Bureau of Transport Economics

WORKING PAPER 45

BRISBANE–MELBOURNE RAIL LINK: ECONOMIC ANALYSIS

The Bureau of Transport Economics undertakes applied economic research relevant to the portfolio of Transport and Regional Services. This research contributes to an improved understanding of the factors influencing the efficiency and growth of these sectors and the development of effective policies.

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PREFACE

Historically, railways have provided the means to open up new areas for economic development. When built to link existing centres of economic activity, they have given rise to greatly increased opportunities for trade and travel. A major new rail link is therefore seen as an exciting prospect because of the potential for establishment of new businesses and growth in existing industries.

Nowadays, Australia's good quality arterial road network and highly efficient trucking industry already provide cost-effective, reliable freight transport links, so the case for building new rail lines and roads is less clear-cut. Careful research and analysis is required to understand whether major investments in infrastructure will be beneficial for the national economy.

Australian Transport & Energy Corridor Ltd (ATEC) has completed a pre-feasibility study of a new rail corridor linking Melbourne and Brisbane and passing through a number of regional centres along the way. The ATEC study considers the financial viability of the project by comparing benefits and costs for private sector investors. Governments need to take a broader view, giving consideration to benefits and costs to the whole national economy. The Deputy Prime Minister and Minister for Transport and Regional Services, the Hon John Anderson MP, asked the Bureau of Transport Economics to undertake an economic benefit–cost analysis of the ATEC proposal to provide this broader perspective.

The principal author of the paper was Quentin Reynolds. Dr William Lu and Brett Evill assisted with data review and analysis issues. Dr Mark Harvey provided overall supervision and input.

Tony Slatyer
Executive Director

Bureau of Transport Economics
Canberra
October 2000

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EXECUTIVE SUMMARY

The Minister for Transport and Regional services asked the Bureau of Transport Economics (BTE) to undertake a benefit–cost analysis of the inland rail link between Melbourne and Brisbane being proposed by Australian Transport & Energy Corridor Ltd (ATEC). The BTE analysis relies significantly on information gathered recently for a pre-feasibility study carried out for ATEC.

Nothing in this report is intended as comment on the financial viability of the ATEC proposal. BTE has not undertaken a re-assessment of the various estimates in the financial pre-feasibility study, but has relied on estimates made in that study and carried out sensitivity tests.

A number of options were analysed in the pre-feasibility study. The A2/A2M option was the one recommended, and it is this project on which the economic analysis is based. The A2 option provides for 2.5 km passing loops, 21 tonne axle loads, 1.25 per cent ruling gradients and line clearance to permit double stacked containers from Melbourne to Acacia Ridge, via Seymour, Albury-Wodonga, Parkes, Dubbo, Narrabri, Moree and Goondiwindi. The A2M variant achieves lower cost by undertaking different curve and grade alignment improvements, and catering for shorter train lengths, although operational performance is apparently maintained. Estimated construction costs for the A2/A2M option range from $1.2 B to $1.68 B, of which about 80 per cent is to be spent in the region between Moree and Brisbane on new lines.

The benefits were analysed under four headings: existing rail freight, rail freight transferring from road, induced freight, and landbridged containers. The new rail line is predicted to produce a significant reduction in the amount of road freight. Most of the economic benefits fall under this heading.

The net present value of the project is estimated to be over $8 billion, with a benefit–cost ratio (BCR) above 6, at a 4 per cent discount rate. These results are heavily dependent on the ATEC assumptions of freight flows and growth. Using lower freight volumes and higher costs, the sensitivity testing produced an NPV of $2.4 B and a BCR of 2.

It is understood that ATEC is currently developing a business case for the project. If that work significantly changed the estimates of freight flow and growth, it would be appropriate to review this benefit–cost analysis.

CHAPTER 1 BACKGROUND

Australian Transport & Energy Corridor Pty Ltd (ATEC) is proposing to establish an inland network of infrastructure linking capital cities. Rail, road, gas, electricity, water and fibre optic cables are all part of the scheme.

The first stage of the ATEC proposal is an inland rail link between Melbourne and Brisbane. During 2000, ATEC coordinated a financial pre-feasibility study, which was partly funded by the Department of Transport and Regional Services. The study was carried out by Maunsell McIntyre Pty Ltd in association with Access Economics, Macquarie Bank and Corrs Chambers Westgarth (MMI).

The Minister for Transport and Regional Services asked the Bureau of Transport Economics (BTE) to undertake a benefit–cost analysis of the proposal. This paper reports that analysis. The analysis relies significantly on information gathered and estimates made by MMI as part of the ATEC financial pre-feasibility study. Nothing in this paper should be taken as support or otherwise for the estimates in the ATEC study.

ATEC representatives have been promoting the rail elements of their national project as providing fast, low-cost, environmentally friendly and reliable transport, at no cost to government. The proposal has attracted significant support from the local communities through which the transport corridor is tentatively planned to run.

Early drafts of the ATEC study suggested train operating speeds of up to 300 km/h for passenger services and 160 km/h for freight trains, and project expenditures of up to nearly $6 billion. The final report recommended an option that involves expenditures of between $1.2 and $1.68 billion, with operational speeds up to 115 km/h. It is this final recommendation (called the A2/A2M option) that is the basis of this benefit–cost analysis.

CHAPTER 2 PURPOSE

Being a benefit–cost analysis, the present study aims to estimate the net benefits to Australia as a whole of constructing and operating the proposed Melbourne to Brisbane rail line.

A clear distinction needs to be made between an economic (benefit–cost) analysis and a financial analysis. According to Austroads (1996, p.1),

> Benefit Cost Analysis (BCA) is a technique for assessing the economic efficiency of resource allocation. It allows us to compare alternative approaches to individual projects and to set priorities amongst competing projects. It uses as its framework the values of all costs and benefits to the community which can be quantified in money terms. …
>
> BCA can provide useful information to the decision maker about:
>
> - the economically best option out of a set of project alternatives;
> - priorities of competing projects within a constrained budget.

