUND

At the time a decision was made to establish the seat of the Commonwealth Government at Canberra, it was recognised that connection to the existing rail line at Queanbeyan involved an indirect route for rail traffic between the National Capital and points south and west of Yass (primarily the State capitals of Melbourne and Adelaide). Negotiations between the Commonwealth and New South Wales Governments dealt with respective responsibilities should a rail link between Canberra and Yass[1] be constructed.

When the development of Canberra commenced, a temporary spur from Queanbeyan was built in order to bring building materials into the area. Subsequently, investigations were carried out into possible routes for a long term rail service to Canberra - perhaps chief among them a new line leaving the New South Wales rail system at Bungendore and passing through what is now known as Civic Centre in Canberra and then on to Yass. These investigations culminated in the Parliamentary Standing Committee of Public Works submitting a report in 1924 recommending retaining and upgrading the existing line and not constructing a link with Yass at that time. A major factor influencing the Committee's opposition to the Canberra-Yass link was its cost in relation to the small population which would benefit.

Subsequent growth in Canberra, particularly in the post-war period, and projections suggesting continued rapid growth, prompted the Minister for Shipping and Transport in 1964 to request from the Commonwealth Railways Commissioner a report on the proposed rail link between Canberra and Yass.

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(1) Clause 9 of the First Schedule of the Seat of Government Acceptance Act 1909-1938, provides:

In the event of the Commonwealth constructing a railway within the territory to its northern boundary, the State shall construct a railway from a point near Yass on the Great Southern Railway to join with the said railway and the Commonwealth and the State shall grant to each other such reciprocal running rights as may be agreed upon, or in default of agreement may be determined by arbitration over such portions of that railway as are owned by each.

The Commissioner's report, completed in May 1969, stated that:

> ... the operation of a Canberra-Yass link would not in isolation be a commercial proposition. However, when the considerable savings are taken into account that would accrue to the various instrumentalities and people located in the Australian Capital Territory as the result of lower freight rates and passenger fares consequent upon the direct linking of Canberra with Yass, construction of the Canberra-Yass railway can be justified on economic grounds.(1)

In April this year, the Minister for Shipping and Transport requested the Bureau of Transport Economics to carry out a detailed economic evaluation of the link. In carrying out this evaluation, the B.T.E. has been greatly assisted by the Commonwealth Railways Commissioner's earlier report, and by discussions with the Commissioner's officers. However, responsibility for this report, including responsibility for the analytical methods employed and the conclusions, rests solely with the B.T.E.

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(1) Commonwealth Railways, Report on Canberra-Yass Railway, Unpublished report, May 1969, p. 8.

CHAPTER 2. SCOPE OF THE STUDY

The Bureau has evaluated a link following the route proposed by the Commonwealth Railways Commissioner in his 1969 report. The route was chosen in consultation with the National Capital Development Commission and the New South Wales Department of Railways: it is shown in Figure A.1 of Annex A. (The gradient profile for the proposed link is shown in Figure A.2 of the same annex). A schematic representation of the proposed rail link, together with other major transport links to Canberra, appears on page 4.

The plan provides for the major rail passenger terminal to be at a new site at Majura, within a mile of the present Canberra airport. However, moving the passenger terminal from its present site at Kingston is not essential to the Canberra-Yass link, and raises issues beyond those involved in an evaluation of that link. Consequently, the cost of a new station at Majura has not been included in the present study.

In assessing the costs and benefits of the proposal, the levels of service provided by transport links with Canberra are assumed constant, except insofar as they are affected by the particular improvement now under consideration.(1)

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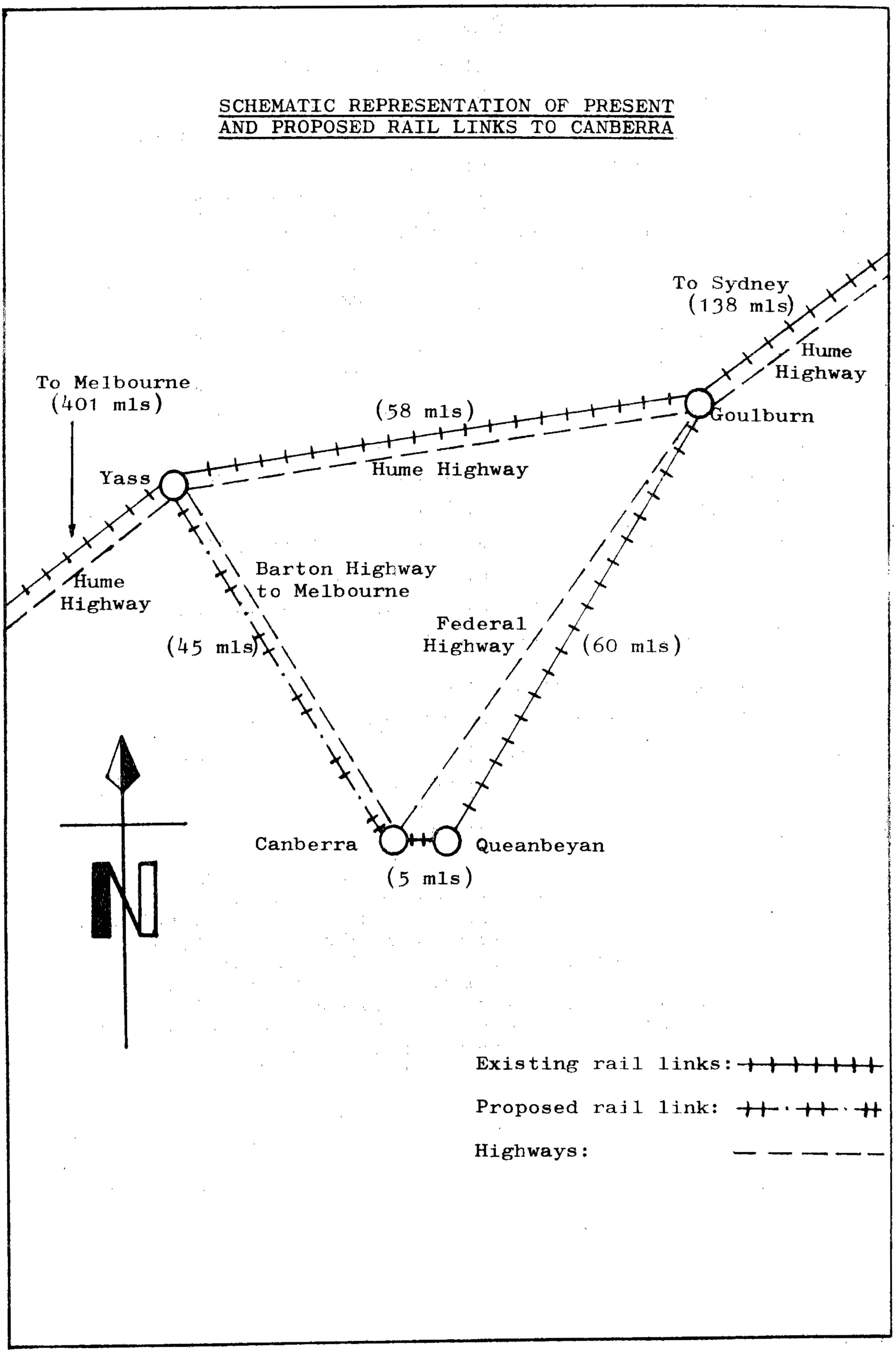
(1) It should be pointed out that, especially as regards roads, this assumption is not tantamount to assuming no physical improvements will be made. Rather, the assumption made is that such physical improvements as do take place will maintain current levels of service (and, consequently, of congestion and accident costs) for a higher volume of traffic, and not improve the level of service experienced by individual motorists.


SCHEMATIC REPRESENTATION OF PRESENT
AND PROPOSED RAIL LINKS TO CANBERRA
To Sydney
(138 mls)
Hume
Highway
To Melbourne
(401 mls)
(58 mls)
Goulburn
Yass
Hume Highway
Hume
Highway
Barton Highway
to Melbourne
Federal
Highway
(45 mls)
(60 mls)
Canberra
Queanbeyan
(5 mls)
Existing rail links:
Proposed rail link:
Highways:

In fact, there will probably be improvements to existing rail and road links during the study period. However, nothing is known about the likely bias of these improvements so that a reasonable course is to assume that there will be none - that is, that upgrading of existing infrastructure and technological change in rolling stock will not significantly affect the relative competitiveness of the two modes. On this assumption, improvements other than the proposed link have been ignored.

The B.T.E. analysis has not taken into account benefits which a Canberra-Yass railway might produce for transport within Canberra, particularly as Canberra extends towards the north. The proposed link would pass near a planned industrial area to the north of Canberra (Crace),[1] and, looking quite a way into the future, might conceivably link at several points with a tentatively planned rapid-transit bus system. These possibilities were discussed with officers of the National Capital Development Commission. However, due to the present uncertainty of the demand for rail sidings at Crace and of the need for links with the rapid-transit bus system, it was decided not to attempt a valuation of the possible benefits. Moreover, any connections between the rapid-transit bus system and the proposed rail link would be so far in the future as to be of little significance, in present value terms, to this study.

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(1) 'Detailed planning studies are now in progress with the aim of releasing the first of the sites in 1974', National Capital Development Commission, 14th Annual Report, 1970-71, p. 18.

CHAPTER 3. TRAFFIC PROJECTIONS

3.1 - Current Freight Traffic

As there is presently no collection of statistics relating to movement of freight into and out of Canberra, it was necessary for the B.T.E. to make its own estimates. Naturally, there was interest only in freight which might be affected by the proposed link. Accordingly, air freight was ignored, on the ground that it is not sensitive to changes in rail freight charges or service (the price per ton-mile of air cargo being 12 times the price for rail freight).

Table 1 shows our estimates of road and rail freight traffic over the Yass-Canberra route during 1970-71. Annex B gives the details of how that estimate was built up. As explained there, the estimate of road freight presented considerable difficulty and, to make data collection manageable, investigations concentrated primarily on Melbourne-origin freight. Informal discussions with industry representatives had indicated that most of the freight coming via a Canberra-Yass direct rail link would originate in Melbourne. Data collected by the Victorian Transport Regulation Board[(1)] suggested that freight from elsewhere in Victoria (other than two items totalling 24,000 tons already included in Table 1)[(2)] is not likely to be significant. South Australian origin road freight (other than that coming through Melbourne) has been ignored on the assumption that it would not be greatly affected by the proposed rail link. Road traffic originating in New South Wales has been ignored on the grounds that, if that traffic is not already on rail as a result of the New South Wales Transport (Co-ordination) Act, a reduction in the rail freight rate between Yass and Canberra is unlikely to attract it.

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(1) See footnote 1 on page B1.

(2) See Annex B for details.

TABLE 1 - ESTIMATE OF FREIGHT TRAFFIC ON YASS-CANBERRA ROUTE, 1970-71

	'000 tons	
INWARD FREIGHT		
By Road		
- major forwarders	12	
- Melbourne-based carriers	26	
- Canberra-based carriers	14	
- other Melbourne-origin freight	9	
- other Victoria-origin freight	24	
Total Road	85	(100)(a)
By Rail		
- from Victoria	5	
- from Southern New South Wales	5	
Total Inward Freight	95	(110)(a)
OUTWARD FREIGHT		
By Road	15	(20)(b)
By Rail	0	
Total Outward Freight	15	
TOTAL FREIGHT	110	(130)(a,b)

(a) Includes maximum estimate of 15,000 tons for unidentified carriers bringing freight to Canberra. (b) Includes maximum estimate of 5,000 tons for unidentified carriers moving freight from Canberra.

As shown in Table 1, two estimates of inward road freight have been used. The lower figure (85,000 tons) is the result of our survey. However, because our survey may not be a complete coverage of inward freight likely to be affected by the new rail link[1], a higher figure (100,000 tons) has also been used as an alternative.

The outward road freight estimates of 15,000 and 20,000 tons were made on the basis of the Victorian Transport Regulation Board data referred to above, which suggested that road backloading from Canberra is around 20 per cent of inward tonnages.

3.2 - Projected Freight Traffic

The next step was to make projections of the likely level of rail freight traffic, with and without the link, for the 30-year study period (1972-73 to 2001-02).

Two alternative projections were made of total freight (road and rail), corresponding to the 'low' and 'high' estimates of 1970-71 freight referred to above. If an improved transport facility is likely to generate an appreciable amount of new traffic (as distinct from encouraging conversion of existing traffic from other modes) separate projections should be made of total traffic with and without the link. However, an examination of the likely magnitude of generated traffic (and the associated benefits) in this case established that it was not worth introducing this complication into the analysis.[2]

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(1) See footnote 1 on page B6.

