

Modelling the national rail system: RIO and NFI

R G Bullock

Director

Travers Morgan P/L

R A Galbraith

Managing Consultant

Travers Morgan P/L

Robert Williams

Senior Consultant

Travers Morgan P/L

Tom Hill

Manager (South Australia)

Travers Morgan P/L

Abstract

This paper describes the development of a computerised operating and costing model of the Australian railway network in all States. The model, developed for the Commonwealth/State Railway Industrial Council, and subsequently modified and updated for the National Freight Initiative study, posed numerous technical challenges. The paper discusses the processes of zoning, network design, traffic classification, and operational representation in a freight railway model believed to be one of the most extensive and detailed ever undertaken. The subsequent application of the models to assess future rail scenarios is described.

Contact author:

Robert Williams

P O Box 1162

North Sydney NSW 2059

Telephone: (02) 922 1999

Fax: (02) 959 5706

Introduction

In May 1990, two reports on the future of the Australian rail system were released within days of each other. One (known as the RIC report) was produced by the Railway Industry Council and discussed a number of long-term policy options for the future development of both urban and non-urban railways. The second, known as the National Freight Initiative (NFI), was produced by a committee comprising railway administrations and major users and examined the potential to establish a single body to operate the intersystem freight network.

Both reports were based on detailed financial analysis. The NFI analysis and the non-urban analysis in the RIC study were undertaken within a common framework using the RAILCOST model. This paper describes the approaches to the two studies, describes the options considered and summarises the main conclusions reached.

This paper contains five sections in addition to this introduction. Section 2 gives the background to and objectives of the RIC and NFI studies; Section 3 describes in broad terms the features of the RAILCOST model used in the analyses; Sections 4 and 5 discuss the options tested in the two studies and the conclusions drawn whilst Section 6 summarises the results and looks to the future.

Background and objectives

In 1981 the Australian Railway Research and Development Organisation (ARRDO) published its Report on Rail. This made a series of recommendations aimed at improving rail's financial performance in the 1980's, including increased labour productivity, and more realistic pricing policies allied to full road cost recovery. It also set out a comprehensive five-year investment program of \$184 million annually⁽¹⁾ on national main-line infrastructure, to be funded by the Commonwealth in a manner analagous to National Highways funding. The ARRDO Report on Rail foundered on politics, both inside and outside the railway systems. A derivative, the National Rail Action Plan, which upped the ante to \$2,090 million of commercially-justified investments, was also consigned to the bookshelf.

During the 1980's, there was a succession of reports, either on specific railways (eg. Booz-Allen & Hamilton in NSW, STAP and METPLAN in Victoria, PA/Travers Morgan in Queensland) or on specific projects (eg. Fast Freight Train, Sydney-Melbourne electrification) or on general aspects of land transport policy

⁽¹⁾ All figures are in \$1989/90 unless otherwise stated.

(eg. Inter-State Commission on cost recovery). Common themes which ran through all the reports on non-urban operations were:

- (i) most railway traffics were losing money, including or excluding externalities; but
- (ii) if labour productivity could be raised to a level that was technically possible, much of the system would become financially and/or economically viable; and
- (iii) there were a large number of moderately priced capital investments which were financially justified.

In hindsight, it is clear that Governments at both the Federal and State levels were reluctant throughout the 1980's to invest significant amounts of money in what was seen as a losing business. Very significant sums were spent (or are being spent) on the urban rail networks in all State Capitals, and on major export traffics. Non-urban general freight however languished as the poor relation - after all, it could always go by road and that's what the national highways were built for!

Railway Industry Council (RIC) Study

From the mid-1980's, labour productivity improved significantly, particularly for non-urban operations, and railways started to become competitive with road on some corridors, with or without road user charges. Suddenly, there was a future for non-urban rail operations other than a lingering death by a thousand cuts from the road freight industry.

In 1986, the Railway Industry Council (RIC) was established by the Federal and State Transport Ministers. Its ultimate membership comprised six representatives of Federal and State Governments, the five chief executives of the rail systems and thirteen representatives of various trade unions involved in the railway sector, together with an independent chairman.

RIC's main objective is to develop and recommend a medium and long-term strategy to improve the viability and competitiveness of the rail industry, including the evaluation of:

- investment requirements to upgrade rail equipment and facilities;
- technological developments relevant to the industry and the scope for their cost-effective introduction;
- measures to improve efficiency including changes to industry-wide practices;
- the scope for revitalisation of the rail industry and the major social and employment implications associated with such action; and
- measures to promote appropriate freight and passenger transport services.

RIC has developed a six-stage work program comprising:

- (i) assessment of current performance of rail industry;
- (ii) establishment of objectives for the industry;
- (iii) identification and evaluation of possible future scenarios for the industry;
- (iv) undertaking an overseas rail mission;
- (v) public consultation; and
- (vi) development of recommendations.

Currently stages (i) to (iv) have been completed and RIC is now embarking on the public consultation phase of its work program.

RIC analysed urban and non-urban operations independently. A number of scenarios were considered for non-urban operations. The key scenarios comprised:

- (i) a 1986/87 Base Case representing actual operations and costs for that year;
- (ii) a 2001/02 Base Case, derived from the corporate plans for each system, but broadly reflecting the current policy framework;
- (iii) a 2001/02 'Commercial Railway', which assumes that rail would act as a purely commercial enterprise; and
- (iv) a 2001/02 'Commercial Railway with Community Service Obligations' (CSO's), which adds to the Commercial Railway a number of services that would be retained on social grounds.

A number of variations on these scenarios were also looked at. These separately considered the impact of deregulation of the remaining regulated traffics, increased road cost recovery, and of operating a bulk-only freight system.

The above scenarios were all subjected to detailed financial evaluation by Travers Morgan and subsequent economic evaluation by the Bureau of Transport and Communications Economics (BTCE). (A further expansionist scenario, the 'Integrated Transport Service', was also developed by RIC but not subjected to detailed analysis).

Further details of the scenarios and the results of the financial evaluations are given in Section 4.

National Freight Initiative

Around two-thirds of the current rail freight task is the carriage of bulk minerals and grains. Both of these traffics are conventionally held to be ones for which rail has a natural advantage and the RIC analysis showed that rail has the potential to return profits on both traffics in the medium-term.

Interstate traffics (mostly intermodal and general goods) remained marginal at best in the RIC analyses, particularly in the East Coast corridor (Melbourne-Sydney-Brisbane). These traffics face strong competition from both road and (in

some cases) sea, are more sensitive to the level of service offered and in many cases operate over sections of the network with sub-standard infrastructure. Besides these physical and technical disadvantages, interstate traffics have the additional problem of crossing administrative boundaries, thus introducing problems of co-ordination and the setting of operational and investment priorities.

In late 1989, the National Freight Initiative (NFI) was therefore established with the participation and support of the individual railway systems, major rail users and the Federal Government, to determine the feasibility of a national rail freight organisation to perform the interstate rail transport task in Australia. A study of various options for achieving this goal was undertaken jointly by Travers Morgan and Booz-Allen & Hamilton and was completed in April 1990. This established that a viable interstate system was achievable but would require significant (but not impossible) improvements in labour and capital productivity and service reliability as well as changes in pricing policy.

Although the overall economic benefits of a viable national interstate rail network were addressed in the study, the prime focus was on the financial performance of the various alternatives. Section 5 describes the different options considered and their respective financial performance.