BTE (1999a) also begins with a definition of benefit–cost analysis, and contrasts it with financial analysis:

> Benefit–cost analysis (BCA) means different things to different people. As defined in this report, it is basically what the name suggests: an analysis of the benefits and costs to society of some action. In addition, a BCA attempts to value benefits and costs in monetary terms as far as possible and to produce a summary measure of net benefit. …
>
> The contrast is often with financial analysis from the perspective of a business. A financial analysis of a private tollway, for example, would include the costs to the business of constructing sound barriers. But it would ignore the cost to society of the remaining noise, unless the business were somehow made to pay for it. A BCA, on the other hand, would want to consider the costs of both the barrier and any remaining noise. (p. 1).

For example, as a result of building a Melbourne to Brisbane rail line, rail transport would replace some truck transport. In both financial and economic analyses, more rail transport and less truck transport are seen as positives for the project—but how this is valued differs totally. In a financial analysis of train operations, the amount of freight that is won over from trucks provides income to the railway operator and is valued at the charge rate that rail could collect. In an economic analysis, the benefits from freight won over from trucks could be valued in two ways, both of which should, in theory, give similar results.

One method comes about from defining the service being provided as 'freight transport' without regard to mode. The new railway line, road haulage and the existing rail network all provide the same service but at different prices. Differences in quality between transport alternatives such as transit time can be accounted for by expressing them in monetary values.

When consignors switch from road to rail, society reaps the benefits of reduced use of road transport via savings in:

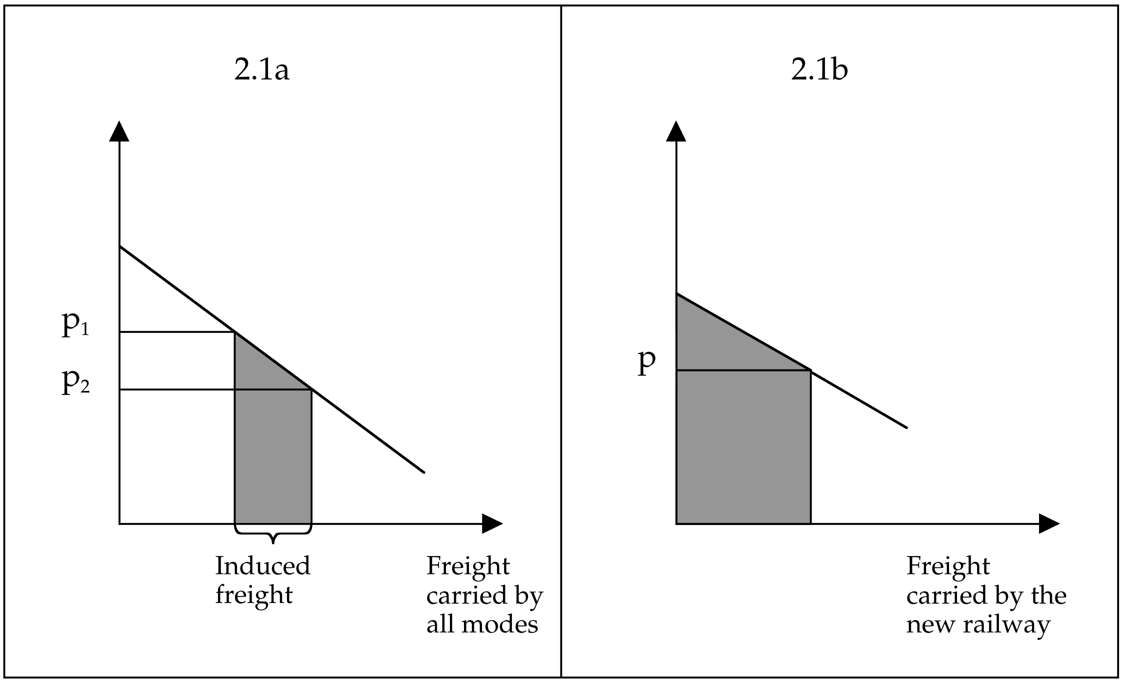
- fuel costs
- road maintenance and repair costs
- accident costs
- enforcement costs
- congestion costs
- cost of regulations
- pollution costs
- noise costs
- cost of time for freight by road
- other line haul costs (driver and other vehicle operating costs).

These would be offset against the additional resource costs of the extra rail transport, under similar headings, namely:

- fuel costs
- rail maintenance and repair costs
- accident costs
- pollution costs
- noise costs
- cost of time for freight by rail
- other line haul costs (wages and other train operating costs).

Benefits from freight shifting from the existing rail system to the new line would be treated similarly. For new freight induced by the project, the benefits would be assessed as consignors' 'willingness-to-pay' for the freight less the resource costs of carrying the freight. 'Willingness-to-pay' is measured as the area under the demand curve *for transport*, over the portion representing the induced freight (the shaded area in figure 2.1a below). The height of the demand curve above any unit of output indicates the maximum amount the purchaser would be prepared to pay for that unit. Hence it represents his or her valuation of the benefit from the unit.

FIGURE 2.1 WILLINGNESS-TO-PAY



Under the alternative method, the new railway is regarded as providing a new service altogether. The new service, road transport and the existing rail system all have their own separate, but related, demand curves. The benefit from the new rail service is the full willingness-to-pay area under the demand curve for the service regardless of where the freight originates (ie. road, existing rail, or induced) (the shaded area in figure 2.1b). From this benefit, the resource costs of the new railway line need to be subtracted.

Under this method, the area under the demand curve captures all the benefits except where freight rates for road and existing rail differ from resource costs. For example, if heavy trucks were not paying fully for the costs of damage to roads or if they caused externalities such as pollution and noise, there would be some extra benefits to factor in—the costs of the damage to roads less charges levied, plus the externality costs for the trucks taken off the roads.

The present study has followed the first of the two methods, treating the new railway as providing the same service as road transport and the existing rail network. The difficulty with implementing the second method is that it requires knowledge of the whole demand curve to the left of the forecast output level, which is very difficult to obtain with reasonable confidence. As part of the financial modelling in ATEC (2000), Access Economics developed a set of demand curves for the new service in order to forecast quantities of freight that will switch from road to rail. However, the shapes of these demand curves are determined by assumptions, which, while plausible, are not empirically derived.