(2) See footnote 1 on page C1.

Having made ('low' and 'high') projections of total freight, it was then necessary to project what proportion would be handled by rail without the link ('base' rail traffic) and how much extra freight might switch to rail if the link were constructed ('converted' traffic).[1] The results of the projections are summarised in Table 2. The basis of the projections is discussed in detail in Annex C, but the projections of converted traffic require some comment at this point. Three alternative assumptions have been made as to degree of conversion, namely, that on completion of the link in 1974, rail would attract road freight equivalent to

(a) 10 per cent
(b) 20 per cent, and
(c) 40 per cent

of the total freight business available.

Given the 10 per cent already on rail, these assumptions would give rail 20, 30 and 50 per cent, respectively of total freight.

Of the three projections, alternatives (a) and (b) are considered to be more realistic than the assumption of rail obtaining an extra 40 per cent of total freight as a result of the construction of the link.

Alternative (c) is included to cover the possibility of all freight forwarding companies converting to rail as a result of the link. It is true that the link would make rail more attractive to these users in two major respects. First, the reliability of overnight delivery would be enhanced and, secondly, any stimulation of traffic would help forwarders achieve economies in the effective cost of rail wagon hire. (By increasing average loads per wagon, forwarders could lower costs per ton by an estimated further 15 per cent in addition to the 10 per cent reduction[2] in basic rail charges

(1) Separate projections have to be made of 'base' and 'converted' traffic because different benefits apply to each.

(2) Calculated from Railways of Australia Goods Rates Book which shows relationships between rates (by different classes) and distance.

TABLE 2 - PROJECTIONS OF YASS-CANBERRA RAIL FREIGHT (a)

('000 tons)

Year ended 30 June -	Base (b)	Converted (b)		
		Low (c)	Medium (c)	High (c)
LOW TOTAL FREIGHT PROJECTION				
1971 (estimate)	10	-	-	-
1977	18	17	34	68
1982	27	23	46	91
1987	37	29	58	117
1992	47	34	67	134
1997	55	37	73	146
2002	64	39	79	158
HIGH TOTAL FREIGHT PROJECTION				
1971 (estimate)	10	-	-	-
1977	21	20	40	80
1982	32	27	54	108
1987	44	34	69	138
1992	55	40	80	159
1997	65	43	86	173
2002	76	47	93	186

(a) Includes traffic moving in both directions. (b) See text for definition of these terms. (c) 'Low', 'medium' and 'high' degrees of conversion correspond to assumptions (a), (b) and (c) as discussed in text.

arising from the reduction in mileage). However, this economy could not be attributed to the new link for any length of time, for the new link would only be slightly advancing in time an economy which would have been achieved without the link, due to the natural growth of freight traffic to Canberra. Furthermore, even if all freight forwarders presently using road were to convert to rail, our estimates (see Table 1 and Annex B) suggest that these companies are presently handling only 13 per cent of the inwards freight with which we are concerned. Thus, their share of the business would have to increase dramatically for projection (c) to be borne out. However, as this possibility is not entirely out of the question it has been thought proper to explore the consequences of projection (c) becoming a reality.

3.3 - Passenger Traffic

Rail passenger traffic between Canberra and Melbourne(1) is presently served in two ways - an overnight rail connection with the Spirit of Progress and a road coach connection with the Intercapital Daylight at Yass.

Because the direct link would produce different benefits for each service, separate projections were made of patronage on each. As with freight, separate projections were made of 'base' and 'converted' traffic. The projections are summarised in Table 3. (See Annex D for further details).

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(1) A direct link between Canberra and Yass would of course benefit rail passengers between Canberra and all points south and west of Yass, and the calculations endeavour to include these benefits. However, in the interests of brevity, discussion of passenger benefits will refer only to traffic between Canberra and Melbourne.

TABLE 3 -

PROJECTIONS OF YASS-CANBERRA RAIL PASSENGER TRAFFIC (a)

('000 passenger journeys)

Year ended 30 June -	Spirit of Progress		Intercapital Daylight	
	Base	Converted	Base	Converted
1971 (estimate)	12.5	-	9.0	-
1977	13.4	6.7	9.7	5.8
1982	14.3	7.1	10.3	6.2
1987	15.1	7.6	10.9	6.5
1992	16.1	8.0	11.6	6.9
1997	17.1	8.5	12.3	7.3
2002	18.1	9.0	13.0	7.8

(a) Includes passengers moving in both directions.

CHAPTER 4. COSTS AND BENEFITS

4.1 - Costs

Commonwealth Railways estimate that construction of the link would take two years and cost $12.9 million - $5.7 million in the first year and $7.2 million in the second. (These amounts, and all others in this report, are expressed in current 1970-71 values.) For the computational purposes of this study, it is assumed that the railway would be built in 1972-73 and 1973-74 and brought into service on 1 July 1974.

The cost of operating services on the new line (excluding track maintenance) have been netted out in the course of estimating the benefits referred to in section 4.2 below. Costs of maintaining the new line have been taken into account separately (see column (5) in each of the tables in Annex G).

4.2 - Benefits

As noted above, it is necessary to treat base and converted rail traffic separately because different benefits apply to each. Methods used to evaluate each type of benefit are discussed in some detail in Annex F.

4.21 - Base Traffic Benefits

There are two categories of base traffic benefits : cost savings to the provider of the transport service (primarily lower rail operating costs) and 'user benefits' (in the form of time savings and increased convenience).

4.211 - Cost Savings

The new link would reduce the rail distance between Yass and Canberra by 78 miles. It is estimated that rail operating costs are in the order of 2 cents per net ton-mile and 3 cents per passenger-mile.(1) Thus, savings in rail operating costs are

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(1) See Appendix E for details.

estimated to be $1.56 (78 x 2 cents) per ton of freight, and $2.34 (78 x 3 cents) per passenger journey on the Spirit of Progress. In annual terms, cost savings on freight are estimated to be $24,000 - 28,000 initially (low and high projections), rising to $99,000 - 118,000 by the end of the study period (2001-02). Corresponding figures for the Spirit of Progress passenger service are $31,000 and $42,000 respectively.

The new link would not result in any reduction in rail passenger-miles for the Intercapital Daylight. Instead it would eliminate the need for a road coach connection between Canberra and Yass. Coach operating costs are estimated to be approximately 40 cents per mile, so that on the basis of current average occupancy (the concept used in calculating rail passenger costs) of 14 persons per trip (1), cost per person-mile is of the order of 2.9 cents, or around the same figure as for rail costs per passenger-mile. Accordingly, no benefit in operating costs has been included in respect of Intercapital Daylight passenger traffic.

Apart from savings in rail operating costs due to route-shortening, there would be savings in wagon maintenance and fuel consumption because of the superior track quality of the new link (heavier rail, better grades and curves). Also, although the alternative longer route could not be closed (2), with deviation of Yass-Canberra traffic to the new route, there would be reduced wear and tear on the track of that longer route. Both these potential savings were explored, but on investigation were found to be negligible.

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(1) Two trips per day (one in each direction) are made Monday to Saturday, so that annual Intercapital Daylight passenger journeys of 9,000 imply an average 14 persons (9,000 divided by 626) per coach trip.

(2) The Yass-Goulburn section of it forms part of the main southern line, and the Goulburn-Canberra section serves Sydney-Canberra (and other) traffic.

4.212 - User Benefits

An attempt has been made to put a value on time savings to passengers. Benefits in the form of reduced freight shipment times would not be of any significance in this particular case [(1)], though this is not to deny their possible importance in other contexts.

In valuing passenger time savings, a distinction was made between actual time spent in transit or motion, and time spent waiting for connections and transferring between modes or different units of transport within the same mode, because there is evidence that people value waiting/transfer time at about twice the value of normal travelling time.[(2)] The new link would reduce transit time via the Spirit of Progress by about $2\frac{3}{4}$ hours and waiting/transfer time by about 20 minutes per journey[(3)]. Travel

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(1) There are two broad classes of rail freight on the Yass-Canberra route : forwarder's and general freight. By special arrangements, the forwarder receives overnight service from Melbourne. The rail trucks arrive in Canberra ready for unloading at the beginning of the working day, so any reduction in this shipment time would be of little value. The forwarder might derive some benefit if the saving in journey time were used to delay departure time in Melbourne, but these times are set for convenience of arrival of trains at Sydney, and thus would be unaffected by the link being evaluated.

As regards general freight, Melbourne-Canberra shipment time is presently a week, due to 'staging' (see Annex E for a description of this operation). It is possible that, with the growth in business stimulated by the new link, this practice could be discontinued reasonably soon, and thereby cut shipment times by up to 5 days. However, this would occur even without the link (though somewhat later) due to the natural growth of traffic on the route, and in any event it is rather unlikely that people who are prepared to use a rail freight service taking a week would place a high value on reduced shipment times.

(2) See T.M. Hogg, 'The Value of Private Travel Time Savings - A Review of the Theoretical and Applied Literature', Paper No. 622 read to the Australian Road Research Board Conference, Canberra, August 1970.

(3) These figures have been derived as follows. Southbound passengers for the Spirit of Progress presently join a train which leaves Canberra at 8.30 p.m. and arrives at Goulburn at 10.40 p.m. for connection with the Spirit of Progress at 11.30 p.m., arriving at Yass around 1.00 a.m. On the assumption that a direct train between Canberra and Yass could make the journey in fifty minutes, and allowing 15 minutes for connection to the Spirit of Progress, the new link would reduce southbound travel time by 2 hours fifty minutes and waiting time by 35 minutes. This means a departure time of about midnight instead of 8.30 p.m. for passengers leaving

time savings for passengers on the Intercapital Daylight are estimated at around half an hour (with no savings in waiting/transfer time).[1]

Transit time was valued alternately at 25 cents and $1.00 per hour, and waiting/transfer time at double that rate. We regard the figure of $1.00 per hour, equivalent to about half the average adult male earning rate, as being very generous

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Canberra - some would question the value of this particular time saving. For travellers to Canberra on the Spirit of Progress, present total travel time from Yass to Canberra is 3 hours 50 minutes, of which 20 minutes is waiting time at Goulburn. Again on the assumption that travel time with the new link would be 50 minutes in transit plus 15 minutes for connection at Yass, Canberra-bound travel would be reduced by two hours forty minutes transit time plus five minutes waiting time. Averaged over journeys in both directions, the savings in travel time therefore become 2¾ hours in transit time and 20 minutes waiting time.

(1) This figure was estimated as follows. Passengers from Canberra for the Intercapital Daylight at the moment travel by road coach (or private transport, but we shall ignore this complication) which departs Canberra at 10.30 a.m. and arrives at Yass at 11.45 a.m. for connection with the Daylight which departs Yass at 12.15 p.m. On the assumption that with the new link transit time would be 50 minutes and transfer time 15 minutes, transit time would therefore be reduced by 25 minutes and transfer time by 15 minutes. For travel in the opposite direction, presently the road coach meets the Intercapital Daylight at Yass at 5 p.m. and departs immediately for Canberra, where it arrives at 6.15 p.m. Transit time, with the new link, would again be reduced by 25 minutes, but transfer time would actually be increased by 15 minutes (the assumption being that whereas the road coach can leave immediately, it takes approximately 15 minutes to detach a carriage from the Spirit, and attach it to a locomotive waiting at Yass to haul the carriage to Canberra). Averaged over journeys in both directions, then, there is a reduction of about half an hour in actual transit time, but no net reduction in waiting/transfer time.

for this project, having regard to the nature of passenger traffic on the route (trips made in non-working time, and a significant proportion of children).

Although passengers on the Intercapital Daylight would, on average, not benefit from any reduction in waiting/transfer time at Yass, there is reason to suppose that they would attach some value to being able to complete the entire journey by rail rather than make a modal transfer at Yass. In fact, the benefit from eliminating the modal transfer would not be confined to passengers - it would extend to others, such as drivers of private vehicles conveying people to and from Yass. We have therefore applied a value of $1 (admittedly arbitrary and, we think, high) to each Intercapital Daylight passenger journey to reflect this benefit.

The value of all base traffic user benefits is estimated to be $22,000 - $60,000 initially ('low' and 'high' time values) rising to $30,000 - $83,000 by year 2001-02.