Method of analysis - the RAILCOST model

The analysis in both the RIC and NFI non-urban studies was undertaken using the RAILCOST model. This was first developed for the then Public Transport Commission of NSW in 1978/79. A description of that early version of the model which was run on a mainframe Cyber 6600, was given at ATRF in 1980 (See Bullock *et al*, 1980).

Since the initial study in NSW, the model has been significantly enhanced and converted to run on a standard PC. It is now installed (or being installed) in all Australian and New Zealand government freight railways. It has also been used in railway costing studies in Indonesia, Uruguay and (in a derivative form) Argentina.

The system has two main components. One is a detailed model simulating the freight and passenger operations of the railway; this produces a detailed set of operating statistics (currently 86 are calculated) which represent the resources used to handle a particular traffic task given a predefined operating plan. The second is a costing module which converts the resources employed into costs using a series of cost functions for the various maintenance and operating activities.

Since the 1980 ATRF paper, there have been many enhancements in the railway operational modelling, in line with the significant improvements in the base information systems from which it feeds. There has also been a quantum change in the level of detail by which traffics are classified, reflecting the marketing based organisation structures introduced into most railways during the

1980's. Instead of the traditional 'commodities', such as 'manures' or 'Class E', many of which were of doubtful relevance, either operationally or commercially, rail systems have reorganised their traffics into 'products' (eg. 'Overseas Containers loaded') and 'product lines' (eg. 'Overseas Containers loaded Melbourne-Adelaide'). Typically, a rail system will have about 500 product lines and these form building blocks for the operational modelling, replacing the 20-30 broad commodities previously used.

Technical innovations to the model proper since 1980, which have mostly been possible because of the greater ease and flexibility of programming a PC rather than a mainframe, include:

- .. specific modelling of block trains;
- .. multi-path assignment by traffic type;
- .. organisation of input data in databases;
- .. provision of various forms of graphics output; and
- .. a wide range of menu-driven costing options.

The other major change since 1980 has been the formalisation of the costing framework. The standard costing approach at that time had been agreed in about 1930 by the Chief Accountants of the (then) seven government railways. This set out a standard form for the annual reporting of expenditure (which still survives in the Queensland Railways Annual Report) whose primary use seems to have been to allow inter-railway cross-charging (eg. Border Loop - Brisbane) to be conducted on an orderly basis. By 1980, there was a distinct lack of uniformity between railways; with cost classifications varying widely as a result of the different philosophies adopted during the computerization of accounting systems, and marked differences between systems as to perceived factors influencing cost causations.

In 1985, the National Freight Group of the Railways of Australia developed a standard convention for calculating the cost of interstate freight. This became known as NFG1⁽¹⁾ and this, in spite of the unfortunate message conveyed by its initials, has become the de facto standard throughout Australia.

Although RAILCOST has a perfectly general costing module, it has been particularly geared to the NFG conventions. In practice, all applications have used NFG1 and/or NFG2 as a basis. Table 1 summarises the main features of the NFG conventions

⁽¹⁾ A draft revision of the convention (known as NFG2) is currently under preparation. There are few changes of substance from NFG1, other than its extension to passenger trains and its explicit treatment of fixed costs.

Table 1 NFG cost convention⁽¹⁾

| Item | Cost Causality |
|----------------------------------|---|
| <i>Overheads</i> | |
| Payroll overheads | Pro-rata to direct labour, where not directly assigned |
| Stores overheads | Pro-rata to materials (excluding fuel), where not directly assigned |
| Branch administration | Pro-rata to direct labour |
| <i>Direct costs</i> | |
| Train running/terminal costs | |
| Loco repairs/maintenance | 50% loco hours and 50% loco km |
| Carriage & wagon maintenance | Vehicle km |
| Crew | Train hours or paid crew hours |
| Fuel/energy | Rise and fall of line, adjusted for train size |
| Variable track maintenance | GTK's |
| Shunting and marshalling | Location/product-specific costs/tonne |
| Passenger/goods handling | Directly identified |
| <i>Renewable Capital Charges</i> | |
| Rollingstock capital | Hours or days based on replacement costs |
| Track capital | Gross tonnes, based on replacement costs |
| <i>Corridor Costs</i> | |
| Fixed track maintenance | Allocated by gross tonnes on a link-specific basis |
| Signals & comms maintenance | Allocated by no. of trains on a link-specific basis |
| Signalling/safeworking ops. | Allocated by train km |
| <i>Overhead Costs</i> | |
| Business/corporate overheads | Allocated by GTK's |

⁽¹⁾ Based on draft NFG2 convention.

The model provides estimates of both long-run avoidable/incremental costs (LRAC) and fully distributed costs (FDC).

The avoidable/incremental costs of a product are the costs directly attributable to that product. The financial performance of the product can then be assessed by the margin by which revenue exceeds or falls short of its LRAC. LRAC is

generally taken to be the sum of train-running and terminal operations costs, together with renewable capital charges.

A fully distributed cost level can be calculated by including an allocation of joint and fixed costs (corridor-fixed and fixed overheads). The FDC should not be used to measure the desirability of retaining or attracting individual products to rail. It does however provide a useful benchmark for reviewing the performance of an entire, or major sections of a, business.

The actual implementation of the costing in RAILCOST is done using a set of unit costs, constructed according to the NFG conventions. These unit costs can be developed on a variety of bases. One obvious set is 'current costs', reflecting the actual costs currently incurred by rail systems. Another possible set is 'future costs' which would incorporate possible changes in operating and maintenance practices.

The RIC study developed a set of 'future costs' based on the various productivity improvements projected by each railway system. Examples are one-person train crewing, improved maintenance practices and more economical signalling procedures. It is important to emphasise that these changes apply to input costs only, i.e. they are concerned with such matters as crew costs per train hour. They are not concerned with operational improvements such as larger train sizes. This type of impact is captured by the operational modelling and reflected in the changed number of resources required to undertake a particular task. The 'future costs' used in the RIC study, which have become known as 'RIC unit costs' generally represented a 20%-30% improvement in labour productivity over the next decade compared to the 1986/87 Base Case. This level of improvement is broadly comparable to the changes being introduced in NSW following the Booz-Allen & Hamilton study in 1989.

The NFI study, undertaken some 18 months after the RIC analysis, reviewed the RIC unit costs and developed another set, geared to interstate operations, representing the ultimate that could be achieved given the existing infrastructure and rollingstock. These costs have become known as 'world-standard' costs. In general, they are either similar to or up to 10% below the RIC costs for operations and maintenance, but assume much higher level of capital utilisation for interstate operations than the system averages used in RIC.

With these unit costs established, the analytical process then consisted of:

- (i) deriving a traffic demand level, either current or projected, based on growth rates and an assumed policy framework;
- (ii) developing an operating plan to handle the assumed demand;
- (iii) calculating the resources required given (i) and (ii) above; and
- (iv) calculating the cost of those resources using one of the sets of unit costs.

This process is normally done twice, and the difference in costs then represents the cost of the change in the input parameters. For example, in order to cost a traffic, the operating plan would be held constant and two model runs undertaken, with and without the traffic in question. The difference in resources, and hence the difference in costs, represents the cost of that traffic. To establish the benefits of a change in operating plan, eg. an increase in train size, two runs would be done with a constant traffic demand, but with the two different plans, and the difference in resources again valued using the set of unit costs.