REGIONAL ISSUES

From a regional development perspective, if any part of Australia is targeted with hundreds of millions of dollars of expenditure over a few years, that area is likely to benefit over the period of expenditure, with temporary increases in employment, supplier business turnover and profits. It is possible that this will be the case in the region from Moree to Brisbane, where most of the expenditure will occur if the project proceeds. But this is not an economic benefit as far as the traditional benefit–cost analysis is concerned. Regional development impacts are not counted as part of the 'benefit' stream. In all probability, high growth in particular industries supporting and surrounding the rail line will be at the expense of growth elsewhere in Australia. This approach is supported by BTE (1999a), which provides a discussion of employment creation, national impacts, and regional development issues (especially chapters 5, 9 and 10).

In particular, BTE (1999a, chapter 5) considers whether employment creation benefits should be estimated. It states:

> The effect of an infrastructure project on aggregate employment is extremely difficult to estimate. (p. 49)
>
> … the use of workers for the project will reduce employment elsewhere in the economy … (p. 51)
>
> Reliable estimates of the aggregate employment effects of transport investments are unavailable. Transport BCAs should exclude such effects from their estimates of net benefit; the working assumption should be that such effects are absent, as various government agencies have recommended in their BCA guidelines (Summary, p. 55)

In the current analysis, the returns to Australia as a whole over the life of the project (in terms of lower transport costs and increased consumer surplus) are compared against the costs of construction and operation. The Productivity Commission also supports this approach of focussing on the use of infrastructure rather than the impacts of its production[1].

NO COST TO GOVERNMENT

Despite claims that the project '… could be implemented on a no cost to Government basis' (ATEC 2000, page 8) one or more levels of government will be involved if the project goes ahead. Much of the proposed project from Melbourne to Brisbane involves relatively minor upgrades within existing alignments. However, land will have to be purchased for some new rail line

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1 Australia's Gambling Industries, Draft Report, 1999 – 'But these 'production side' benefits … *are* largely illusory. … The real contribution … depends on the extent to which consumers are better off …' (p. XXV, italics in original).

reservations. Depending on the final option chosen, this will involve between 100 and 200 kilometres of new line. It is only governments that have the powers of compulsory acquisition—the project is most unlikely to proceed unless it receives government assistance in acquiring the necessary land.

Knowing whether the project is likely to benefit Australia as a whole will assist governments in deciding whether to support it. A benefit–cost analysis seeks to answer this question.

Other important questions such as how the project is financed, who owns the infrastructure, what contractual arrangements exist and whether governments contribute any significant funds, are not addressed here.

CHAPTER 3 METHODOLOGY

A benefit–cost analysis requires a clear understanding of the base case, that is, the situation *in the absence* of the project. ATEC (2000, table 5.3, page 138) provided estimates of the existing rail freight market in the form of an origin–destination matrix, for the year 2000. MMI's further advice to BTE provided a breakdown of that estimated freight task into nine commodity groups (email from K Baggett, 19 June 2000). This freight flow by rail has been assumed to constitute the base case. ATEC (2000, table 6.2, page 150) showed 'freight growth rate forecasts by commodity' for different time periods. These were taken to apply to the base case (up to the year 2015—see below under Rail Freight Demand Modelling).

The improved or project case also needs to be clearly defined. There are a number of improvements that could be made in the Melbourne to Brisbane corridor that would result in less road transport and/or more transport by train. A total of seven options are contemplated in ATEC (2000), but the ones finally recommended are called A2 and A2M.

The A2 option provided for 2.5 km passing loops, 21 tonnes axle loads, 1.25 per cent ruling gradients, line clearance to permit double stacked containers from Melbourne to Acacia Ridge and maximum train speeds of between 80 and 115 km/h depending on numerous design and terrain parameters. The A2M variant has a slightly lower construction cost by having different improvements to curve and grade alignment, and catering for shorter train lengths, although operational performance and freight flow characteristics are apparently the same as for A2. For both, about 80 per cent of the cost is for new lines in the region between Moree and Brisbane and the remainder for upgrading existing track from Melbourne to Moree, via Seymour, Albury–Wodonga, Parkes, Dubbo and Narrabri. Between Goondiwindi and Brisbane, the route is referenced as going via Toowoomba, although an alternative route option via Warwick is also mentioned.

The freight estimated to flow by rail in the year 2000 if the A2/A2M project had been operating, was advised by MMI in spreadsheets covering nine commodity groups by origin–destination pair (email from K Baggett, 6 July 2000). ATEC referred to this freight as its 'core' inland rail market. The same 'freight growth rate forecasts by commodity' used for the base case are assumed to apply.

ATEC (2000, table 6.35, page 179) provided estimates of 'potential additional market' (induced demand and landbridging) for each commodity, as a percentage of the core rail freight. This was included as part of the project case. The same 'freight growth rate forecasts by commodity' were assumed, except for landbridged containers, for which ATEC (2000, table 6.33, page 176) provided separate estimates.

CONSTRUCTION COSTS

Construction costs include planning, design, approvals, construction and commissioning of missing links and upgrading of existing sections, including sidings, passing loops and transfer/terminus/shunting facilities. ATEC (2000, pp. 68, 70, 89) provided estimates of costs for the A2/A2M proposals, from $1.2 B to $1.68 B.

Sensitivity testing

ATEC (2000, p. 315) suggested that a future feasibility study should include:

- further route option investigation;
- detailed review of existing infrastructure along the routes (in particular the preferred routes); and
- identification of preferred solutions in urban areas (ie. Melbourne, Brisbane).

Despite the apparently substantial work so far (as evidenced by the 320 page ATEC report and equally thick appendices), the above quotation suggests that the ATEC construction cost estimates are not very robust. As part of the sensitivity test, the high estimate of construction cost was increased by 50 per cent.

RAIL FREIGHT DEMAND MODELLING

ATEC (2000) used a two-step approach to predict rail freight demand over the next 35 years. The first step involved using the Access Economics Macro model to predict future economic growth and to help estimate future freight demand on each origin–destination link.

The second step was to employ a discrete choice model for determining the rail share of the total projected freight demand. For the modelling, it was stipulated that the rail share depends on the 'effective price' of rail compared to road. The effective price for rail was defined as comprising three elements—monetary price, time and level of service quality. Time and service quality differences were assessed between road and rail. These differences were converted to monetary values by using weights to represent varying degrees of importance for each commodity, and calibration weights to reflect historical trends.

Overall, the approach used for freight forecasting seems to be theoretically sound, although the application may be problematic. In particular, the items considered as determinants of service quality may not be exhaustive. Other considerations, which may influence mode choice, include packaging, damage costs and security. The pick-up and delivery times to and from the rail stations do not explicitly take account of limited train schedules and terminal capacities, so delivery by train may not be as seamless and comparable as modelled.