4.22 - Converted Traffic Benefits

As explained in Annex F, there are two categories of converted traffic benefits

(i) perceived user benefits - half the unit rate accruing to 'base' traffic;

(ii) 'producers' surplus' benefits - the excess of revenue (freight charges) over marginal resource cost of rail transport.

4.221 - Perceived User Benefits

It has been estimated that the effective reduction in rail freight costs to users would be of the same order as the reduction in rail operating costs ($1.56 per ton). Accordingly, $0.78 (half of $1.56) has been applied to each ton of converted freight traffic to obtain perceived user benefits for this traffic. Table 4 shows the annual value of this benefit, for the range of assumptions employed, in the initial benefit year and the last year of study period.

TABLE 4 - PERCEIVED USER BENEFITS, CONVERTED FREIGHT
($'000)

	1974-75	2001-02
Low Total Freight Projection		
- low conversion	12	31
- medium conversion	23	62
- high conversion	46	123
High Total Freight Projection		
- low conversion	14	36
- medium conversion	27	73
- high conversion	55	145

A benefit of $0.875 per journey has been applied to passengers on the Intercapital Daylight, being half the reduction in fares arising from elimination of the road coach connection. There is no corresponding benefit for Spirit of Progress passengers, as the new link would not result in any reduction in fares for that service.(1) However, converted passengers on both services benefit from reduction in travel time, valued at half the unit rate accruing to 'base' traffic. Total perceived user benefits for converted passenger traffic are estimated to be $11,000 and $21,000 initially ('low' and 'high' time values), increasing to $18,000 and $29,000 eventually.

(1) At present, the rail fares for Canberra-Melbourne and Yass-Melbourne are the same.

4.222 - 'Producers' Surplus' Benefits

Rail freight charges for traffic on this route exceed the marginal resource cost of carrying that freight, the difference being a contribution to general system overheads. Thus, if account were taken of perceived user benefits (lower freight charges) only, this would be an understatement of the benefits to the nation from converting traffic to rail. We estimate that this 'producers' surplus' benefit (the gap between rates or fares and marginal resource cost) is of the order of 1 cent per net ton mile on Melbourne-Canberra freight operations, with no gap at all in respect of passenger operations.(1) Table 5 shows the annual value of this benefit, for each alternative assumption, in the initial benefit year and the last year of the study period.

TABLE 5 - EXCESS OF PERCEIVED COST OVER MARGINAL RESOURCE COST, CONVERTED FREIGHT

($'000)

	1974-75	2001-02
Low Total Freight Projection		
- low conversion	66	175
- medium conversion	132	351
- high conversion	264	701
High Total Freight Projection		
- low conversion	78	207
- medium conversion	156	414
- high conversion	313	828

(1) See Annex F for details. Of course, it is also true that road taxes and various indirect taxes tend to raise road freight rates above private resource cost. However, we argue in Annex F that this is offset by an understatement of social resource costs due to the 'external costs' of road use (road maintenance, congestion and accidents).

4.23 - Residual Value

Although a study period of 30 years was selected, the rail facility, if constructed, would still be in existence at the end of that period and should continue to produce net benefits. Residual value has been estimated by taking the capitalised net benefit stream for the remainder of the asset's economic life. The line has been assumed to have an economic life of a further thirty years beyond the end of the study period(1), and annual net benefits throughout that period are assumed to be the same as the average level of benefits for the last five years of the study period.

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(1) Although selection of thirty years is arbitrary, the difference between assuming thirty years and say, fifty (or even a hundred) years is not great in present value terms. At 7 per cent discount rate the present value of an annuity of $1 per annum for thirty years is $12.41 and for fifty years $13.80.

CHAPTER 5. EVALUATION RESULTS

In converting the streams of future benefits and costs to present values a discount rate of 7 per cent was used. The question of the appropriate discount rate to use in benefit-cost analysis has been much discussed in the economic literature but no consensus has emerged. The B.T.E. view is that 7 per cent is at the low end of the range of discount rates which can reasonably be applied. In normal circumstances we would have carried out a discount rate 'sensitivity test' using a discount rate of 10 or 12 per cent; however, in the light of the results which follow such a sensitivity test was not warranted.

Table 6 summarises the results of the evaluation for each of the twelve combinations of alternative assumptions relating to overall levels of freight traffic, degrees of conversion of road freight to rail, and values of private travel time. (More detailed results are set out in Annex G.)

The results range from a benefit/cost ratio of 0.21 (least optimistic set of assumptions) to a ratio of 0.82 (most optimistic set of assumptions), the most favourable ratio being based on assumptions as to level of rail traffic and value of travel time which we regard as very generous to the project. Accordingly, on the assumptions made in this study, constructing the proposed rail link is not economically justified at this point of time.

It is not possible, of course, to descry the future; developments in rail or road technology and costs, or in the growth of the A.C.T., may well justify, before the end of the 'seventies', another evaluation of a Canberra-Yass rail link. For example, if the link were to connect at several points with the tentatively proposed rapid-transit bus system for the A.C.T., of if it were itself to serve commuter traffic between future northern towns(1) and other employment centres, or if rail sidings were required at the proposed industrial area of Crace, or if the rail passenger terminal were to be resited at Majura, then the net benefits of the

(1) Including, looking far into the future, the possible development of Yass itself into a satellite town related to Canberra.

TABLE 6 - SUMMARY OF EVALUATION RESULTS

Assumptions (see Key below)	Discounted Capital Cost	Discounted Net Benefits (7 per cent rate of discount)	Benefit/ Cost Ratio
	$'000	$'000	
A.Q.X.	12,429	2,603	0.21
A.Q.Y.	12,429	3,322	0.27
A.R.X.	12,429	4,428	0.36
A.R.Y.	12,429	5,147	0.41
A.S.X.	12,429	8,076	0.65
A.S.Y.	12,429	8,798	0.71
B.Q.X.	12,429	3,064	0.25
B.Q.Y.	12,429	3,788	0.30
B.R.X.	12,429	5,239	0.42
B.R.Y.	12,429	5,937	0.48
B.S.X.	12,429	9,532	0.77
B.S.Y.	12,429	10,250	0.82

Key to assumptions :

A Low total freight projection
B High " " "
Q Low degree of freight conversion
R Medium " " " "
S High " " " "
X Low valuation of private travel time
Y High " " " " "

project could be increased. However, none of these developments is imminent. On the basis of present knowledge it would be impossible to attribute any significant 'present value' to benefits arising from them.

However, it follows that if any of the above developments were to take place, a re-evaluation of the proposed rail line might well produce more favourable results at some future time.

ANNEX A

STANDARDS OF CONSTRUCTION

Commonwealth Railways consider that a Canberra-Yass railway should conform to the following standards:

1. Grading:

   Ruling Grades -

   (a) in A.C.T. 1 in 79

   (b) in N.S.W. 1 in 75

2. Main Line Curvature:

   Minimum Radius 40 chains where practicable

3. Crossing Loops:

   To provide 2,000 ft standing

4. Track Centres - 17 ft

5. Structure Gauge - Ultimate minimum structure gauge 1963 to provide for width of 12 ft at a height of 20 ft from rail level

6. Earthworks:

   (a) Banks - formation width 20 ft

   (b) Cuttings - formation width 22 ft or as necessary to meet drainage or other requirements

7. Track Structure:

   (a) Rails -

   (i) Main line and crossing loops - 94 lb A.S. x 270 ft nominal length

   (ii) Sidings - 82 lb A.S. x 270 ft nominal length

(b) Sleepers 9 in x $4\frac{1}{2}$ in x 8 ft long -

(i) Main line and crossing loops - 2,640 per mile

(ii) Sidings - 2,000 per mile

(c) Sleeper Plates - A.S. Double Shoulder

(i) Main line and crossing loops - Fully plated

(ii) Sidings - Unplated

(d) Dogspikes - A.S.

(i) Plated Track - $5\frac{3}{4}$ in x $\frac{3}{4}$ in

(ii) Unplated Track - 5 in x $\frac{3}{4}$ in

(e) Rail Anchors - 3,500 per mile

(f) Ballast - $1\frac{1}{4}$ in Crushed Rock

(i) Main line and crossing loops - 3,000 cu yd/mile

(ii) Sidings - 2,000 cu yd/mile

8. Bridges and Culverts:

Designed for Coopers E.50 loading with impact as specified in Minute No. 6151 of 1962, Australian and New Zealand Railways Conferences.

9. Signalling:

Automatic absolute block signalling Canberra to Yass Junction and Canberra to Queanbeyan to apply. Relay interlockings to be provided for control of main lines, passing sidings and converging leads from railway marshalling yard at Canberra and connections to junctions at Yass and Queanbeyan.

FIGURE A.1

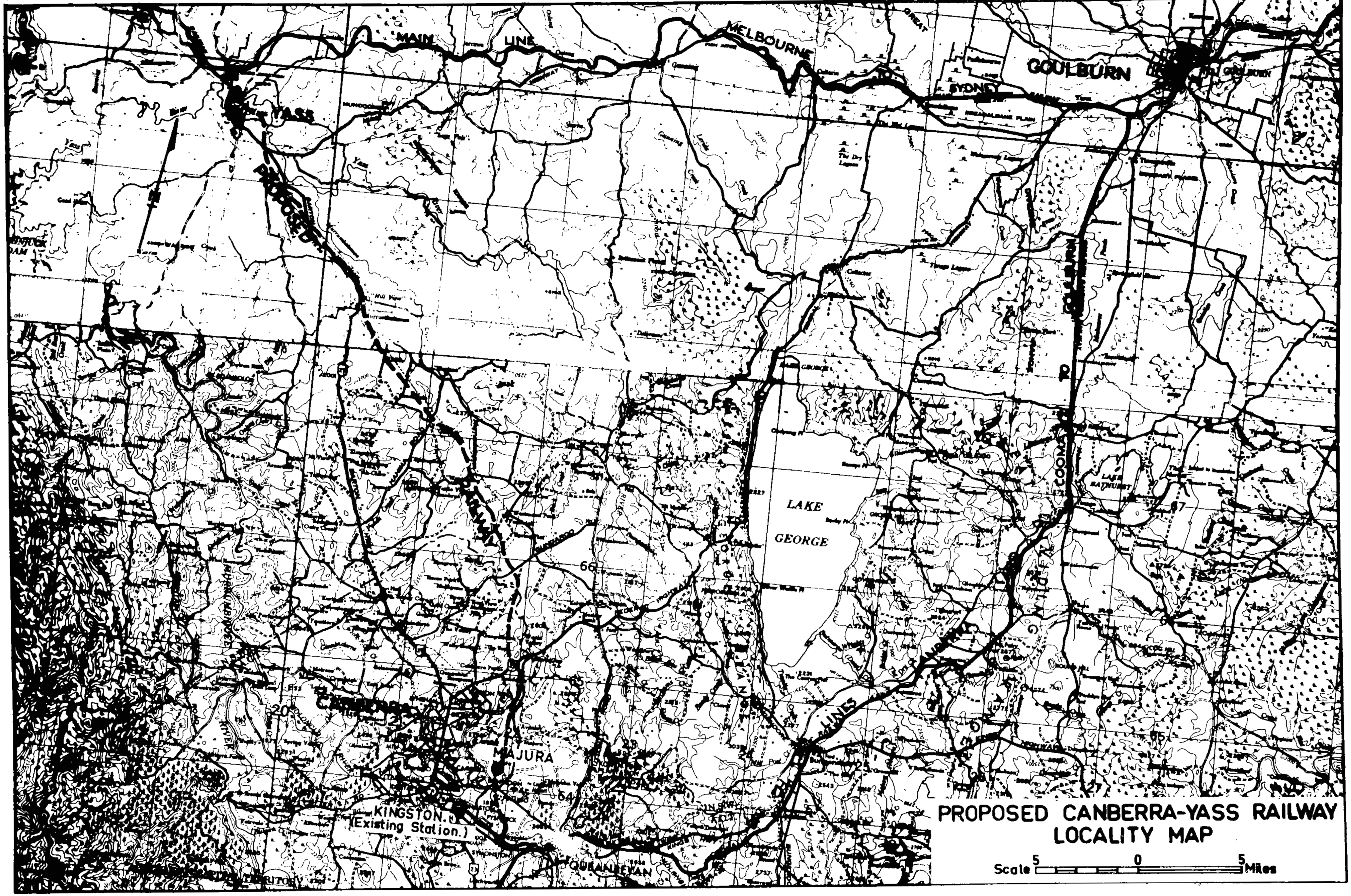
PROPOSED CANBERRA-YASS RAILWAY -
LOCALITY MAP

Source: Commonwealth Railways, Report on Canberra-Yass Railway, Unpublished report, May 1969, Fig. 4.