The next two sections describe the different options examined in the two studies. The final section then summarises the results and discusses the main conclusions.

The RIC model

As outlined in Section 2, the RIC study considered three main options, in addition to the 1986/87 Base Case. These were:

- the 2001/02 Base Case
- the 2001/02 Commercial Railway
- the 2001/02 Commercial Railway & CSO's.

1986/87 Base Case

The 1986/87 Base Case was analysed using data supplied by each of the individual rail systems. It included all mainland systems together with the isolated Tasmanian and Eyre Peninsula systems. The country was divided into 348 zones, joined by a series of links representing the (then) current train operations. The traffics that ran on this network were classified into 22 products, comprising 163 sub-products. For reporting purposes, the 22 products were themselves aggregated into seven main groups:

- (i) coal and minerals
- (ii) intermodal
- (iii) grains
- (iv) other rural
- (v) industrial/manufactured products
- (vi) LCL
- (vii) passengers (non-urban)

Figure 1 shows the 1986/87 modelled national network. Note that it is an operational network rather than a physical network and the links thus represent services rather than sections of physical infrastructure.

In 1986/87 the estimated deficit for non-urban rail operations was \$811 million⁽¹⁾ on total revenues of \$2.5 billion. Figures 2 and 3, derived from Figures 6.4, 6.6 and 6.7 in the RIC report, give national costs and revenues by reporting group, both in absolute terms and in cents/ntk.

The figures show that only coal and minerals, of all the product groups, was covering its costs in 1986/87. All other traffics were making a loss, some by very significant margins. Even the result for coal and minerals is flattering; the RIC analysis only includes renewable capital and does not include any allowance for capital charges for the large capacity-related infrastructure investments made throughout the 1980's.

Leaving aside LCL, the financial results broadly reflect the physical and operating characteristics of each traffic. Coal and minerals are generally hauled in dedicated block trains with comparatively high operational efficiency. However, these movements are generally short-distance, some as low as 20-30 kilometres, and overall operating costs are heavily influenced by terminal arrangements. Generally, however, rail is very competitive for these traffics and the average rate is well below comparative road rates (say 8¢/ntkm).

Intermodal traffic comprises domestic traffic (mostly freight forwarders) and overseas container traffic moving between the major centres. Unit rates are very low; driven down by competing road rates for domestic traffic and shipping costs for the overseas containers. Unit costs are higher than for minerals, reflecting lower net:tare ratios, smaller average train sizes and higher terminal costs, which are only partially compensated by the longer average haul. This traffic is discussed further in the next section.

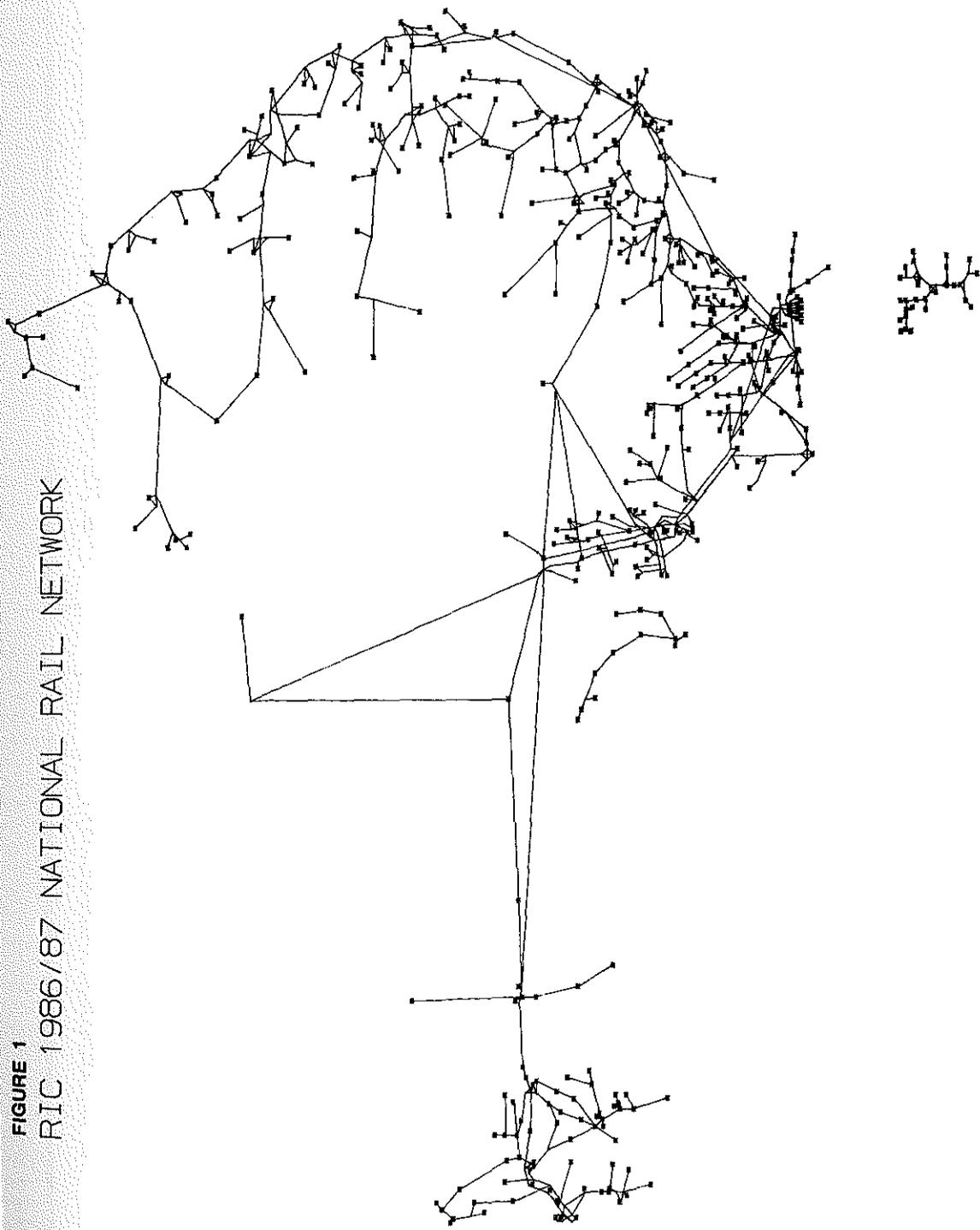
Grain traffic has a comparatively high unit rate, but which is still broadly road-competitive for point-to-point movements of bulk commodities. Grain generally moves in unit trains with a reasonable level of operational efficiency. Most systems have a large network of low-density feeder grain lines, with low-throughput outloading rates from the grain silos, (it is not unknown for a loco crew to spend an entire shift loading a grain train in a single siding) and terminal arrangements often impose a significant handicap.

Other rural traffic (eg. wool, meat, fruit, livestock, timber) has a unit rate generally determined by competitive road rates (which average about 4¢/ntkm for general traffics and 7¢/ntkm for bulk traffics with no return loads⁽²⁾). However, much of this traffic is medium-density at best and it also moves in small groups of wagons, incurring significant marshalling and terminal costs.

⁽¹⁾ This will not necessarily correspond to estimates contained in Annual Reports as capital charges were calculated on a replacement basis in RIC, as compared to the historical cost basis used for formal reporting.