The effective price for rail may, therefore, have been under-estimated, or its relative competitiveness with road freight over-estimated. This was considered in designing the sensitivity testing.

ATEC (2000, p. 122) suggested that 'the infrastructure is around saturation point' at 2015 with the predicted freight volumes, and some undefined additional infrastructure would be required. Economic benefits grow with freight volume, but growth will fall off if congestion problems occur. This issue was resolved by maintaining ATEC's 30 year operating period (2005 to 2034), but reducing the growth in benefits beyond 2015 to zero.

BENEFITS

Existing Rail Freight

In assessing the differences between the base and project cases, the changes to the resource costs of existing rail transport, that is, freight travelling on the existing tracks, were considered first. The 'resource cost' is the cost to Australia as a whole. The base-case rail freight was predicted to travel faster and at lower cost via the new infrastructure (ATEC, 2000, pp. 141 and 153). Whether the existing rail freight transfers to the new rail network depends on future negotiations between ATEC and the existing rail authorities. For the purposes of this analysis, a full transfer of freight was assumed to occur.

ATEC (2000, p141) estimated that the current time required for rail transport from Melbourne to Brisbane, including 6 hours for pickup and delivery, is 40 hours. With a distance of 1941 km and a transit time of 34 hours, the average train speed is 57 km/h. This is a reasonable speed to use as a network average and was used as the basis for all other origin–destination calculations of trip time for existing rail.

Base-case distances and travel times by rail were estimated using a 'distance by line sector' spreadsheet provided by Rail Access Corporation (email from D Harris, 4 August 2000). Travel times for all origin–destination pairs were calculated using the average network speed of 57 km/h. The same time adjustments as used by MMI were incorporated, except that an allowance of 6 hours for freight to/from Toowoomba or Warwick was added, to allow for a transfer from standard gauge rail to narrow gauge.

MMI provided estimates of travel time by origin–destination for the A2/A2M option in two groups: coal, minerals and bulk agricultural products in a slow speed group (maximum 80 km/h); and all other commodities in a higher speed group. The travel times included allowances of 6 hours for pickup and delivery, plus additional delays for particular origin–destination pairs of up to 6 hours.

From MMI's estimate of the existing rail freight task, estimates of tonne·kilometres and tonne·hours were made, based on the base-case origin-destination distances, and the trip times calculated above. Similar estimates were made for the base-case freight being transported over the A2/A2M network, using MMI's distance and trip time estimates. The new network provided savings of 1.1 billion tonne·kilometres of train travel and 16.5 million tonne·hours of freight in transit.

There are three elements of benefit under the existing rail freight category. First, each tonne·kilometre of train travel is forecast to cost less than existing trains, due to operational improvements. Second, there are fewer tonne·kilometres of train travel due to the new rail links providing shorter distances between some origin–destination pairs. These two produce reductions in operating costs, some of which can be passed on to users in the form of lower charges.

Third, with higher speeds and some shorter distances, there will be less tonne·hours of freight in transit. This is of direct value to users, who can respond more quickly to market requirements, would incur less costs of degradation in transit for highly perishable goods, and may be able to operate with reduced inventory levels.

Sensitivity testing

The above benefits are directly proportional to the amount of freight—if half as much freight were won from existing rail markets, the benefits would be halved. Reservations about the assumption that ATEC will win all of the existing rail freight have already been noted.

The benefits are also dependent on the improvements in rail operating cost and speed. These are linked to MMI's understanding of current rail technology and its application to Australian climate and terrain.

Reducing the benefits in this category by 70 per cent has been taken as the test. This is put forward as a possible outcome if relations with existing rail authorities do not result in the free or low priced handover of all existing rail customers along the corridor, as assumed by ATEC (2000).

Rail Freight transferring from Road

ATEC (2000) refers to the freight it expects to win from the existing road and rail freight markets as its 'core' freight. About half of the core freight predicted to run on the A2/A2M network is to be won over from road.

Using BTE (1999b), estimates were made of the avoidable resource costs of road and rail transport operations. While rail transport involves lower costs, road transport is quicker. An allowance for the longer delivery times for freight switching from road to rail was included as a negative benefit.

ATEC's core freight transferred from road produces a reduction of 10.3 billion tonne·kilometres of road freight per annum. In valuing this benefit to Australia, an average resource cost per tonne·kilometre for road freight was used. This reduction in costs within the long distance road freight industry is partially offset by additional costs for the new rail transport.

A notable element is that the amount of steel and building materials being moved from Wollongong by rail (mostly to Melbourne) seems to decrease with the project implementation. This could come about from the pricing structure being proposed, which may have the effect of causing existing rail freight to shift to road transport[2]. This is only significant for steel and building materials from Wollongong. As stated above, the general impact is a reduction in road freight between virtually all origin–destination pairs.

Sensitivity testing

The benefits from road freight transferring to rail are, again, directly proportional to the amount of freight. If half as much freight is won from the existing road markets, the benefits will be halved. Reservations about the share of the existing road freight market that ATEC will win were expressed above.

The road freight market is highly competitive with no likelihood that a long-term price discount could be offered to counter the lower prices being proposed by ATEC. The question of how much freight will be won (from road) depends on the thoroughness of the ATEC analyses, especially with respect to the actual sensitivities of users to the price, delivery and reliability characteristics of the new rail services.

As part of the sensitivity test, the benefits from freight transferring from road to rail were reduced by 60 per cent.

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2 MMI supplied the estimates of existing rail freight flows by commodity by origin–destination pair. This was relied upon by BTE, since it was the only readily available source of such data. However, existing rail freight flows are not a critical element in the ATEC financial analysis. Rather, they are used as one element towards estimating the existing total freight task, and as such, may have been developed with less effort than the more critical elements of the revenue prediction task.