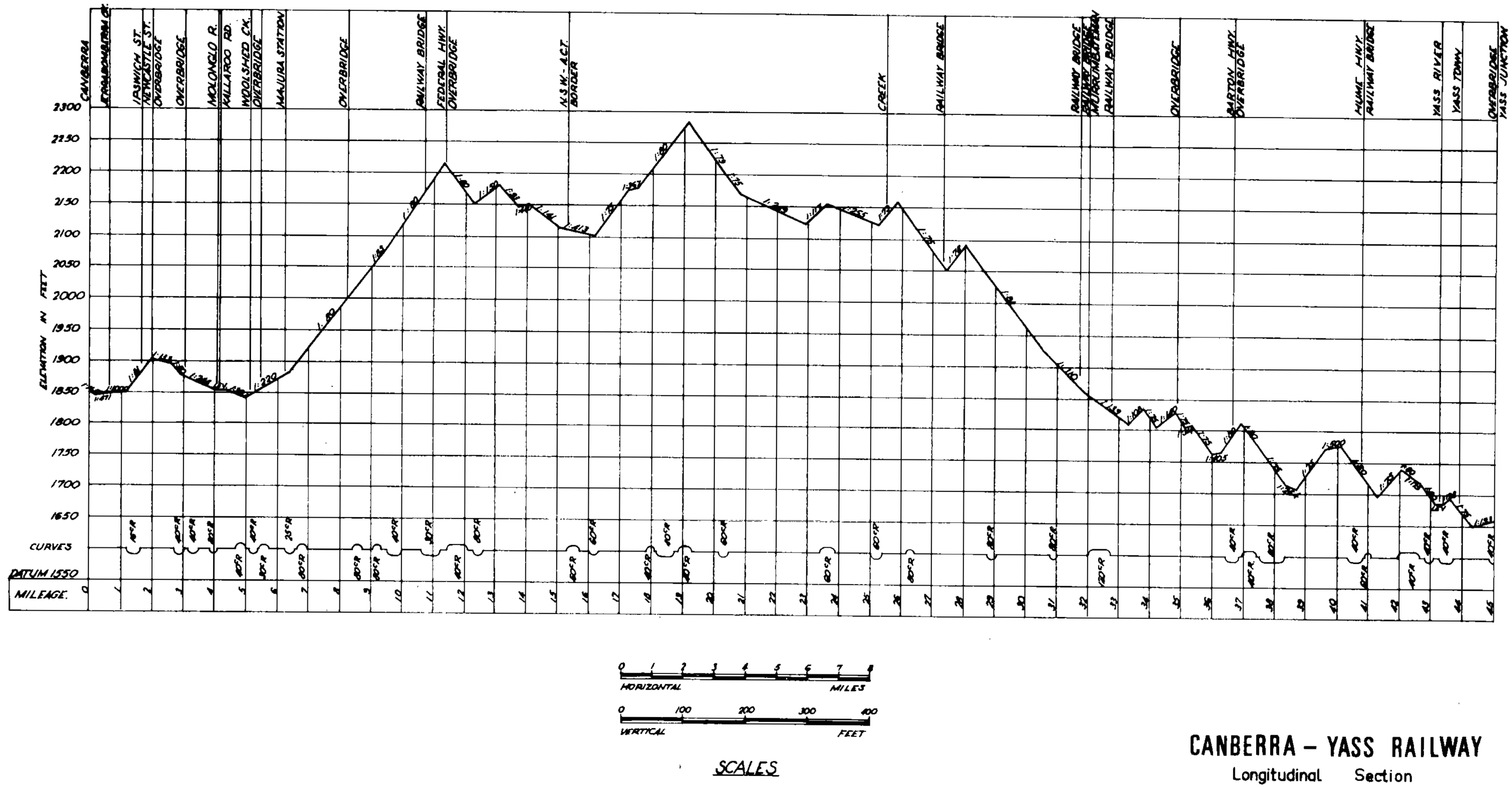
FIGURE A.2

PROPOSED CANBERRA-YASS RAILWAY -
LONGITUDINAL SECTION

Source: Commonwealth Railways, Report on Canberra-Yass Railway, Unpublished report, May 1969, Fig. 7.



PROPOSED CANBERRA-YASS RAILWAY
LOCALITY MAP



CANBERRA – YASS RAILWAY

Longitudinal Section

ANNEX B

FREIGHT ESTIMATES

As there is presently no collection of statistics relating to movement of freight into and out of Canberra, it was necessary for the B.T.E. to make its own estimates of freight traffic likely to be affected by the improvement. This Annex describes how those estimates were built up.

Attention was confined to rail and road freight. Air freight was ignored on the grounds that it is not sensitive to changes in rail freight charges or quality of service (price per ton-mile of air freight being 12 times that for rail freight).

Rail Freight

The estimation of current rail traffic which would be diverted to a Canberra-Yass rail link was relatively straightforward. From Commonwealth Railways' records it is possible to extract details of origin of Canberra freight by State, and, if necessary, station. It was only necessary to go to the latter detail in the case of New South Wales, which dominates freight movements into Canberra (275,000 tons in 1970-71). A split had to be made of the proportion likely to travel over a Canberra-Yass link. Current rail traffic which would travel over a Canberra-Yass direct link is estimated at 10,000 tons - 5,000 tons to and from southern New South Wales, and 5,000 tons to and from Victoria.

Road Freight

Estimating road freight into Canberra presented much more difficulty as there is no single source of data comparable to Australian Capital Territory Railway freight records. Some information was available from highway checks conducted in three separate weeks in 1968 and 1969 by the Victorian Transport Regulation Board, but the coverage of these checks is very incomplete.[1] A completely satisfactory estimate of road freight

(1) The data shows, inter alia, truck loadings between Melbourne and Canberra and between other Victoria regions and Canberra reported as passing through at least one of six highway checking points in Victoria and New South Wales in the period 24-31 August 1968, 21-26 May 1969, and 17-22 September 1969.

into and out of Canberra would involve identifying all transport operators, in and out, and approaching all or a sample of them. However, it was not possible to ensure that all operators were identified. Intensive investigations were concentrated primarily on Melbourne-origin freight as informal discussions with industry representatives indicated that the greater part of the freight coming by the Yass-Canberra route originates in Melbourne. The Victorian Transport Regulation Board data(2) suggested that freight from elsewhere in Victoria was not likely to be significantly greater than the 24,000 tons specifically identified as a result of our inquiries. South Australia-origin road freight was ignored on the assumption that it would be unlikely to be greatly affected by the proposed link.(3) Road traffic from New South Wales was ignored because freight not already on rail, as a result of the New South Wales State Transport (Co-Ordination) Act, is not likely to be attracted by the improved rail facility.

The B.T.E. Survey of Melbourne-Canberra Road Freight

Road freight is carried to Canberra by firms which vary considerably in size, from the owner of a single truck to large firms which operate an Australia-wide network. To take account of the relative probabilities of various firms participating in the Melbourne-Canberra trade, and so improve the efficiency of the survey, the population of firms was stratified according to location and apparent importance in the carrying business. The stratification

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(2) Although, as noted above, this data is an unsatisfactory guide to total annual freight movements, nevertheless it gives some indication of the relative importance of Melbourne-origin and other Victoria-origin freight.

(3) A Canberra-Yass link would only serve rail traffic coming from Adelaide via Melbourne, whereas once the standard gauge link is built between Adelaide and Port Pirie much rail traffic from Adelaide would seek to avoid the bogie exchange at Melbourne and travel by the standard gauge through Broken Hill and Sydney, then onto Canberra.

is shown in Table B.1. There is a stratum missing from this table, namely ' all other carriers', but it was judged that the considerable cost of obtaining a complete list of these and of sampling from that list would not be justified by the improvement to be expected in the estimate (i.e. removal of the downward bias). Furthermore, our subsequent check on classes of incoming freight eliminated part of the deficiency and gave us reasonable confidence that any remaining downward bias is not large in relation to the total.

It can be seen in Table B.1 that a full count (100 per cent sample) was taken except in the case of the small-type entries in the Melbourne telephone book pink pages. From these, a 3 per cent random sample was drawn, giving an intended sample size of 63 out of a population of 2,078. Out of the 60 who could be contacted, only one carried to Canberra in 1970-71. He carried 12 tons. Thus, the estimated quantity carried to Canberra by the 2,078 carriers in this stratum was 420 tons. Although this estimate is based on only a small sample, statistical tests indicate that, taking into account sampling variability, it is highly unlikely that the total for this stratum could have exceeded 1,000 tons. The carriers in the other strata accounted for 51,000 tons (see Table B.2).

The largest firms are known as 'forwarders' because they take a higher level of responsibility for the delivery of the goods than can a smaller operator. Forwarders maintain a frequent schedule of service to move the large tonnages handled. Because of the detailed records kept by these firms, it was possible for them to provide actual figures of total tonnages carried in recent years. All of the major national forwarding companies with Canberra offices were contacted and, in the belief that projections of future traffic would be aided by a knowledge of the commodity composition of present traffic, a broad commodity dissection was obtained (see column 1 in Table B.2).

TABLE B.1 - CARRIERS CONTACTED IN MELBOURNE-CANBERRA ROAD FREIGHT SURVEY

Category	Number in Population List	Gone out of Business	Sample Size	Actually Contacted	Sample firms Engaged as Principals in Carrying Melbourne-Canberra
1. Major National Freight Forwarders	4	-	4	4	4
2. Principal Melbourne-based Carriers (a)	145	3	142	134	35
3. Other Melbourne-based Carriers (b)	2078	(n)	63	60	1
4. Canberra-based Carriers (c)	104	13	91	75	8

(a) Includes an unduplicated list of carriers which are listed as:-

(i) bold-type entries in the pink pages of Melbourne telephone directory under the classifications of 'Carriers-Heavy' and 'Transport Services'; or

(ii) members of the Freight Forwarders' Division of the Victorian Road Transport Association; or

(iii) Melbourne-based members of the Long Distance Road Transport Federation

and which are not included in category 1.

(b) Includes carriers listed as small-type entries in the pink pages of the Melbourne telephone directory under the classifications 'Carriers-Heavy' and 'Transport Services', other than those included in categories 1 and 2.

(c) Includes all carriers listed in the pink pages of the Canberra telephone directory under the classifications 'Carriers-Heavy' and 'Transport Services', other than those included in categories 1, 2 and 3.

(n) Not known.

The bold-type entries in the pink pages of the Melbourne telephone book proved to be the major source of names of firms carrying from Melbourne to Canberra. A composite list was formed from the phone book coverage, members of the Freight Forwarders' Division of the Victorian Road Transport Association, and Melbourne-based members of the Long Distance Road Transport Association. All operators were asked for frequency of trips, principal commodities carried, and average load. The results are contained in column 2 of Table B.2.

A similar survey was conducted of the 104 local entries in the 'pink pages' of the Canberra telephone directory under 'Carriers-Heavy' and 'Transport Services', and the results of this survey are shown in column 3 of Table B.2. All but a few were engaged in local haulage and sand and gravel cartage.

Other Data Sources

Having covered the categories of carriers mentioned above, there remained the possibility of freight coming by carriers other than those based in Melbourne or Canberra, or freight being shipped on manufacturers', wholesalers' or retailers' own trucks.

First, a check was made of the Victorian Transport Regulation Board data mentioned earlier. Although this check did not reveal any commodities not reported by transport operators, a further check of commodity coverage was made by approaching over 20 firms in Canberra-Queanbeyan to ascertain tonnages received by road from Melbourne and the carriers engaged. Generally speaking, it was found that no records indicating this information are kept, particularly as there is an increasing proportion of business to Canberra being done on a 'Free Into Store' basis. However, some tonnages not covered elsewhere were picked up in this way and are shown in column 4 of Table B.2. The most significant tonnages were of cement (20,000 tons from Geelong) and bricks (7,800 tons from Melbourne and 4,000 tons from Ballarat).