⁽²⁾ Coal and minerals on average move at a slightly higher rate per ntkm reflecting generally shorter linehaul distance

FIGURE 1
RIC 1986/87 NATIONAL RAIL NETWORK



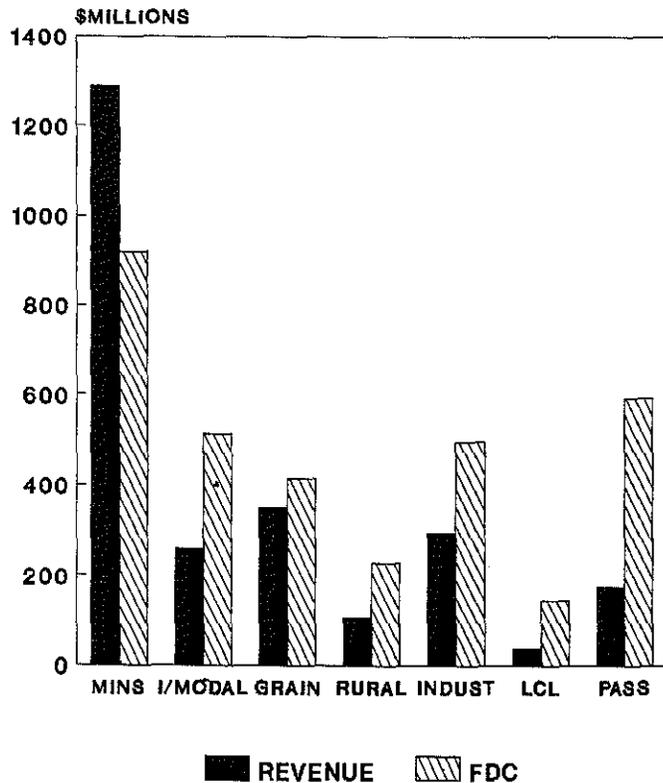


FIGURE 2: NON-URBAN RAIL COSTS & REVENUES (\$1986/87)

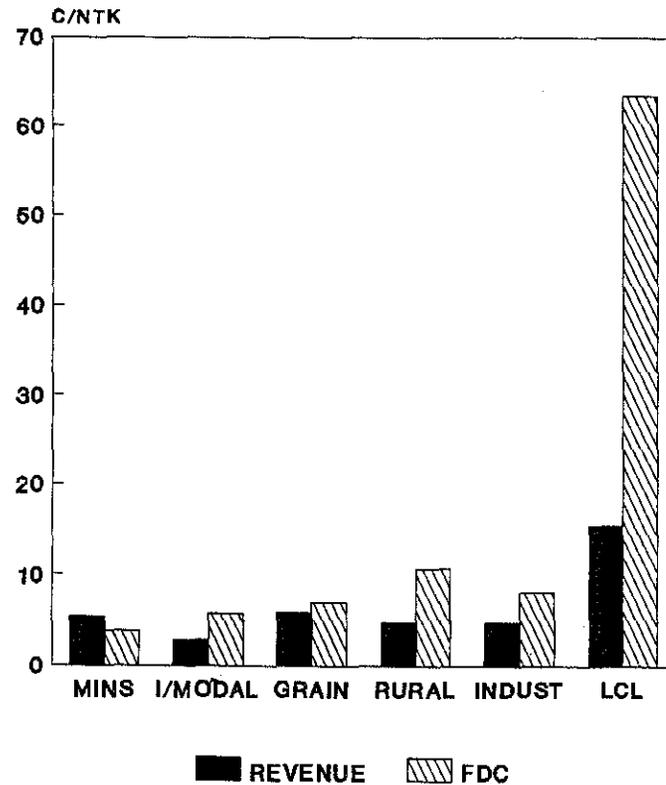


FIGURE 3: NON-URBAN RAIL UNIT COST & REVENUES BY TRAFFIC (\$1986/87)

Industrial and manufactured traffics (eg. steel, cement, petroleum) have a similar unit rate to other rural traffic but their unit cost is rather less, reflecting the denser nature of the traffic. Many of these traffics in practice move in block trains or half-train loads and this also helps to reduce overall operating costs.

Both LCL traffic and passenger traffic had very poor cost recoveries in 1986/87.

Overall, the 1986/87 results are dismal. At an industry level, all traffics other than coal and minerals lost money, and most failed to cover LRAC, equal to around 70% of FDC. Even if road cost recovery policies had been in place (at a rate of around 1¢/ntkm) allowing commensurate increases in rail rates, general freight would still have been unprofitable by a wide margin.

In spite of the poor national results, there were nevertheless some hopeful areas. Excluding passengers and LCL, AN and to a lesser extent, Westrail, both approached breakeven in 1986/87. Since that year, there have been continuing improvements in most systems and AN reported a profit on its commercial operations (ie. excluding passengers, LCL and Tasmania) for 1988/89.

2001/02 analysis

The 1986/87 results clearly demonstrated that rail would not have a long-term future unless changes were made both to the range of tasks they were performing and also how they were performed. This was not a novel conclusion and all systems had a series of plans at that stage with projected improvements and efficiency measures that would be introduced over the medium/long-term (ie. 5-10 years).

A 2001/02 Base Case was therefore constructed to take into account not only the projected change in traffic but also the efficiency initiatives proposed by the various systems.

The 2001/02 Base Case, discussed in more detail below, demonstrated that, although cost recovery would improve, there would still be a loss on general traffic, even after the various efficiency measures had been implemented. In other words, merely making changes to **how** tasks were performed was not sufficient; a fundamental appraisal was required of **which** tasks should be performed. Accordingly, an alternative scenario, known as the 'Commercial Railway' was developed. This assumed:

- (i) the railway system would carry commercial traffic only, within the same regulatory and road cost recovery environment as currently exists.
- (ii) a commercial traffic was defined as one for which revenue exceeds LRAC; for branch-lines, the aggregate contributions of revenue over LRAC of traffics using that track section should exceed fixed corridor costs, whilst at a system level total revenue should cover FDC.

- (iii) non-commercial traffics would no longer be carried and non-commercial line sections closed.

As could be readily predicted from the 1986/87 analysis, both passengers and LCL, amongst others, proved to be non-commercial traffics in 2001. Because these services are, and would continue to be, operated in accordance with Government social policy, a second alternative scenario, known as 'Commercial Railway with CSO's' was also developed. This assumed the systems would carry certain traffics considered to be CSO's, in addition to the commercial traffics.

These CSO's were defined as passenger services in all States (operating as in the Base Case with the exception of the Queensland inland services), intrastate LCL in Victoria and Queensland and certain agricultural freight traffics in Queensland (around 0.9 m tonnes in total).

In addition to these two main options, three variations were also analysed, which separately considered:

- (i) a system carrying bulk traffics only;
- (ii) the impact of removing the remaining requirements for certain traffics to be regulated to rail;
- (iii) an increase in road cost recovery.

Cost and revenue assumptions

All the above scenarios were analysed assuming the efficiency improvements proposed by the systems. These include:

- (i) reduction of linehaul operating costs by increasing train size, introduction of one-person crewing, increased axle loads and payloads, increased productive time of train crews and mainline electrification in Queensland.
- (ii) reduction of terminal and marshalling costs by yard rationalisation, one person crewing of shunt locos, and increased block and unit train working.
- (iii) increased fuel efficiency arising from new locomotives.
- (iv) reduction in rollingstock and infrastructure maintenance costs resulting from improved workshop procedures, planning and maintenance techniques.
- (v) reduction of administrative overheads in line with direct costs.