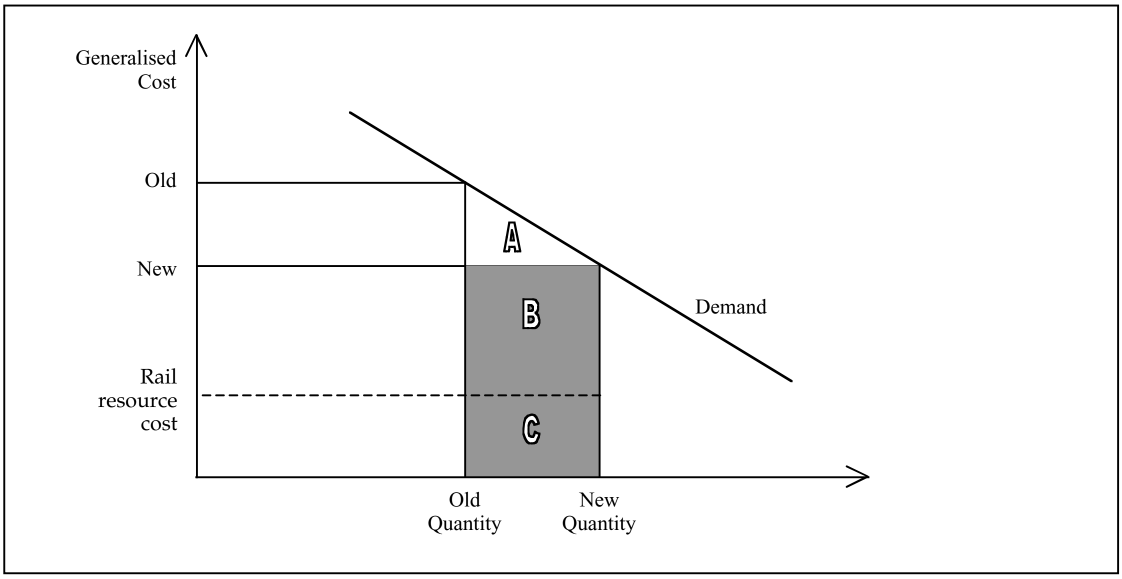
Induced Freight

ATEC (2000, p. 174 and following) provides freight flow estimates for landbridged containers and induced demand. These forecasts are based on the lower transport costs that the A2/A2M project provides. A lower price produces an increase in the quantity demanded because of the downward sloping demand curve. The new customers (or existing customers transporting additional freight) receive a benefit from transporting new (or additional) freight.

As a percentage of its ‘core’ rail freight, ATEC (2000, table 6.35, page 179) forecasts significant induced freight for some commodities (containers 106 per cent, domestic fruit and vegetables 80 per cent) and little induced freight for others (motor vehicles 2 per cent). Except for containers (see below), this additional freight was assumed to flow between the existing origin–destination locations for core freight. Induced freight was estimated to produce 1.76 billion tonne·kilometres of additional freight on the A2/A2M rail network, and 48.3 million tonne·hours of additional freight in transit per annum.

To estimate the benefit, the extra freight was valued at a generalised cost on the A2/A2M rail network. The generalised cost incurred by consignors is defined as the price charged plus the value of time for the freight in transit. The benefit is represented by the area under the demand curve (triangle A plus shaded areas B and C shown in figure 3.1 below).

FIGURE 3.1 USER BENEFITS AND GENERALISED COST



The generalised cost used should have been the average of the generalised costs for the new rail and the existing rail—the total area under the demand curve between the old quantity and the new quantity. Using only the generalised cost of the new rail system omits a small triangle of consumer surplus gains (triangle A shown in figure 3.1).

Given the effort involved, the likely small impact on the results and the confidential nature of the information, it was considered not warranted to attempt to collect existing rail pricing structures by commodities by origin-destination pairs, in order to calculate the correct average generalised cost.

The resource costs of transporting the extra freight were estimated as the freight task in tonne·kilometres for each commodity, multiplied by the estimated resource cost of operations on the new rail system (the shaded area C shown in figure 3.1 above).

Sensitivity testing

ATEC (2000) was a Pre-Feasibility study. The primary objective was to establish, to a level of confidence, the financial viability of the railway as a commercial undertaking. The study excluded the effects of induced freight from the financial analysis. The justification for this was that bankers are conservative and income from this source is more risky than from the existing road and rail freight market:

> Induced revenues are unlikely to be valued by banks, and … has not been included in the analysis, ie. only existing and diverted revenue has been included. (ATEC 2000, page 192)

Regardless of why the induced freight was omitted in the ATEC analysis, it is a regular part of most benefit–cost analyses of transport projects. As part of the sensitivity test, benefits of this type were reduced by 50 per cent.

Landbridged Containers

All of the potential additional market for shipping containers estimated in ATEC (2000, p. 179) is assumed to come from landbridging of freight. Landbridging involves transporting imports or exports by rail between ports, allowing ships to skip some ports-of-call. The market is relatively small in Australia and is somewhat different from the concept of induced freight. The benefits from landbridging are reduced ship costs and reduced transit times for freight. These are offset by the additional land transport costs.

Landbridging containers is a case of freight diversion, from sea to rail. However, the information needed to assess these benefits and costs is not available from ATEC (2000) and it is not readily available from other BTE sources. A rigorous analysis of landbridging among Melbourne, Sydney and Brisbane ports would involve taking into account long distance rail transport costs, plus:

- capacity constraints at all of the ports in question (numbers of berths, loading rates, draught limits);

- port and intermodal costs and charges;
- time and cost savings that might be possible for the fleet of ships serving Australia;
- the value of time savings for freight in transit; and
- transport costs between ports by other modes.

Assuming that freight transport in general (road, rail and ship) is reasonably efficient and produces relatively few externalities, an estimate of the minimum benefit can be made from the ATEC forecasts. The calculation is to estimate the revenue and subtract the avoidable resource costs of the extra rail transport. This is a minimum estimate because any re-organisation of the fleet of ships serving Australia as a consequence of landbridging, will increase ship productivity, which would be expected to be eventually passed on to users in the form of lower shipping charges.

ATEC (2000) forecasts high and low estimates of potential landbridge traffic in 2005, 2015 and 2025 (p.176); charge rates to capture that traffic (p. 177); and operating costs for container traffic on the A2 network (p. 120). With no other guidance from the ATEC report, and with growth beyond 2015 limited by network capacity, straight-line growth and the average of the ATEC high and low freight flow estimates were used. The traffic flow and charge rate figures were combined to forecast revenue. An estimate of the resource costs of the rail transport was made based on costings in BTE (1999b).