TABLE B.2 - ROAD FREIGHT MELBOURNE TO CANBERRA, 1970-71
(Tons)

Commodity	(1) Forwarders	(2) Melbourne-based Carriers	(3) Canberra-based Carriers	(4) Other	(5) Total
Timber	2,500	5,050	-	-	7,550
Bricks	-	50	-	(a)11,800	11,850
Glass	-	-	1,000	-	1,000
Other Building Materials	2,300	1,550	7,800	(b)20,360	32,010
Fresh Food	600	2,250	740	-	3,590
Frozen Food	-	900	-	-	900
Other Food	2,000	3,150	-	-	5,150
Removals	-	4,160	3,000	-	7,610
Household Appliances	1,100	40	2,000	-	3,140
Petroleum Products	250	1,200	-	-	1,450
Chemicals	250	-	-	-	250
Motor Vehicles and Tyres	-	700	-	50	750
Machinery	400	1,080	-	-	1,480
Other Goods	2,500	4,870	-	-	7,370
Not Identified by Commodity	-	420	-	480	900
TOTAL	11,900	25,870	14,540	32,690	85,000

(a) Includes 4,000 tons of bricks from Ballarat. (b) Includes 20,000 tons of cement from Geelong.

Combining the figures from all sources produced a grand total of 85,000 tons. Because we cannot be certain of having covered all freight coming to Canberra [1], the figure must be regarded as a minimum. Accordingly, two base year freight estimates have been used in the evaluation - 85,000 and 100,000 tons. In addition, these figures need to be increased to reflect backloading or outwards freight. On the basis of the Victorian Transport Regulation Board data, road backloading from Canberra appears to be of the order of 20 per cent of inwards tonnages. Thus, a range of 100,000 to 120,000 tons was ultimately arrived at for total in and out road freight between Canberra and Victoria in 1970-71.

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(1) The most likely deficiencies relate to freight possibly being carried by manufacturers'/wholesalers'/retailiers' own trucks, or by carriers other than those with offices in Melbourne or Canberra.

ANNEX C

PROJECTIONS OF FREIGHT TRAFFIC

The evaluation required projections to year 2001-02 of the amount of freight which might be carried by rail both with and without the project. The first step was to project the likely volume of total freight traffic. An assumption was then made about the proportion of that freight which would be handled by rail in the absence of the improvement. Finally, three alternative assumptions were made as to the likely volume of freight traffic which would 'convert' from road to rail if the improvement were carried out.

Projections of Total Freight Movements

Two separate projections of total freight were made using as a base the 'low' and 'high' estimates of present freight (110,000 and 130,000 tons), derivation of which is described in Annex B. If the improved facility were likely to generate new traffic, as distinct from encouraging conversion of existing traffic from other modes, separate projections would be required of total freight with and without the improvement. However, a preliminary exploration of the likely magnitude of generated traffic (and the associated benefits) in this case established that it was not worth introducing this complication into the analysis.(1)

In projecting future values of any economic variable it it desirable, irrespective of the technique employed, to know past values. Unfortunately, because of the way in which the road

(1) The proposal, if implemented, would constitute a marginal improvement to existing transport facilities rather than a major change in the transport system. An improvement in an existing rail link cannot be assumed to generate new traffic in the same way that construction of a rail link where none existed before might. In this connection, it is interesting to note that a recent study of a similar rail improvement project also assumed no generated traffic. (See New South Wales Development Corporation, Report on Sandy Hollow - Maryvale Railway Proposal, Sydney, September 1970, pp. 2 and 32.)

freight estimate was derived, this information was not available.(1) Further, although data on rail freight received from all Victorian stations were readily obtainable (see Table C.1) information on New South Wales - origin freight which would pass over a Canberra-Yass direct link (as distinct from freight passing over the Goulburn-Canberra line) could only be obtained by detailed analysis of freight documents at Canberra rail station. But this was not done because lack of matching road data made the effort pointless (especially as present rail freight is small anyway).

Thus, projection of future traffic was difficult because there was only a one-year estimate of road freight - which in that year constituted over 90 per cent of total freight. To minimise the problem this freight was considered in two commodity groups. The first contained building materials and furniture (which together accounted for two-thirds of total tonnage). Consumption of these was taken to be related to the year to year increments in Canberra's population. The second group contained the remaining commodities (approximately one-third of the total), consumption of which was taken to be proportional to the absolute size of Canberra.(2)

The population projections employed in the calculations were arrived at after consultation with officers of the National Capital Development Commission. Table C.2 summarises the results of the calculation.

Projected Rail Freight without the Link

The tendency for freight forwarders to increase in relative importance in long-haul operations suggests that, even without the link, rail will in the future carry an increasing proportion of total Melbourne-Canberra freight. Rail freight on the Melbourne-Canberra route has already been stimulated by one forwarder switching largely to rail early this calendar year -

(1) See Annex B. The major freight forwarders could provide information for a number of years, but this was not possible in the case of owner-drivers. Moreover, by the nature of the business a survey of drivers currently bringing freight from Melbourne would not cover all those who had brought freight for the past 5 or 10 years.

(2) Strictly speaking, this procedure can be logically applied only to inward freight, and some different procedure would be appropriate in projecting outward freight. However, due to the relatively small size of the latter, and in the interests of simplicity, the procedure described was applied to both inward and outward freight.

TABLE C1 - RAIL FREIGHT RECEIVED FROM VICTORIA

Year ended 30 June -	Tons
1965	2,516
1966	[illegible],820
1967	1,954
1968	2,291
1969	1,699
1970	2,804
1971	4,802

TABLE C2 - PROJECTIONS OF FREIGHT TRAFFIC OVER YASS-CANBERRA ROUTE (a)

('000 tons)

Year ended 30 June -	Low	High
1971 (estimate)	110	130
1977	170	201
1982	228	269
1987	292	344
1992	335	396
1997	365	432
2002	395	466

(a) As explained in Annex B, the estimate for 1970-71 (and thus the projections for subsequent years) does not purport to reflect all freight traffic over the Yass-Canberra route, only that which might be affected by a Yass-Canberra rail link.

the effects are evident in Table C.1. Similar changes have been occuring over a number of years on other intercapital routes[1] and, so far as Canberra is concerned, it is significant that all major forwarding companies already have sites alongside rail sidings and that a modern forwarding complex has recently been completed.

With these considerations in mind, it has been assumed that in the absence of the link, rail's present share of 8-9 per cent (depending on which road freight estimate is used) would approximately double to 16 per cent by the end of the century. The projected 'base' rail traffic is shown in Table 2 on page 10.

Projections of Converted Rail Freight

Three alternative assumptions have been made as to the likely degree of conversion of road freight to rail. These are that, if the link was completed in 1974, rail would attract (in addition to the 'base' traffic of the preceding section, which would go by rail anyway) additional freight equivalent to

(a) 10 per cent
(b) 20 per cent
(c) 40 per cent

of the total freight business available on this route.

Of the three projections, alternatives (a) and (b) are considered to be more realistic than the assumption of rail obtaining an immediate extra 40 per cent of total freight as a result of the construction of the link.

In effect, alternative (c) is included to cover the possibility of all freight forwarding companies converting to rail as a result of the link. It is true that the link would make rail more attractive to these users in two major respects. First, the reliability of overnight delivery would be enhanced and, secondly, any stimulation of traffic would help forwarders achieve economies in the effective cost of rail wagon hire. By increasing average loads per wagon, forwarders could lower costs per ton by a further 15 per cent in addition to the 10 per cent reduction in basic rail charges. However, this latter economy could not be attributed to the new link for any length of time, for the new link would only be slightly advancing in time an economy which would have been achieved without the link due to the natural growth

(1) See P.J. Rimmer, Freight Forwarding in Australia, Australian National University, Canberra, 1970, pp. 12-15.

of freight traffic to Canberra. Furthermore, even if all freight forwarders presently using road were to convert to rail, our estimates (see Annex B) suggest that these companies are presently handling only 13 per cent of the inward freight with which we are concerned. Thus, their share of the business would have to increase dramatically for projection (c) to be borne out.

Detailed projections, at 5-year intervals of 'base' and 'converted' rail freight used in the evaluation are shown in Table 2 on page 10.

The proportions of total freight projected to be carried by rail in the form of 'base' plus 'converted' traffic are as shown in Table C.3.

TABLE C.3 -

PROJECTED YASS-CANBERRA RAIL FREIGHT AS PROPORTION OF PROJECTED TOTAL YASS-CANBERRA FREIGHT (a)

Year ended 30 June -	Low Conversion	Medium Conversion	High Conversion
	%	%	%
1977	21	31	51
1982	22	32	52
1987	23	33	53
1992	24	34	54
1997	25	35	55
2002	26	36	56

(a) The figures in the table relate to the low total freight projection. Figures in respect of the high total freight projection are either the same as those shown in the table or differ by 1 percentage point.

ANNEX D

PROJECTIONS OF PASSENGER TRAFFIC

As with the freight estimates and projections, lack of data in the desired form was a problem in estimating current and projecting future passenger traffic. Special estimates of passenger traffic had to be made and this entailed counting seat allocations for each individual train service. Because of the work involved in this procedure, data compilation was confined to the six months ended 30 June 1971, and the total for that period was doubled to obtain an estimate of the annual figure.(1)

In the absence of previous years' figures in this form, projection of future rail passenger movements had to be made by a roundabout method. The first step was to estimate the rate of change in total trips by all modes. A simple gravity model, whereby Melbourne-Canberra passenger traffic was assumed to vary in direct proportion to the product of the two centres' populations(2), suggested that total passenger movement between the two centres would grow at approximately 9½ per cent per annum between now and the end of the century

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(1) It is recognised that there is a shortcoming in this estimate due to the likely existence of seasonal variations in rail passenger traffic. The major seasonal affect is probably school holidays, which would mean that estimates made using the abovementioned procedure would tend to be on the high side (there being more school holidays in the first half of the calendar year).

(2) A fairly general form of the gravity model is

$$T_{ij} = \frac{k.\, P_i^a\, P_j^b}{C_{ij}^{\,n}}$$

T_{ij} = trips between points i and j

P_i = population of i

P_j = population of j

(continued-see next page)

a figure comparable to the 10 per cent per annum growth rate in total visitor[1] traffic to Canberra expected by the Department of Interior.[2]

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k = a constant

a,b to be estimated

C_{ij}^{n} = transport system impedance, representing in the simplest case distance and in more complex cases generalised cost (comprehending distance and other factors such as money cost and travel time).

In hypothesising that Melbourne-Canberra travel will vary in proportion to the product of the two centres' populations we are applying this model with following simplifying assumptions:

(i) C_{ij}^{n} does not vary over time

(ii) $a = b = 1$

The first assumption implies that implies that improvements to the transport links between Melbourne and Canberra (primarily, the Hume Highway) will merely preserve existing standards of service for increased volumes of traffic. As to the second assumption, two recent overseas studies of intercity travel estimated population exponents close to unity. (See Eric Culley, 'Forecasting Intercity Travel', paper presented to the Sixth Annual Meeting of the Canadian Transportation Research Forum, Winnipeg, May 1970, and K.H. Young 'An Abstract Mode Approach to the Demand for Travel', Transportation Research, Pergamon Press, Vol.3, No.4, December 1969.)

The basic gravity model application described above has been endorsed for intercity or regional travel studies, by G.E. Brokke in a panel discussion on Inter-Area Travel Formulas, Highway Research Board Bulletin, No. 253, 1960, pp. 128-38, and by K.B. Davidson 'Models for Forecasting Regional Traffic', paper presented to the Road Planning Conference organised by the Commonwealth Bureau of Roads, 1969.

(1) Passenger traffic will of course differ from visitor traffic to the extent that Canberra residents make journeys.

(2) See Department of Interior, Statement of Evidence to Joint Committee on the Australian Capital Territory, Employment Opportunities Inquiry, May 1971, para. 9.1.2.

However, rail passenger traffic between Melbourne and Canberra could only be expected to grow at 9½ per cent per annum if rail's share of total person trips could be assumed to remain constant. This seems unlikely. Rail's share of total visitor[(1)] traffic (from all origins) to Canberra declined at an average rate of 7.6 per cent per annum during the period 1950 to 1970.[(2)] When this declining rail share is set against a growth rate of 9½ per cent in total person trips between Melbourne and Canberra, rail traffic is projected to grow at 1.2 per cent per annum between now and the end of the century[(3)], and this growth rate produces the figures for projected patronage of the Spirit of Progress and Intercapital Daylight

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(1) Data on total person trips by all modes was not available. Estimates of total visitor (as distanct from passenger) traffic were derived from Department of Interior road traffic counts and visitor counts at the Australian War Memorial.

Although relating rail passenger traffic to total visitor traffic is not a strictly valid basis for determining rail's share of the business (because visitor figures exclude trips by Canberra residents), the comparison was judged sufficient for our purposes, given that we were interested in the trend in rail's share rather than its absolute level.