Overall, these changes lead to a reduction of 28% in unit output costs in the 2001/02 Base Case, equivalent to an improvement of 1.7% pa. The bulk of this (90%) arose from reduced input costs.

The other 2001/02 scenarios assumed an investment environment which would allow further productivity gains. These gave a further reduction of 10% in unit input costs, equivalent to an overall improvement of 2.2% pa. over the period.

Unit revenues were assumed to decline at 1% pa. in real terms, in line with the projected trend in real road freight rates. Coal rates however declined at a faster rate as the impact of the capital charges associated with the once-off infrastructure investments of the early 1980's became less pronounced.

Traffic levels

The Base Case freight traffic task was forecast to increase by 58% over the period (3.1% pa), broadly in line with GDP. Much of this growth was forecast to be in minerals and particularly, intermodal traffic with the other sectors growing much more slowly. Base Case passenger demand levels increased much slower at 11% for the period, with almost all the increase occurring in Victoria.

Traffic levels for the other scenarios were rather lower, reflecting the loss of non-commercial traffics no longer carried in these options.

Results

Figures 4-7 show the key indicators for each scenario. Fuller details are given in the RIC report, including network size, workforce and cost recovery by product group.

The key points to note are:

- (i) tonnage alone is not the solution to railway problems. It is essential that any additional tonnage is contributing ie. its revenue must be above LRAC. One of the main problems with the 2001/02 Base Case was that much of the growth initially forecast was at freight rates below LRAC even in 2001/02 and this additional traffic therefore actually increased the deficit rather than reduced it.
- (ii) the Commercial Railway requires significant changes in two key sectors, intermodal and other rural, and the complete divestment of two more (passengers and LCL).
- (iii) reintroduction of the CSO traffics will require funding (presumably from Governments) of around \$200m pa.
- (iv) deregulation of the remaining traffics currently regulated to rail will have little overall effect on traffic levels at the national level. Some rate adjustments would be required and overall there would be a reduction of about \$100m in net profit.