Sensitivity testing

ATEC (2000, p.176) provided high and low estimates of market capture for landbridged containers. For sensitivity testing, the low estimates were used.

CHAPTER 4 VALUATIONS AND RESULTS

Table 4.1 below summarises the values used to calculate the benefits of the project.

TABLE 4.1 VALUATIONS OF RAIL IMPACT

Commodity: / *Item*	*Shipping Containers*	*Chemicals & Fertiliser*	*Steel & Building Products*	*Domestic Fruit*	*Motor Vehicles*	*General Freight*	*Coal & Minerals*	*Bulk Ag. Products*	*Petroleum*
Time value for freight in transit (*$/t·h*)	1.60	1.60	1.20	2.40	2.99	1.60	0.36	0.00	1.67
A2/A2M rail cost (*¢/t·km*)	1.574	1.574	1.574	1.574	4.25	1.574	1.574	1.574	1.574
Existing rail cost (*¢/t·km*)	2.074	2.074	2.074	2.074	5.25	2.074	1.674	1.774	2.074
A2/A2M rail price (*¢/t·km*)	2.5	2.5	2.5	2.5	5.89	2.5	2.5	3.37	2.5
Growth rate (*per cent per annum*)	3.8	4.1	5.0	4.1	4.9	5.5	4.2	2.9	5.2

Time value for freight in transit

Values of time are needed to estimate the benefits of existing rail traffic travelling faster on the new network; the negative benefit of existing road traffic travelling slower when it changes to the new rail network; and the estimates of generalised cost used for calculating the benefits of the induced traffic.

Austroads (1999) provides values of time for freight in transit for different vehicle types, equivalent to approximately $0.60 per tonne·hour. ATEC (2000) includes its own transit time analysis as part of assessing the mode share to be won from road. Using information from ATEC's tables 6.6, 6.7, 6.9 and 6.11, in combination with equation (5) in ATEC's appendix E, produces the valuations in table 4.1 for individual commodities.

The fact that Bulk Agricultural Products, as well as Coal and Minerals, have lower values of freight than the Austroads averaged figure is understandable—non-perishable products or those with low values per tonne have little need to be delivered quickly. The magnitude by which the other commodities exceed the Austroads figure could be the source of some debate. However, ATEC (2000, appendix E, page E–15) in qualifying equation (5) and the mode share analysis, states that: 'The parameters … are weights used to calibrate the model to historical data'.

This is the only source available of values of time for freight in transit by different commodity groups, and was relied upon in the benefit–cost analysis.

A2/A2M rail cost

A2/A2M rail cost figures were used when comparing the cost of new rail travel with the cost of existing rail travel. BTE (1999b, pp. 60-65) provides estimates of rail charges under a competitively neutral regime vis-à-vis road. From that report, resource costs for rail consist of non-excise fuel cost 0.21, avoidable resource costs of infrastructure 0.30[3], accident costs 0.03, pollution costs 0.004, noise costs 0.02, and other line-haul costs 1.01 (including crew and train costs but excluding taxes and tariffs). The total of these resource costs for rail was 1.574 cents per net tonne·kilometre. This value was used for all commodities shown in table 4.1, except motor vehicles.

MMI suggested (spreadsheet 'AIRE(May2000).xls' provided by Ken Baggett, 11 July 2000) that above rail operating costs for most commodities will be 2.0 ¢ per ntk from 2005, with motor vehicles being a significant exception—its cost of carriage by rail is 5.39 ¢, a factor of 2.7 bigger. This difference is apparently related to the lower density, higher value and specialised nature of motor vehicle transport. To estimate the *resource* cost of motor vehicle transport by rail, the *resource* cost for other commodities was multiplied by 2.7.

Existing rail cost

Neither the financial operating costs, nor the resource costs of existing rail operations for different commodities are known. MMI (pers. comm. Ken Baggett, 3 August 2000) suggested that, compared to existing rail operations, A2/A2M rail costs will be 1.0 ¢ per ntk cheaper for Motor Vehicles; 0.1 ¢ cheaper for Coal and Minerals; 0.2 ¢ cheaper for Bulk Agricultural Products; and 0.5 ¢ cheaper for other commodities. Adding these differences to the A2/A2M rail costs (in the preceding line in table 4.1) gives estimates of the resource costs of existing rail operating costs.

3 Although infrastructure use fees in that report were 0.87 cents per net tonne·kilometre based on rail access fees, advice from Rail Access Corporation (pers. comm. Mr Derek Harris, 12 July 2000) is that access fees on average throughout Australia contribute significantly to fixed costs. Only 0.30 cents of the 0.87 cent charge was considered an avoidable resource cost.

A2/A2M rail prices

A2/A2M rail prices in table 4.1 are estimates of prices to be charged for induced freight. The values shown in table 4.1 are the operating cost (as given in ATEC 2000, page 120) plus half a cent, as suggested by MMI (pers. comm. Stephen Corcoran, Access Economics, 3 August 2000). These values are used, together with the values of time for freight in transit, to determine the generalised cost, which in turn is used to estimate the benefit of the induced freight.

Growth rates

Growth rates in table 4.1 are the estimates of freight growth rates, from 2006 to 2015, taken from ATEC (2000, p. 150). Except for landbridged containers, these compound annual growth rates apply to all the 2005 benefits (identified below) up to 2015. ATEC (2000, p. 176) provides other estimates for potential landbridge traffic in 2005 and 2015, and straight line growth between these years was used. At 2015, ATEC predicts saturation problems and benefits are assumed to remain constant beyond that year (see above on page 11).

Avoidable road transport cost

Avoidable road transport cost (*not* in table 4.1) is used to calculate the benefit when some road travel transfers to A2/A2M rail travel. BTE (1999b, pp. 60-65) provides estimates of road charges under a competitively neutral regime vis-à-vis rail. Although infrastructure use fees for road in that report were 0.97 cents per net tonne·kilometre, they included vehicle registration fees (access charges) of 0.34 cents. When this is removed, the remaining 0.63 cents represents avoidable resource costs of road infrastructure use. So for road, avoidable resource costs include non-excise fuel cost 0.77, resource costs of infrastructure 0.63, accident costs 0.32, enforcement costs 0.05, congestion costs 0.03, cost of regulations 0.04, pollution costs 0.01, noise costs 0.034, and other line haul costs 3.07 (including driver and vehicle costs but excluding taxes and tariffs). The total avoidable resource cost for road is 4.954 cents per net tonne·kilometre.