(2) The rate of decline in the rail share of total traffic was estimated by least squares regression. The fitted curve (with t-values beneath the coefficients) was

$$\log_e (\% \text{ Rail Share}) = \underset{(38.14)}{1.807} - \underset{(-10.273)}{0.0793T} \qquad R^2 = 0.85$$

where T is the year (T = 0 in 1961).
The implied annual decline in Rail Share is 7.6 per cent.

(3) The change in rail traffic per annum is the natural increase in total traffic, modified by the trend away from rail, i.e.

$(1 + 0.095)(1 - 0.076) = 1.012.$

without the link ('base' traffic) shown in Table 3 on page 12. Separate projections had to be made for each service because different benefits apply in each case.

It is also necessary to project converted rail passenger traffic - that is, passenger traffic which would convert from other modes to rail if the new link were built. A direct link would lead to a reduction in effective travel times of about 25 per cent and 5 per cent, for Spirit of Progress and Intercapital Daylight passengers respectively.[1] In addition, Daylight passengers would avoid the inconvenience of transferring between modes at Yass and would save $1.75 each trip due to elimination of the road coach.[2] In the belief that elimination of the need for intermodal transfer would improve the attractiveness of the rail journey, this has been treated as equivalent to a further $1.00 reduction in the cost of the journey, so that the total money cost of Melbourne-Canberra trips in the Intercapital Daylight is estimated to be reduced by $2.75, or 16 per cent.

There is a dearth of information on the responsiveness of demand for intercity rail travel to improvements of this nature. However, a recent study of demand for intercity travel in the Northeast Corridor of the United States suggested elasticity coefficients of the order of 3 in respect of money cost of travel and 2 in respect of journey time.[3]

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(1) For further details on these estimates of travel time savings, see footnote 3 on page 15 and footnote 1 on page 16.

(2) There are no other reductions in cost of the trips, as rail rail fares would be the same with or without the link, Melbourne-Yass fares being the same as Melbourne-Canberra fares.

(3) K.H. Young, 'An Abstract Mode Approach to the Demand for Travel', Transportation Research, Vol. 3, No.4, December 1969, pp.455-60.

When applied to the cost and time savings indicated above, these elasticity coefficients suggest that patronage of the Spirit of Progress and Intercapital Daylight would be 50 per cent and 60 per cent higher, respectively, with the link. The elasticity coefficients used are probably too high for application in this way to Australian intercity travel and, accordingly, probably lead to an overstatement of passenger benefits from the new link. However, for the purposes of the analysis they have been employed - consequently, the projections of converted traffic are 50 and 60 per cent of the respective base figures (see Table 3 on page 12).

ANNEX E

RAIL OPERATING COSTS

Economic costing of rail operations raises complex problems to which it is not easy to find practical solutions - indeed, solutions at a conceptual level are sometimes far from clear. Problems arise in identifying those costs which are fixed and those which are related to traffic - and even when the latter (variable) costs can be identified they may be common to two or more operations. Economic literature abounds with discussion of this problem - for example Transport, edited by Denys Munby, Penguin Modern Economics, 1968, Part 2. The problems are accentuated in the case of Canberra traffic by the existence of trains comprising both freight and passenger cars. Mixed trains operate at the moment between Goulburn and Canberra and would continue to operate between Yass and Canberra if the proposed link was constructed.

Ideally, what is wanted is the cost savings that arise from carrying freight and passengers directly from Yass to Canberra rather than by the present route through Goulburn and Queanbeyan. While the costs of running trains on the new link are reasonably determinate(1), it is very difficult to identify the costs of the present operation via Goulburn and Queanbeyan. To explain this more fully, it is necessary to describe in some detail how Canberra freight is carried at the moment and would be carried if the new link were built.

Presently, there is a forwarder's rail wagon which comes to Goulburn every night attached to a Sydney-bound freight train. This wagon, together with the 'VAC' car(2) from the Spirit of Progress and another passenger car which serves en route passengers between Goulburn and Canberra, is taken as a special train to Canberra.

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(1) Though there is still the issue of how much a branch line should contribute - over and above its identifiable and separable costs - to general system overheads.

(2) A mixed passenger car comprising sleeping compartments, and first and economy class seats.

There would be a saving from no longer having to haul freight wagons and the 'VAC' car the 58 miles between Yass and Goulburn. However, this benefit would be relatively small as no train miles would be saved. There is a very little extra cost involved in the Spirit of Progress or the Sydney-bound freight train, having hauled Canberra cars and wagons as far as Yass, hauling them on to Goulburn. Virtually the only saving from avoiding this 58 mile haul is a small reduction in wear and tear on wagons and cars.

Freight traffic other than the forwarders' is presently of such a small magnitude that it generally does not make up a complete wagon load. It is therefore 'staged'[(1)] up to Goulburn where it goes through the goods shed as 'smalls'. This process, which normally involves a Melbourne-Canberra transit time of about a week, would continue if the new link were built (except that the Canberra freight would no longer need to be 'staged' as far as Goulburn). Gradually, as traffic built up, Canberra freight would make up complete wagons; eventually complete trains from Melbourne to Canberra might be warranted.

Once complete trains were running between Melbourne and Canberra the benefits from a Canberra-Yass link would be quite substantial, as train miles would be saved. However, our projections of 'base' passenger and freight traffic suggest that it would be a long time - well beyond our study period - before complete trains would be warranted.[(2)] Until then, the savings from no longer hauling Canberra freight over the Yass-Goulburn section would be minimal. As with the freight forwarder's

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(1) This word is used to describe the process whereby a truck containing freight for several stations is unhooked from a train at one station, and after that station has withdrawn its freight, added to a subsequent train service for transport to the next station, where the process is repeated.

(2) For example, our projections suggest that by the end of the century 'base' freight traffic would be around 60,000-70,000 tons. This compares with present Sydney-Canberra rail freight (for which complete trains are still not being used) of 275,000 tons. The prospects of complete Melbourne to Canberra trains would be considerably enhanced if passenger cars and freight trucks were combined into mixed trains. Irrespective of what is done about traffic from Melbourne to Yass, mixed trains would seem to be the most feasible way of operating, from the outset, a Yass to Canberra link.

traffic, if a Sydney-bound freight train has to haul Canberra wagons as far as Yass anyway there is little extra cost in continuing to Goulburn.

The magnitude of the costs avoided on the Goulburn-Canberra route depends on the likely level of Sydney-origin rail freight over the study period. At the moment, freight from southern origins destined for Canberra, is transferred to Sydney-origin wagons at Goulburn for haulage to Canberra. Once again, the only costs associated with Melbourne- origin freight travelling over the present route (and thus, the only costs which would be avoided if there were a direct Canberra-Yass link) are wear and tear on the relevant number of wagons. However, once the Sydney-origin freight plus Melbourne-origin freight exhausts the capacity of the locomotive presently hauling it from Goulburn to Canberra, Melbourne-origin freight must bear the appropriate proportion of the total costs of running the train. (This is an example of another problem affecting economic analysis of railway operations - the effect of discontinuities and indivisibilities on marginal cost, making short-run marginal cost, often, very different from long-run marginal cost).

For these reasons some practical compromises had to be made in costing the projected railway operations. Rather than attempt a detailed costing of the Canberra services specifically (both with and without the new link), we have attempted to derive a general system-wide long-run marginal cost figure for freight and country passenger operations. From the detailed statement of working expenses in the latest available New South Wales Railway Annual Report[1], we have identified those items which can be attributed, in whole or in part, to freight and country passenger operations, and which can be expected to vary in the long run with volume of traffic. After incorporating a service charge for incremental capital, we estimate that the long-run marginal cost of rail freight

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(1) Department of Railways, New South Wales, <u>Annual Report</u>, 1969-70, Appendix C.

operations is approximately 2 cents per net ton-mile, and that of country passenger operations 3 cents per passenger-mile. As the new link would reduce the rail distance between Yass and Canberra by 78 miles, operating cost savings of $1.56 (78 x 2 cents) and $2.34 (78 x 3 cents) have been applied, respectively, to each net ton of freight and each Spirit of Progress[1] passenger journey. For reasons explained in Annex F, these benefit rates are applied only to 'base' traffic, converted traffic benefits being valued differently.

(1) The new link would not result in any reduction of rail passenger miles for the Intercapital Daylight.

ANNEX F

ESTIMATION OF BENEFITS

In assessing the benefits of a transport improvement it is important to distinguish between 'base' traffic [(1)] and 'converted' traffic[(2)], because different benefits apply to each.

'Base' Traffic Benefits

The treatment of 'base' traffic benefits is clear enough, at least conceptually. In the present case, there are two such benefits:

(i) lower resource costs to the railways due to reduction of route length;

(ii) user benefits in the form of travel time savings and increased convenience for passenger traffic.

Although freight rates would be reduced as a result of the improvement[(3)] this is not taken as a user benefit because it is merely a reflection of the resource cost savings already included in (i). That is, it would be double-counting to include freight rate or fare reductions as 'base' traffic benefits.

'Converted' Traffic Benefits

The appropriate treatment of 'converted' traffic benefits is more complicated. In many transport studies in the past, benefits to converted traffic have been taken as simply the difference between costs on the new facility and costs on the route or mode from which the converted traffic has switched. However, this simple 'cost-difference' approach ignores quality differences between alternative modes and routes.

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(1) 'Base' traffic is defined as that which would have used the facility even without the improvement.

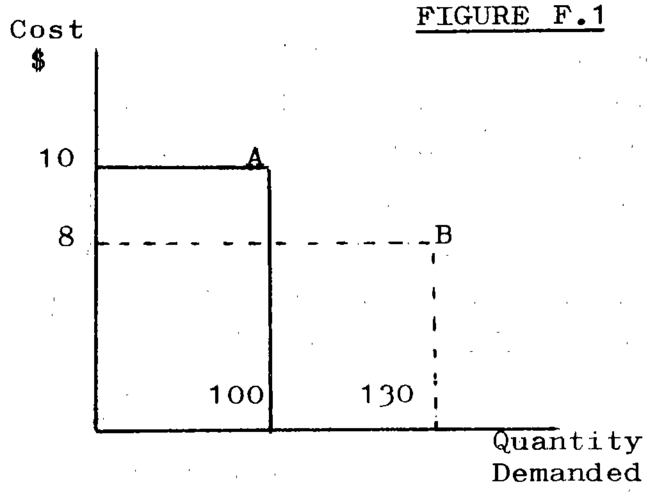
(2) 'Converted' traffic is defined as that which is attracted to a particular mode (from another mode or route) as a result of the improvement.

(3) There would be no reduction in rail passenger fares (except for a saving of fares in the road coach connection with the Intercapital Daylight at Yass).

In the present context, for example, it would be inappropriate to take the difference between rail line-haul costs (with the link) and road line-haul costs as a measure of the benefit to converted traffic - that is, in this case, traffic shifting from road to rail. This is because road and rail freight transport are not perfect substitutes, as indicated by the fact that rail's present share of Melbourne-Canberra freight transport is low, despite the fact that rail freight rates, even without the new link, are below road freight rates. Road and rail offer different qualities of service with respect to such factors as terminal costs, delivery time, risk of breakage and so on.

For these reasons, a straight 'cost-difference' approach, as described above, is inappropriate, and recent contributions to the theoretical literature (1) (with which we agree) suggest that the correct approach is to apply half the unit rate of base traffic perceived user benefits (2) to converted traffic. Briefly, the reasoning behind this approach can be illustrated by reference to figure F.1.

FIGURE F.1



(1) See, in particular, H. Neuburger, 'User Benefit in the Evaluation of Transport and Land Use Plans', Journal of Transport Economics and Policy, January 1971, pp.52-75.

(2) Reductions in the costs perceived or taken into account by users in making their choice of transport mode and/or route.

At a price of $10, 100 units (say, tons of freight shipped from Melbourne to Canberra) are demanded. It is estimated that, with the improvement, price would fall to $8 and quantity demanded would expand to 130 units. Now whereas the 'base' traffic of 100 units enjoys the full extent of the $2 price reduction, the converted traffic of 30 units was not using this mode initially so cannot be assumed to enjoy the full $2 cost reduction. Some of this new traffic might have been attracted by a very small reduction in cost (say 10 cents), while some would require the full extent of the reduction ($2) before converting. In the absence of specific information concerning the demand function, the most reasonable approach is to apply half the cost reduction to converted traffic (i.e. 30 units @ $1 = $30).