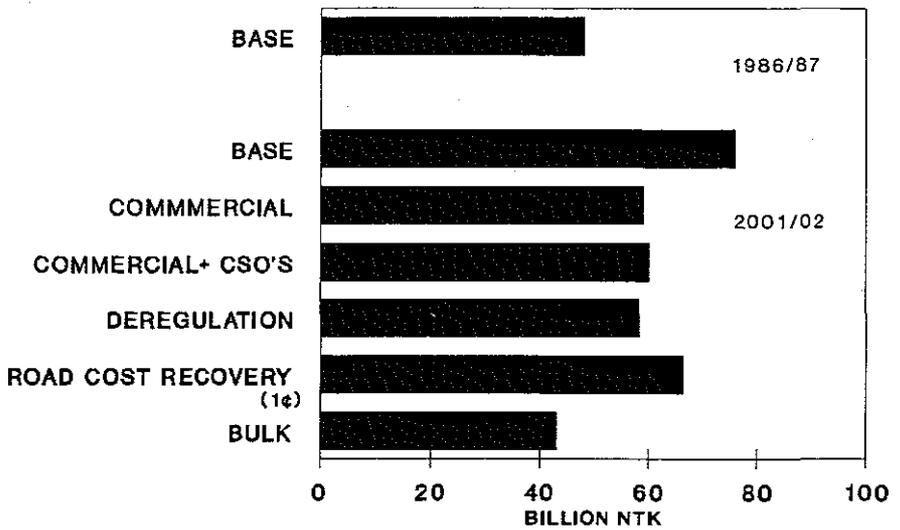


FIGURE 4: FREIGHT TRAFFIC TASK BY SCENARIO

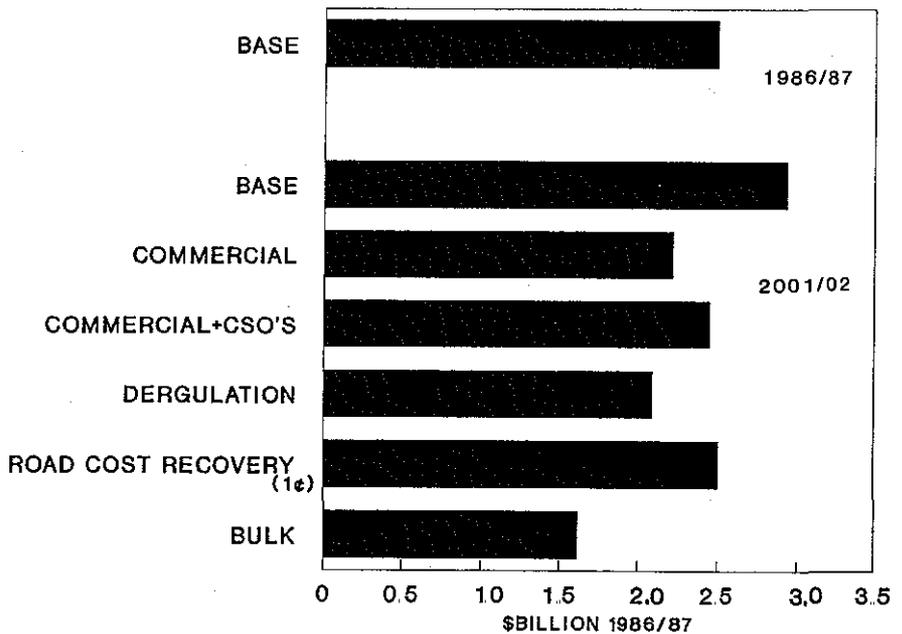


FIGURE 5: REVENUE BY SCENARIO

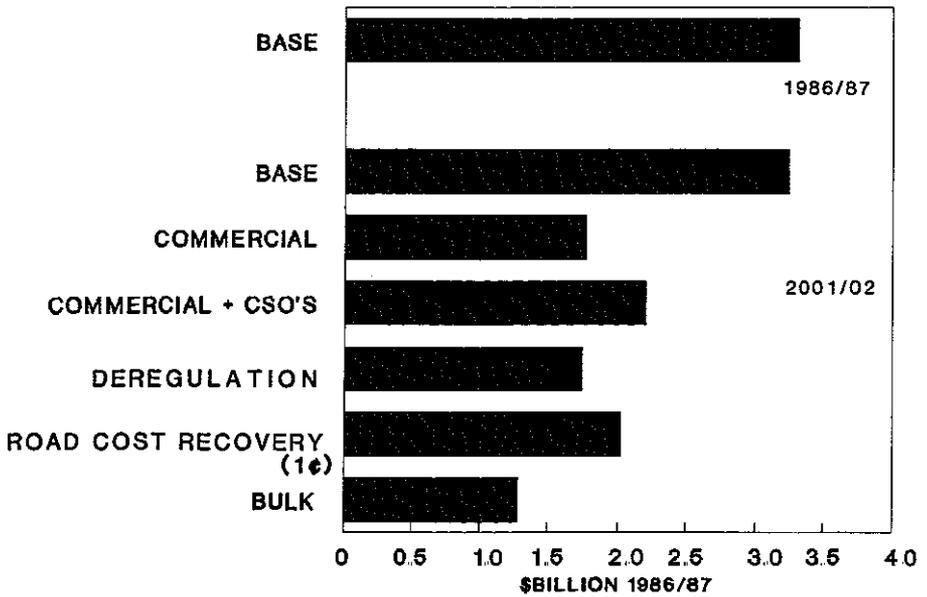


FIGURE 6: FULLY DISTRIBUTED COST BY SCENARIO

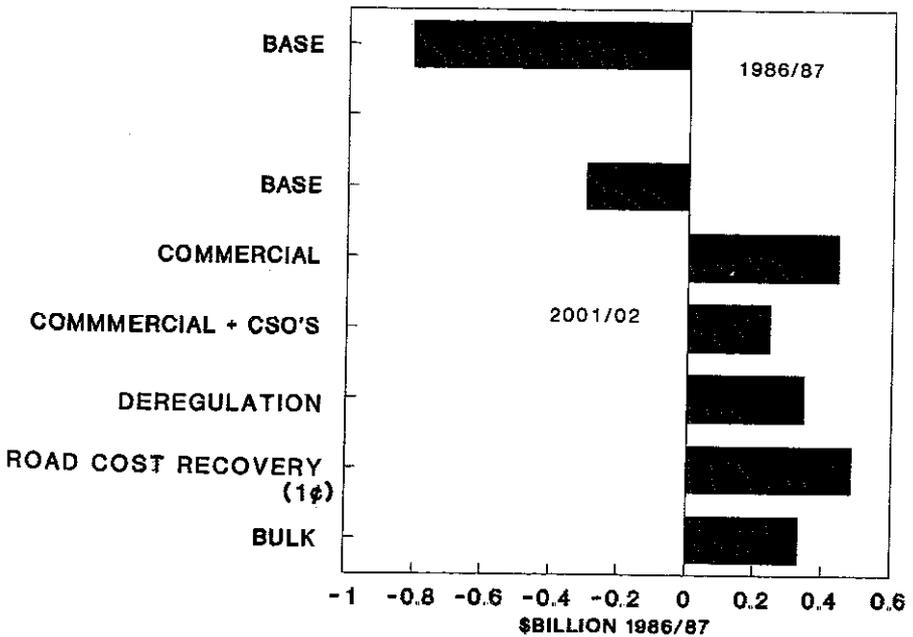


FIGURE 7: PROFIT/LOSS BY SCENARIO

- (v) increased road cost recovery (combined with deregulation) would enable rail rates to be increased for road-sensitive traffics, thus allowing traffics previously judged non-commercial (particularly in intermodal/freight forwarding) to be reintroduced and improving the margin on existing traffics carried by rail.
- (vi) a bulk-haul railway would generate profits below the Commercial Railway. This is because the Commercial Railway includes a large number of contributing non-bulk traffics.

Overall, the RIC analysis and results demonstrate that the key to a long-term future for the railways in other than coal and minerals lies in reducing input costs, together with withdrawal from (or conversion to CSO's of) chronically uncommercial traffics such as non-urban passengers, LCL and some agricultural traffics. Deregulation would have a negative effect, but it is unlikely to be critical and, if combined with road cost recovery, would be broadly neutral (although the impact would vary widely between States).

The NFI study

Background: interstate rail freight

The RIC study identified interstate traffic as a major problem at the national level. Although some corridors have come close (or indeed are) breaking even, overall interstate traffic has lost significant amounts of money, as documented in the various reports of the (late) Inter-State Commission.

Interstate traffic suffered for many years from being a low priority as far as most State railways were concerned. Although there had been particular projects aimed at upgrading specific corridors (Melbourne-Albury standardisation in 1962 and the East-West standardisation in 1970), interstate corridors and operations were of little political interest and there are many examples of worthwhile investments concerned with interstate traffic being deferred whilst more politically attractive ones were undertaken.

Co-ordination and integration in the planning and operation of intersystem services was limited to say the least. Instead of the 'seamless service' so often discussed today, the interstate service of the 1970's (even after the major infrastructure projects) still resembled nothing so much as a giant obstacle course, where trains were remade and locos changed at system boundaries, operating rules were the lowest common denominator of all the various systems, and where interstate traffic was continually delayed by local priorities.

In 1980, the INTRANS Plan was developed and introduced and intersystem co-ordination began to improve. The remainder of the decade saw many

operational changes, with the introduction of Superfreighters, the partial elimination of en-route shunting of interstate trains, through running of locomotives and investment by all systems in improved and expanded terminal facilities.

Unfortunately, although traffic levels have improved significantly, profitability is still a major problem, particularly on the East Coast corridor, and service performance continues to generate problems. It is perhaps worthwhile explaining the financial significance of service performance.

Interstate rail comprises four major traffic segments:

- (i) freight forwarder
- (ii) overseas containers
- (iii) steel
- (iv) other (mostly wagonload general freight eg. paper, cement, manufactured products)

Figure 8 shows the breakup of the total market between these four segments.

Around 70% of traffic is general freight and is thus reasonably time-sensitive. For freight forwarder traffic, in particular, the rail leg is only one link in the transport chain and road connections are organised at each end of the journey to undertake the pickup and delivery to and from the freight's ultimate origin and destination.

Late train arrival means that road delivery vehicles make fewer trips each day, increasing delivery costs. As the total amount that can be charged for rail freight plus pickup and delivery is constrained by the competing road door-to-door rate, increased road delivery costs are inevitably reflected in the rate that can be charged for the rail linehaul. Figure 9, taken from current Superfreighter rates between Sydney and Melbourne, highlights the relative importance of these terminal charges, which comprise 45% of the total door-to-door rate.

It was clear from previous analysis that interstate freight would need not only to be operated at a lower cost but also that the average revenue would need to be maintained, if not increased. This latter could only be done by improving the service level commensurately and it was generally considered that these aims were most likely to be achieved by creating a new body specifically responsible for interstate freight.

Accordingly, in late 1989 the National Freight Initiative (NFI) was established, to "investigate the establishment of an efficient national rail freight enterprise providing profitable and competitive interstate services".

A major task of the NFI was therefore to establish the financial feasibility of this concept. This was undertaken using RAILCOST to analyse a series of options for the main interstate network and the traffics handled over it.