EXISTING RAIL FREIGHT

The existing rail freight identified by MMI as transferring over to the A2/A2M network provides benefits, in terms of lower resource costs of operations, of $55.4 M in the first year of operations, 2005. This comes from high operating costs on the old network being replaced by low operating costs on the new network, as well as shorter travel distances on the new network for many existing trips.

The combination of shorter distances and faster trip speeds produces time savings for freight in transit. This provides an additional $10.4 M per annum accruing directly to users. No change in externalities was considered.

For the sensitivity test, the existing rail freight benefit is only $19.8 M p.a.

RAIL FREIGHT TRANSFERRING FROM ROAD

A benefit of $224 M is estimated to accrue to the economy in 2005 from freight moving off the road system, made up of 10.3 billion tonne·kilometres reduction in road freight (saving $509 M in resource costs of road transport), offset by additional rail costs and additional freight time in transit.

The sensitivity testing reduces benefits to $89.7 M p.a. for road freight that transfers to the new rail network.

INDUCED FREIGHT

Induced freight provides an estimated $51.7 M of benefits in the first year of operations, accruing primarily to the bulk agricultural products and general freight commodity groups, with domestic fruit third.

The sensitivity test produces a benefit of $25.9 M p.a.

LANDBRIDGED CONTAINERS

The assessment of benefit for landbridged containers totals $8.49 M in 2005, using the average of the high and low estimates in ATEC (2000, p. 176). Using ATEC's minimum estimates, the sensitivity test results in benefits of $5.33 M p.a.

CAPITAL COSTS

ATEC (2000, pp. 68, 70 and 89) provided estimates of costs for the A2/A2M options, ranging from $1.2 B to $1.68 B. Adding 50 per cent to the high cost gives the sensitivity test value of $2.52 B. All capital costs are assumed to be in year 2000, present value terms.

ECONOMIC MEASURES

Table 4.2 shows the benefits that will accrue in the first year of proposed operations, 2005. The benefits are expressed in year 2000 dollar values and sum to $350 M.

TABLE 4.2 ECONOMIC RESULTS – FIRST YEAR

Item	*Economic benefit (using ATEC freight estimations, 2000 to 2005)* *$M per annum*	*Sensitivity Test Result* *$M p.a.*
Captured existing rail freight	66	20
Rail freight transferring from road	224	90
Induced freight	52	26
Landbridged containers	8	5
Sum	350	141

Benefits are assumed to grow from 2005 to 2015 as predicted by ATEC. Table 4.3 shows the present value results, expressed in year 2000 dollar values, assuming the project operates from 2005 to 2034. The present value of the benefit stream is $10.2 billion. Subtracting the range of construction cost estimates gives a range of net present values for the project of $8.5 B to $9.0 B and a BCR range of 6.1 to 8.5.

TABLE 4.3 ECONOMIC RESULTS – PRESENT VALUE (YEAR 2000 DOLLAR VALUES)

Item	*Economic benefit (using ATEC freight estimations, 2000 to 2015)*	*Sensitivity Test Result*
Present value of benefits		
4% discount rate	$10.2 B	$4.9 B
(7% discount rate)	($6.1 B)	($2.8 B)
Construction costs	$1.2 B to $1.7 B	$2.5 B
Net present value		
4% discount rate	$8.5 B to $9.0 B	$2.4B
(7% discount rate)	($4.4 B to $4.9 B)	($320 M)
Benefit—cost ratio		
4% discount rate	6.1 to 8.5	2.0
(7% discount rate)	(3.6 to 5.1)	(1.1)

BTE (1999a) favours a 4 per cent discount rate. The results at 7 per cent (in parentheses) are provided for comparison with older analyses.

The combined effect of all the sensitivity tests discussed above is to reduce the benefits by about 60 per cent, producing an NPV of $2.4 B and BCR of 2.

The results based on ATEC's freight estimates might be viewed as optimistic. Equally, and especially from ATEC's perspective, the sensitivity test results could be considered pessimistic. The project appears to be economically robust even if many of its cost and freight flow estimates prove to be only partially realised.

Nothing in this analysis should be misinterpreted as comment on the financial viability of the ATEC proposal. BTE has not undertaken a re-assessment of the various estimates in ATEC (2000).

BENEFIT DISTRIBUTION

The significantly positive net present value for this Melbourne to Brisbane rail project suggests that Australians as a whole would be better off with the project than without it. As for most other investment projects, there will be winners and losers. One of the usually unstated conditions under which a benefit–cost analysis is carried out is that winners could in theory, compensate losers. This in turn rests on an assumption that wealth is *not* poorly distributed among the affected individuals.

For this project, some of the adjustment impacts are easily identified. Any reduced demand for road freight services will affect current road freight operators and their suppliers.

In ATEC (2000), it is proposed that control of existing rail lines and freight be passed over to the new operator. That operator will want to obtain the business at least cost. The final arrangements for such a transfer (including price and freight volumes) will determine the extent to which existing rail owners, operators and employees are affected.

ATEC (2000) also proposed that the Commonwealth Government's current competitive rail access arrangements and legislation will need to be modified in order that potential investors in the new rail network receive a sufficient rate of return to induce them to invest in it as a private sector venture. If this happens, banks and businesses providing finance, the construction company and its suppliers, as well as the operator and the proponents of the new rail network are all likely to be winners. This will include new employees of those companies, as well as the owners.

During the negotiation and construction phase, industries supporting all players in the rail consortium (and especially servicing the construction sites along the corridor during construction) will be winners. Other industries throughout Australia that rely on similar inputs to the rail consortium (legal services, financiers, designers, engineers, steel, concrete, construction workers, etc) will be losers, as the project will make these inputs less available and/or more costly.

During the operations phase, most users of transport in the Melbourne-Sydney-Brisbane corridor will have better inter-regional access and so be winners. This may well be where the majority of benefits accumulate, although the magnitude to individuals is likely to be small. BTCE (1996) estimated that the average transport cost reduction for grain farmers would be less than 3 per cent. The distribution of benefits among the users will be dependent on the legislative and contractual arrangements put in place, as well as the skills of the operator in advertising, pricing and market segmentation.