Estimation of the converted traffic benefit in this way can be regarded as measuring the increment in consumers' surplus resulting from the improvement. Thus, assuming a linear demand curve, the addition to the area under the demand curve passing through A and B would be given by the triangular area

$$\frac{(\$10 - \$8) \times (130 - 100)}{2} = \$30$$

The above approach is appropriate to valuing perceived user benefits.(1) However, the perceived costs considered by users may not be an accurate reflection of resource costs to the nation. This is particularly so in the case of railways, where freight rates tend to be above marginal resource cost of carrying that freight.

In terms of the above discussion, if the rail freight rate (after the improvement) is $8 but actual resource cost is only $6, there is a ' producers' surplus ' of $2, which goes towards covering general system overheads. If the freight rate on the alternative mode is exactly reflecting resource cost(2),

(1) In the present evaluation, this approach has therefore been used to value fare savings/time savings/convenience benefits to converted passenger traffic and freight rate savings to converted freight traffic.

(2) This assumption is further discussed below.

then although, on average a $1 reduction in freight rates was sufficient to attract 30 units of traffic to rail, there is an extra benefit to the nation not reflected in the converted traffic user benefit of $1. This is the gap between actual resource cost and the cost figure used by shippers in deciding to convert to rail. Our estimates are that the gap between rates and resource cost on Melbourne-Canberra rail freight operations is of the order of 1 cent per ton-mile, with no gap at all in respect of passenger operations.

These estimates were based on the following calculations:-

(1) As mentioned in Annex E, the long-run marginal cost of rail freight operations, including a 7 per cent capital servicing return, is estimated at about 2 cents per ton-mile. Taking into account the fact that a substantial proportion of the freight would be carried at the relatively low wagon hire rates available to large rail users, such as freight forwarders, we estimate that the average charge for the projected traffic would be about 3 cents per ton-mile. Thus, the surplus on freight operations would be approximately one cent per ton-mile.

(2) As also mentioned in Annex E, the long-run marginal cost of rail country passenger operations is about 3 cents per passenger-mile. Adult fares for the Melbourne-Canberra rail journey (taking half the return fare) are $12.20 economy class and $16.70 first class. The composition of passenger traffic is 30 per cent economy class and 70 per cent first class and the weighted average fare is $13.55 per journey or 3.1 cents per passenger-mile. However, as a proportion (the figures are not available) of the train journeys that are made by children the overall weighted average revenue per passenger-mile is likely to be less than 3 cents. Thus, instead of there being a ' producer's surplus ' in respect of passenger traffic, there appears to be a ' producer's deficit '. The estimate used, however, assumes break-even.

The assumption that the producers' surplus calculation need only take into account the rail surplus implies that freight rates on the alternative mode (in this evaluation, road) accurately reflect resource costs. That implication is here taken to be valid although, in assessing its validity, there are two complicating factors to take into account. On the one hand certain elements of the freight charge reflect 'costs' which are not resource costs - these comprise taxes on fuel, road usage, vehicles, spare parts, tyres, etc.,and profits in excess of the minimum needed to service capital. On the other hand, the use of roads by vehicles, and particularly heavy vehicles, add to needed road expenditures and congestion and accident costs.

The difficulties in the way of estimating these offsetting values are formidable. However, such work as has been done on the general question in the B.T.E.[1] suggests that, in general, taxes paid in the course of purchasing and operating heavy vehicles tend to fall short of total community costs arising from their use of roads. When account is taken of profit margins also and the particular circumstances of this case - a marginal change in traffic on a major highway - it appears reasonable to assume that the two offset each other. In short, it is reasonable to assume that in road haulage operations freight charges and resource costs are the same.

It follows that each ton of freight converted from road to rail, where freight charges are 1 cent per ton-mile above resource costs requires that benefits of 1 cent per ton-mile be attributed to the project. These benefits are shown in the main tables under the heading 'Producers' Surplus'.

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(1) See Bureau of Transport Economics, Transport and Handling of Australia's Wool Production , Unpublished report, December 1971, pp 26-35.

Finally, there is the question of the effects on road costs of passenger traffic converted from road to rail. There would be some external cost savings but, on the other hand, there would be lower taxation payments in respect of vehicle operation. It is probable that the latter would exceed the former but as the magnitudes involved are small they are disregarded in the analysis.

DETAILED RESULTS

This annex contains tables setting out the detailed results of the evaluation, for each of the twelve alternative combinations of assumptions employed. The tables, and the different assumptions incorporated in each, are as follows -

TABLE G.1 - BENEFITS AND COSTS OF A CANBERRA-YASS RAIL LINK

Assumptions: Low total freight projection
Low degree of freight conversion
Low valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	'Producers' Surplus ' (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	54	22	23	66	58	107	93
1975-76	57	22	24	71	40	134	109
1976-77	60	23	25	76	58	126	96
1977-78	63	23	26	80	40	152	108
1978-79	65	23	27	85	40	160	107
1979-80	69	23	28	91	58	153	95
1980-81	72	24	29	96	40	181	105
1981-82	75	24	30	101	40	190	103
1982-83	79	24	31	107	40	201	102
1983-84	82	25	32	112	61	190	90
1984-85	86	25	33	118	48	214	95
1985-86	90	25	34	124	59	214	89
1986-87	94	25	35	129	72	211	82
1987-88	98	26	37	135	74	222	80
1988-89	102	26	38	142	189	119	40
1989-90	106	26	39	145	40	276	87
1990-91	107	27	39	146	229	90	27
1991-92	111	27	40	149	40	287	79
1992-93	112	27	40	149	240	88	23
1993-94	116	28	41	153	40	298	72
1994-95	119	28	41	156	216	128	29
1995-96	122	28	42	159	40	311	66
1996-97	126	29	43	162	40	320	63
1997-98	129	29	44	165	178	189	35
1998-99	131	29	44	166	40	330	57
1999-2000	135	30	45	169	64	315	51
2000-01	139	30	45	172	60	326	49
2001-02	142	30	46	175	57	336	47
				Residual Value 12.4090 x .141 x 299.2			524
				Total Discounted Benefits			2,603
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.21

TABLE G.2 - BENEFITS AND COSTS OF A CANBERRA YASS RAIL LINK

Assumptions: Low total freight projection
Low degree of freight conversion
High valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	'Producers' Surplus' (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	54	60	32	66	58	154	134
1975-76	57	61	33	71	40	182	149
1976-77	60	61	34	76	58	173	132
1977-78	63	62	36	80	40	201	143
1978-79	65	63	37	85	40	210	140
1979-80	69	64	38	91	58	204	127
1980-81	72	65	39	96	40	232	135
1981-82	75	65	40	101	40	241	131
1982-83	79	66	41	107	40	253	129
1983-84	82	67	43	112	61	243	115
1984-85	86	68	44	118	48	268	119
1985-86	90	68	45	124	59	268	111
1986-87	94	69	47	129	72	267	104
1987-88	98	70	48	135	74	277	100
1988-89	102	71	49	142	189	175	59
1989-90	106	72	50	145	40	333	106
1990-91	107	73	51	146	229	148	44
1991-92	111	74	51	149	40	345	96
1992-93	112	74	52	149	240	147	38
1993-94	116	75	53	153	40	357	86
1994-95	119	76	54	156	216	189	43
1995-96	122	77	55	159	40	373	79
1996-97	126	78	55	162	40	381	75
1997-98	129	79	56	165	178	251	46
1998-99	131	80	57	166	40	394	68
1999-2000	135	81	58	169	64	379	61
2000-01	139	82	58	172	60	391	59
2001-02	142	83	59	175	57	402	57
				Residual Value 12.4090 x .141 x 652.2			636
				Total Discounted Benefits			3,322
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.27

TABLE G.3 - BENEFITS AND COSTS OF A CANBERRA YASS RAIL LINK

Assumptions: Low total freight projection
Medium degree of freight conversion
Low valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	Producers' Surplus (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	54	22	34	132	58	184	161
1975-76	57	22	36	142	40	217	177
1976-77	60	23	38	151	58	214	163
1977-78	63	23	40	161	40	247	176
1978-79	65	23	42	171	40	261	174
1979-80	69	23	43	181	58	258	161
1980-81	72	24	45	191	40	292	170
1981-82	75	24	47	202	40	308	168
1982-83	79	24	50	213	40	326	166
1983-84	82	25	52	224	61	322	153
1984-85	86	25	54	235	48	352	156
1985-86	90	25	56	247	59	359	149
986-87	94	25	58	259	72	364	141
1987-88	98	26	60	271	74	381	138
1988-89	102	26	63	283	189	285	97
1989-90	106	26	64	290	40	446	141
1990-91	107	27	64	291	229	260	77
1991-92	111	27	66	298	40	462	128
1992-93	112	27	66	299	240	264	68
1993-94	116	28	67	305	40	476	115
1994-95	119	28	69	312	216	312	71
1995-96	122	28	70	318	40	498	105
1996-97	126	29	71	325	40	511	101
1997-98	129	29	73	331	178	384	71
1998-99	131	29	73	332	40	525	90
1999-2000	135	30	74	338	64	513	83
2000-01	139	30	75	344	60	528	79
2001-02	142	30	77	351	57	543	77
				Residual Value 12.4090 x .141 x 498.6			872
				Total Discounted Benefits			4,428
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.36

TABLE G.4 - BENEFITS AND COSTS OF A CANBERRA YASS RAIL LINK

Assumptions: Low total freight projection
Medium degree of freight conversion
High valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings	User Benefits	Perceived User Benefits	'Producers' Surplus'		Undis-counted	Discounted (at 7 per cent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	54	60	44	132	58	232	203
1975-76	57	61	46	142	40	266	217
1976-77	60	61	48	151	58	262	200
1977-78	63	62	50	161	40	296	211
1978-79	65	63	52	171	40	311	207
1979-80	69	64	54	181	58	310	193
1980-81	72	65	56	191	40	344	200
1981-82	75	65	58	202	40	360	196
1982-83	79	66	60	213	40	378	192
1983-84	82	67	62	224	61	374	178
1984-85	86	68	65	235	48	406	180
1985-86	90	68	67	247	59	413	171
1986-87	94	69	69	259	72	419	163
1987-88	98	70	72	271	74	437	158
1988-89	102	71	74	283	189	341	116
1989-90	106	72	76	290	40	504	160
1990-91	107	73	76	291	229	318	94
1991-92	111	74	78	298	40	521	144
1992-93	112	74	78	299	240	323	83
1993-94	116	75	80	305	40	536	130
1994-95	119	76	81	312	216	372	84
1995-96	122	77	82	318	40	559	118
1996-97	126	78	84	325	40	573	113
1997-98	129	79	85	331	178	446	82
1998-99	131	80	86	332	40	589	101
1999-2000	135	81	87	338	64	577	93
2000-01	139	82	89	344	60	594	89
2001-02	142	83	90	351	57	609	86
				Residual Value 12.4090 x .141 x 563			985
				Total Discounted Benefits			5,147
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.41

TABLE G.5 - BENEFITS AND COSTS OF A CANBERRA YASS RAIL LINK

Assumptions : Low total freight projection
High degree of freight conversion
Low valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings	User Benefits	Perceived User Benefits	' Producers' Surplus '		Undis-counted	Discounted (at 7 per cent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	54	22	57	264	58	339	296
1975-76	57	22	61	283	40	383	313
1976-77	60	23	64	302	58	391	298
1977-78	63	23	68	322	40	436	311
1978-79	65	23	72	342	40	462	308
1979-80	69	23	75	362	58	471	293
1980-81	72	24	79	383	40	518	301
1981-82	75	24	83	404	40	546	297
1982-83	79	24	87	426	40	576	293
1983-84	82	25	91	448	61	585	278
1984-85	86	25	95	471	48	629	279
1985-86	90	25	99	494	59	649	269
1986-87	94	25	104	518	72	669	260
1987-88	98	26	108	542	74	700	253
1988-89	102	26	113	566	189	618	210
1989-90	106	26	115	580	40	787	249
1990-91	107	27	116	583	229	604	179
1991-92	111	27	118	596	40	812	225
1992-93	112	27	119	598	240	616	159
1993-94	116	28	121	611	40	836	202
1994-95	119	28	124	623	216	678	153
1995-96	122	28	126	636	40	872	184
1996-97	126	29	128	649	40	892	176
1997-98	129	29	131	662	178	773	142
1998-99	131	29	131	663	40	914	157
1999-2000	135	30	134	676	64	911	147
2000-01	139	30	136	688	60	933	140
2001-02	142	30	138	701	57	954	135
				Residual Value 12.4090 x .141 x 687			1,569
				Total Discounted Benefits			8,076
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.65