Source: NFI Report, P15

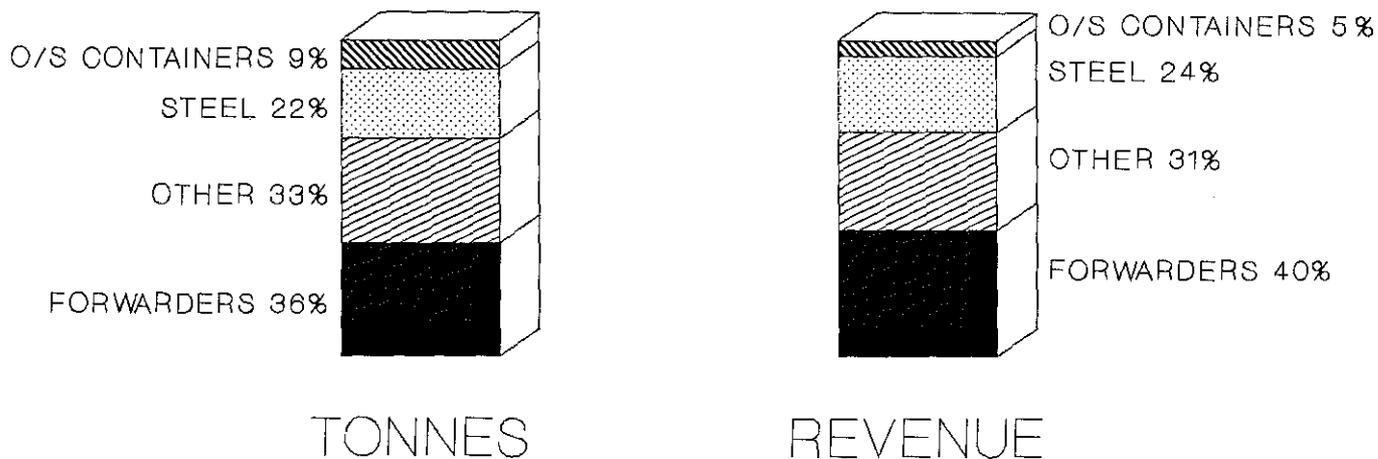


FIGURE 8: 1988/89 INTERSTATE TRAFFIC BY PRODUCT GROUP

Source: Published Superfreighter rates for up to 11 tonnes gross. Metropolitan pickup and delivery.

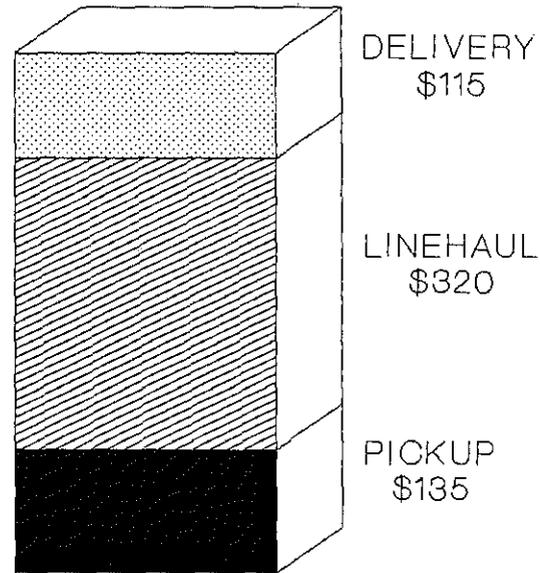


FIGURE 9: COMPONENTS OF DOOR-TO-DOOR COSTS PER CONTAINER, SYDNEY-MELBOURNE, MAY 1990

NFI analysis

Figure 10 shows the interstate network considered in the study. This included all rail-connected mainland capitals, as well as the major steel centres. The 1988/89 interstate freight flows in these corridors are shown in Figure 11. In addition to the interstate traffics, many of the corridors also carry significant local traffics (eg. grain in southern NSW and in WA). Nationally, interstate freight is about 25% of the total rail task.

Broadly speaking, rail has around two-thirds of the general freight market to and from WA and a quarter to a third of the general freight market in the Eastern States.

The first step in the modelling process was to identify traffics which were carried, either interstate or locally, on the proposed interstate network as defined in Figure 10. Following this analysis, a network was built consisting of 164 zones, representing the interstate network itself, together with a number of feeder links for traffics originating on other parts of the system (eg. paper from the Mt Gambier area). At the same time, the traffics handled were classified into four reporting groups (freight forwarding/intermodal, overseas containers, steel and other), consisting of some 27 products. A plot of the NFI modelled network is given as Figure 12. (The network has been 'loaded' with 1993/94 tonnage).

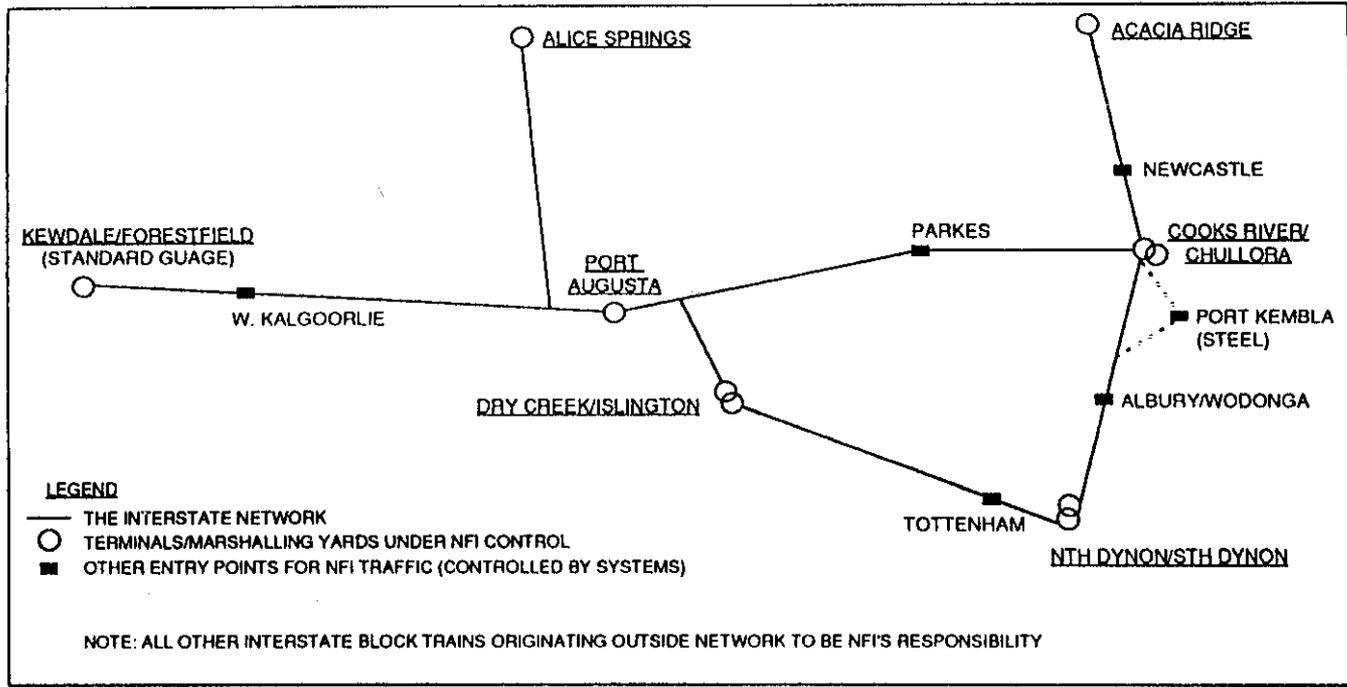
The analysis calculated costs according to NFG2 guidelines and used three sets of unit costs: current costs, RIC costs and 'world-standard' costs. This last set was specifically developed to reflect both interstate operating conditions and also further reductions to RIC unit costs which were technically achievable but which had not been included in the rail systems forward plans as presented to RIC. In effect, 'world-standard' costs were system-independent, with the only differences between systems being a function of terrain and physical operating characteristics.

In practice, the biggest differences between 'world-standard' costs and RIC costs arose as a result of the much improved capital utilisation assumed because of the longer average haul and the high proportion of point-to-point movements in interstate traffic.