However, the impact of better access may be equivocal—for some locally produced goods and services along the rail corridor, the slightly lower cost of transport will mean more competition from products made elsewhere. In this case, local producers may be losers and distant producers winners. This situation would be reversed if local producers are more successful in distant markets as a result of the project.

COMPARISON TO PREVIOUS STUDY

BTCE (1996) examined two questions:

- do regional development effects contribute to the overall benefit from transport investments? and
- would the inland railway proposed by QR [QueenslandRail] provide a positive net benefit to society?

The QR proposal examined in that paper is not dissimilar to the current ATEC proposal. BTCE (1996, p57) concluded:

> As to the second question raised above, the proposed inland railway emerges from our analysis as an investment of uncertain merit for implementation in the near future. The cost of the investment would be partly offset by an increase in the gross operating surplus of the rail sector: rail operating costs would decline while traffic would increase. But the estimates of operating cost savings and traffic volumes supplied by QR imply that this source of benefit would not suffice to justify the project economically. Thus, whether the project is economically warranted would seem to depend critically on the magnitude of the benefits to users of rail services. However, the orders of magnitude obtained in this paper leave it unclear whether the benefits to users would tilt the balance in favour of the project. …
>
> Additional research might clarify the merits of the proposed inland railway for implementation either in the near or more distant future. … the attractiveness of the inland railway may have been understated in this paper.

Some of the differences between that study and the present one warrant mention.

BTCE (1996, p3) mentions the sources of benefit: 'The measures exclude possible benefits in reduced accidents, pollution and road congestion due to diversion of freight traffic from road to rail.' The present study includes such benefits, and they represent about 10 per cent of the benefits in the first year of operation.

BTCE (1996, p44) lists the predicted rail freight task in 1994-95 in units of billion net tonne kilometres as 8.4 for the base case, 10.9 for the basic inland project and 11.7 for the enhanced inland project. ATEC (2000, p14) states 'The current rail task relevant to the line segments which form the Melbourne–Brisbane Railway is estimated at 7 billion net tonne kilometres per annum' and that the A2/A2M investment '… would allow the capture of approximately 15 billion net tonne kilometres of freight along the corridor in 2005' (page 8).

In comparison, the present BTE study assumes 10.4 billion net tonne kilometres of rail freight transport in 2005 coming from existing rail traffic and an additional 11.4 billion coming from road freight. The higher amounts, compared to ATEC (2000), come from the links to Sydney, Wollongong, Newcastle and other centres in NSW which are not parts of the line segments ATEC proposes to operate. However, the same benefits in terms of lower rail operating costs were assumed to accrue. A review of the infrastructure limitations and operating characteristics of these other line segments was beyond the scope of the current work.

Given the different time frames and different networks, these rail freight flow estimates are comparable, although the 1996 study relied on QR estimates which clearly envisaged winning less freight from road transport. It is understood that ATEC is currently developing a business case for the project. If that work significantly changed the estimates of freight flow and growth, it would be appropriate to review this benefit–cost analysis.

BTCE (1996, p45) used a real discount rate of 11 per cent per annum. The present study relied on BTE (1999a, p77) which argued that, while adding a risk premium to discount rates made some sense, an appropriate value is elusive. It unequivocally recommended that for allocating a fixed budget between competing transport projects, the riskless rate of interest be used for discounting. There is currently no suggestion that any government will allocate funds to this project, but it seemed appropriate that this analysis be on the same basis as projects that a government will fund, since some manner of government involvement seems likely.

The riskless rate is currently about 4 per cent real, being the Commonwealth 10 year bond rate less an allowance for inflation. Using a discount rate of 11 per cent would reduce the present value of benefits in the present study by two thirds.

BTCE (1996, p46) assumed 3 per cent annual growth rate in freight for all scenarios. The present study relied on ATEC estimates of growth, which varied by commodity and time frame. Changing all growth rates to 3 per cent in the present analysis would reduce the first year benefit by less that 7 per cent and have an even smaller impact on present value, since the congestion effects in 2015 would be delayed.

In sensitivity testing, BTCE (1996, p50) used a discount rate of 6 per cent. For the two inland options considered, the NPVs were $933 million and $1.375 billion, with corresponding BCRs of 1.93 and 2.19. The somewhat different results in the present analysis are primarily due to the significantly greater volume of freight envisaged by ATEC to be won from road transport.

CHAPTER 5 CONCLUSIONS

The benefits were analysed under four headings. The first part is existing rail freight transferring from the current rail network to the new network. The extent to which this will occur depends on the existing rail authorities and their future negotiations with ATEC. If all goes according to the ATEC plan, this transfer will account for nearly 20 per cent of the benefit stream. The benefit arises because of the expected lower operating costs and faster trip speeds on the new rail network, compared to existing arrangements.

The major part of the benefit stream is road freight transferring to the new rail network. ATEC appears to have done considerable research in estimating how much freight will use their new network. About 50 per cent of the freight flow on the new network and nearly 65 per cent of the benefits come from transfers from road to rail.

In the ATEC financial study, 'induced freight' was omitted from the revenue calculations. Induced travel is a benefit in economic terms, though quantification entails greater uncertainty than for existing freight. This portion of the benefit stream provides about 15 per cent of the total benefits.

The ATEC report suggests that there will be 'saturation problems' by 2015 at their predicted freight growth rates. By that time, some undefined additional investment would be required. This was resolved in the analysis by assuming zero growth in benefits beyond year 2015, but maintaining the analysis period to 2034.

Using the data and estimates in the ATEC (2000) report, the net present value for the project exceeds $8 billion and the BCR is between 6.1 and 8.5, at a 4 per cent discount rate (NPV over $4 billion and BCR between 3.6 and 5.1 with the older 7 per cent discount rate).

In our view, ATEC's freight flow estimates could well be overoptimistic. It is understood that ATEC is currently developing a business case for the project. If that work significantly changed the estimates of freight flow and growth, it would be appropriate to review the present benefit–cost analysis.

The sensitivity test involved the use of lower freight benefit estimates and higher construction costs, producing an NPV of $2.4 billion and BCR of 2.0, at 4 per cent discount rate.

Based on estimates of freight flows, growth and costs in ATEC (2000), this is a significant project which could produce net benefits to the Australian community of over $8 B over the next 35 years. From the sensitivity test, the project would still be economically desirable even if much more pessimistic costs and freight flows were the eventual outcome.

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