TABLE G.6 - BENEFITS AND COSTS OF A CANBERRA YASS RAIL LINK

Assumptions : Low total freight projection
High degree of freight conversion
High valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings	User Benefits	Perceived User Benefits	Producers' Surplus		Undis-counted	Discounted (at 7 per cent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	54	60	67	264	58	387	338
1975-76	57	61	71	283	40	432	353
1976-77	60	61	74	302	58	439	335
1977-78	63	62	78	322	40	485	346
1978-79	65	63	82	342	40	512	341
1979-80	69	64	86	362	58	523	326
1980-81	72	65	89	383	40	569	331
1981-82	75	65	93	404	40	597	325
1982-83	79	66	98	426	40	629	320
1983-84	82	67	102	448	61	638	303
1984-85	86	68	106	471	48	683	303
1985-86	90	68	110	494	59	703	292
1986-87	94	69	115	518	72	724	281
1987-88	98	70	119	542	74	755	273
1988-89	102	71	124	566	189	674	228
1989-90	106	72	127	580	40	845	268
1990-91	107	73	127	583	229	661	196
1991-92	111	74	130	596	40	871	241
1992-93	112	74	131	598	240	675	174
1993-94	116	75	133	611	40	895	217
1994-95	119	76	136	623	216	738	167
1995-96	122	77	138	636	40	933	197
1996-97	126	78	141	649	40	954	188
1997-98	129	79	143	662	178	835	154
1998-99	131	80	144	663	40	978	168
1999-2000	135	81	147	676	64	975	157
2000-01	139	82	149	688	60	998	150
2001-02	142	83	152	701	57	1021	144
				Residual Value 12.4090 x .141 x 961.4			1,682
				Total Discounted Benefits			8,798
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.71

TABLE G.7 - BENEFITS AND COSTS OF A CANBERRA YASS RAIL LINK

Assumptions : High total freight projection
Low degree of freight conversion
Low valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings	User Benefits	Perceived User Benefits	' Producers' Surplus '		Undis-counted	Discounted (at 7 per cent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	59	22	25	78	58	126	110
1975-76	62	22	26	84	40	154	126
1976-77	65	23	27	89	58	140	111
1977-78	68	23	28	95	40	174	124
1978-79	72	23	29	101	40	185	123
1979-80	75	23	30	107	58	177	110
1980-81	79	24	32	113	40	208	121
1981-82	83	24	33	119	40	219	119
1982-83	87	24	34	126	40	231	117
1983-84	91	25	36	132	61	223	106
1984-85	95	25	37	139	48	248	110
1985-86	100	25	38	146	59	250	104
1986-87	105	25	40	153	72	251	97
1987-88	109	26	41	160	74	262	95
1988-89	113	26	42	163	189	155	53
1989-90	118	26	43	171	40	318	101
1990-91	120	27	44	172	229	134	40
1991-92	124	27	44	176	40	331	92
1992-93	126	27	45	177	240	135	35
1993-94	130	28	46	180	40	344	83
1994-95	134	28	46	184	216	176	40
1995-96	137	28	47	188	40	360	76
1996-97	141	29	48	192	40	370	73
1997-98	145	29	49	196	178	241	44
1998-99	148	29	49	196	40	382	66
1999-2000	152	30	50	200	64	368	59
2000-01	156	30	51	203	60	380	57
2001-02	160	30	52	207	57	392	55
				Residual Value 12.4090 x .141 x 352.6			617
				Total Discounted Benefits			3,064
				Discounted Capital Cost			12,429
				Benefit/Cost Ratio			0.25

TABLE G.8 - BENEFITS AND COSTS OF A CANBERRA-YASS RAIL LINK

Assumptions: High total freight projection
Low degree of freight conversion
High valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	'Producers' Surplus ' (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	59	60	34	78	58	173	151
1975-76	62	61	36	84	40	203	166
1976-77	65	61	37	89	58	194	148
1977-78	68	62	38	95	40	223	159
1978-79	72	63	39	101	40	235	157
1979-80	75	64	41	107	58	229	143
1980-81	79	65	42	113	40	259	151
1981-82	83	65	43	119	40	270	147
1982-83	87	66	45	126	40	284	144
1983-84	91	67	46	132	61	275	131
1984-85	95	68	48	139	48	302	134
1985-86	100	68	49	146	59	304	126
1986-87	105	69	51	153	72	306	119
1987-88	109	70	52	160	74	317	115
1988-89	113	71	53	163	189	211	72
1989-90	118	72	55	171	40	376	119
1990-91	120	73	55	172	229	191	57
1991-92	124	74	56	176	40	390	108
1992-93	126	74	57	177	240	194	50
1993-94	130	75	58	180	40	403	98
1994-95	134	76	59	184	216	237	54
1995-96	137	77	60	188	40	422	89
1996-97	141	78	61	192	40	432	85
1997-98	145	79	62	196	178	304	56
1998-99	148	80	62	196	40	446	77
1999-2000	152	81	63	200	64	432	70
2000-01	156	82	64	203	60	445	67
2001-02	160	83	65	207	57	458	65
				Residual Value 12.4090 x .141 x 417			730
				Total Discounted Benefits			3,788
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.30

TABLE G.9 - BENEFITS AND COSTS OF A CANBERRA-YASS RAIL LINK

Assumptions: High total freight projection
Medium degree of freight conversion
Low valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Costs	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	'Producers' Surplus' (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	59	22	38	156	58	217	189
1975-76	62	22	41	167	40	252	206
1976-77	65	23	43	179	58	279	213
1977-78	68	23	45	190	40	286	204
1978-79	72	23	47	202	40	304	202
1979-80	75	23	49	214	58	303	189
1980-81	79	24	52	226	40	341	198
1981-82	83	24	54	239	40	360	196
1982-83	87	24	56	252	40	379	193
1983-84	91	25	59	265	61	379	180
1984-85	95	25	61	278	48	411	182
1985-86	100	25	64	292	59	422	175
1986-87	105	25	66	306	72	430	167
1987-88	109	26	69	320	74	450	163
1988-89	113	26	70	327	189	347	118
1989-90	118	26	73	343	40	520	165
1990-91	120	27	74	344	229	336	99
1991-92	124	27	75	352	40	538	149
1992-93	126	27	76	353	240	342	88
1993-94	130	28	77	361	40	556	135
1994-95	134	28	79	368	216	393	89
1995-96	137	28	80	376	40	581	123
1996-97	141	29	82	384	40	596	117
1997-98	145	29	83	391	178	470	86
1998-99	148	29	84	392	40	613	105
1999-2000	152	30	85	399	64	602	97
2000-01	156	30	86	407	60	619	93
2001-02	160	30	88	414	57	635	90
				Residual Value 12.4090 x .141 x 587.8			1,028
				Total Discounted Benefits			5,239
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.42

TABLE G.10 - BENEFITS AND COSTS OF A CANBERRA-YASS RAIL LINK

Assumptions: High total freight projection
Medium degree of freight conversion
High valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings	User Benefits	Perceived User Benefits	Producers' Surplus		Undis-counted	Discounted (at 7 per cent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	59	60	48	156	58	265	231
1975-76	62	61	50	167	40	300	245
1976-77	65	61	53	179	58	300	229
1977-78	68	62	55	190	40	335	239
1978-79	72	63	57	202	40	354	236
1979-80	75	64	60	214	58	355	221
1980-81	79	65	62	226	40	392	228
1981-82	83	65	64	239	40	411	224
1982-83	87	66	67	252	40	432	219
1983-84	91	67	70	265	61	432	205
1984-85	95	68	72	278	48	465	206
1985-86	100	68	75	292	59	476	198
1986-87	105	69	78	306	72	486	189
1987-88	109	70	80	320	74	505	183
1988-89	113	71	82	327	189	404	137
1989-90	118	72	85	343	40	578	183
1990-91	120	73	85	344	229	393	116
1991-92	124	74	87	352	40	597	165
1992-93	126	74	88	353	240	401	103
1993-94	130	75	89	361	40	615	149
1994-95	134	76	91	368	216	453	102
1995-96	137	77	93	376	40	643	136
1996-97	141	78	94	384	40	657	129
1997-98	145	79	96	391	178	533	98
1998-99	148	80	96	392	40	676	116
1999-2000	152	81	98	399	64	666	107
2000-01	156	82	100	407	60	685	103
2001-02	160	83	101	414	57	701	99
				Residual Value 12.4090 x .141 x 652.2			1,141
				Total Discounted Benefits			5,937
				Discounted Capital Cost		$ Million	12.429
				Benefit/Cost Ratio			0.48

TABLE G.11 - BENEFITS AND COSTS OF A CANBERRA-YASS RAIL LINK

Assumptions: High total freight projection
High degree of freight conversion
Low valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Cost	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	'Producers' Surplus' (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	59	22	66	313	58	402	351
1975-76	62	22	70	335	40	449	366
1976-77	65	23	74	357	58	461	352
1977-78	68	23	78	380	40	509	363
1978-79	72	23	82	404	40	541	360
1979-80	75	23	87	428	58	555	346
1980-81	79	24	91	452	40	606	353
1981-82	83	24	96	478	40	641	349
1982-83	87	24	101	503	40	675	343
1983-84	91	25	105	530	61	690	328
1984-85	95	25	110	557	48	739	328
1985-86	100	25	115	584	59	765	317
1986-87	105	25	120	612	72	790	307
1987-88	109	26	125	640	74	826	299
1988-89	113	26	128	653	189	731	248
1989-90	118	26	134	686	40	924	293
1990-91	120	27	134	688	229	740	219
1991-92	124	27	137	704	40	952	264
1992-93	126	27	138	706	240	757	195
1993-94	130	28	141	722	40	981	237
1994-95	134	28	143	737	216	826	187
1995-96	137	28	146	752	40	1023	216
1996-97	141	29	149	767	40	1046	206
1997-98	145	29	152	782	178	930	171
1998-99	148	29	152	784	40	1073	185
1999-2000	152	30	155	799	64	1072	173
2000-01	156	30	158	813	60	1097	165
2001-02	160	30	161	828	57	1122	158
				Residual Value 12.4090 x .141 x 1058.8			1,853
				Total Discounted Benefits			9,532
				Discounted Capital Cost		**$ Million**	12.429
				Benefit/Cost Ratio			0.77

TABLE G.12 - BENEFITS AND COSTS OF A CANBERRA-YASS RAIL LINK

Assumptions: High total freight projection
High degree of freight conversion
High valuation of private travel time

Year	Base Traffic Benefits		Converted Traffic Benefits		Track Maintenance Costs	Total Net Benefits	
	Cost Savings (1)	User Benefits (2)	Perceived User Benefits (3)	'Producers' Surplus ' (4)	(5)	Undis-counted (6)	Discounted (at 7 per cent) (7)
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
1974-75	59	60	76	313	58	450	393
1975-76	62	61	80	335	40	498	406
1976-77	65	61	84	357	58	509	388
1977-78	68	62	88	380	40	558	398
1978-79	72	63	93	404	40	592	394
1979-80	75	64	97	428	58	606	378
1980-81	79	65	102	452	40	658	383
1981-82	83	65	106	478	40	692	376
1982-83	87	66	111	503	40	727	369
1983-84	91	67	116	530	61	743	353
1984-85	95	68	121	557	48	793	352
1985-86	100	68	126	584	59	819	340
1986-87	105	69	131	612	72	845	328
1987-88	109	70	137	640	74	882	319
1988-89	113	71	139	653	189	787	267
1989-90	118	72	145	686	40	981	311
1990-91	120	73	146	688	229	798	236
1991-92	124	74	149	704	40	1011	280
1992-93	126	74	150	706	240	816	211
1993-94	130	75	153	722	40	1040	252
1994-95	134	76	156	737	216	887	200
1995-96	137	77	159	752	40	1085	229
1996-97	141	78	162	767	40	1108	218
1997-98	145	79	165	782	178	993	183
1998-99	148	80	165	784	40	1137	196
1999-2000	152	81	168	799	64	1136	183
2000-01	156	82	171	813	60	1162	174
2001-02	160	83	174	828	57	1188	168
				Residual Value 12.4090 x .141 x 1123.2			1,965
				Total Discounted Benefits			10,250
				Discounted Capital Cost		**$ Million**	12.429
				Benefit/Cost Ratio			0.82