The analysis was comparatively short-term, looking at the period from 1988/89 to 1993/94. A set of options was developed for this period designed to test the various key policy parameters. These options were:

- (i) a 1988/89 Base Case, reflecting current traffics, operations and costs;
- (ii) Option A, reflecting projects presently planned or underway, together with forecast 1993-94 traffic levels. It assumed 1988/89 cost and productivity levels and was designed primarily as a reference case against which the other options could be compared;

NATIONAL FREIGHT INITIATIVE BOUNDARIES



20-03727S

Source : NFI Report, P32

FIGURE 10

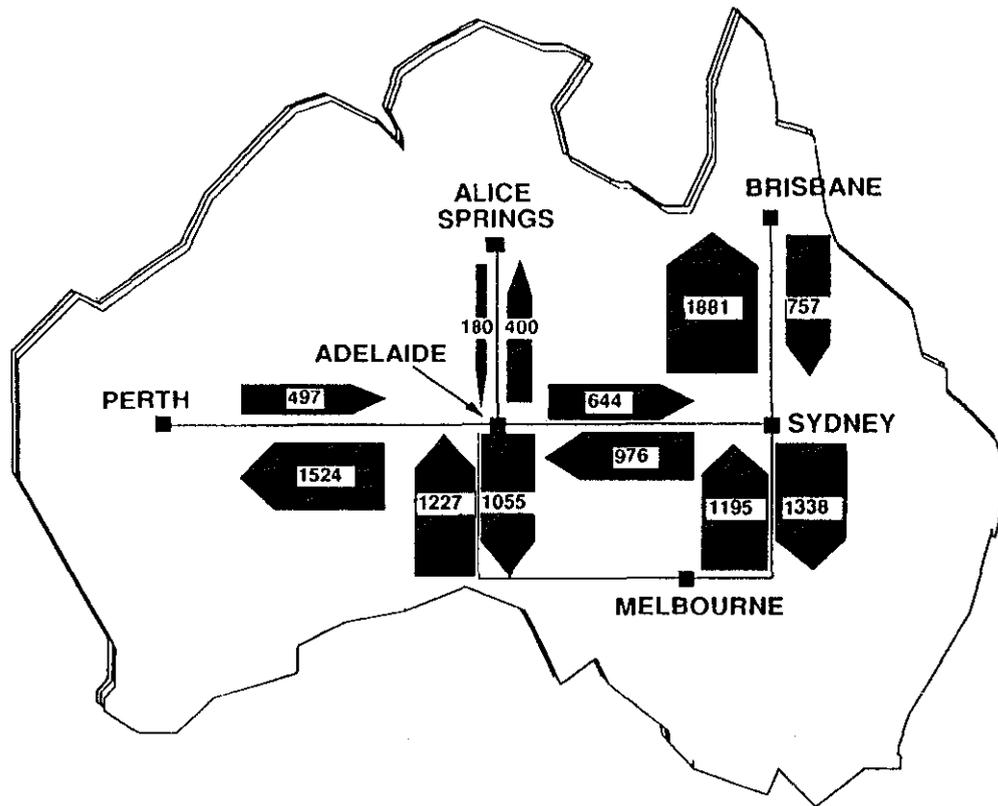
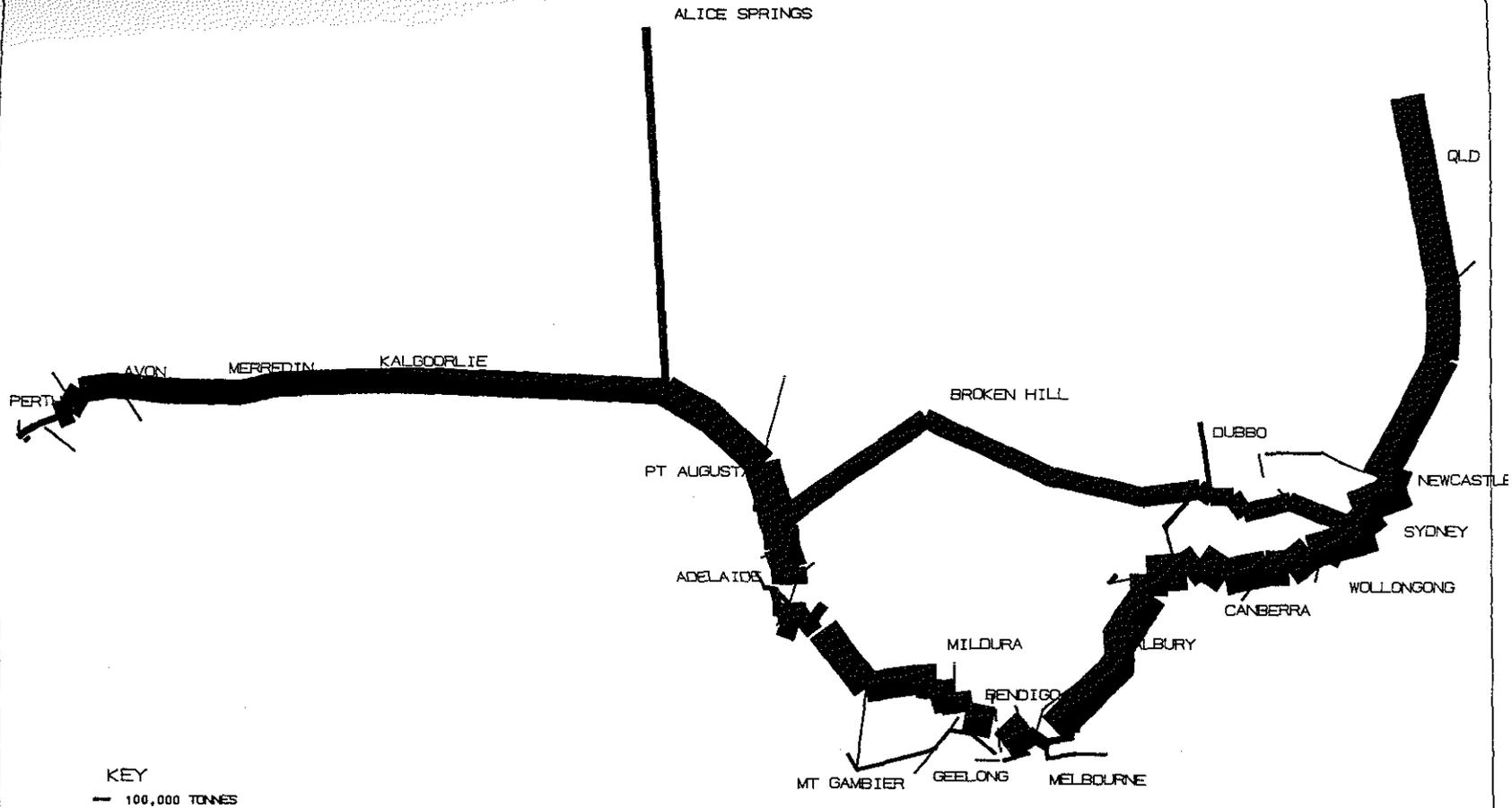


FIGURE 11

**TOTAL TRAFFIC BY CORRIDOR
1988/89 FREIGHT TONNES ('000)**

Source : NFI Report, P13



KEY
 — 100,000 TONNES

NB. ONLY INCLUDES TRAFFICS WHICH TRAVEL FOR AT LEAST PART OF THEIR JOURNEY OVER THE INTERSTATE NETWORK

FIGURE 12
 NATIONAL FREIGHT INITIATIVE
 1993/1994 NET TONNES - OPTION C

- (iii) Option B was the same as Option A but assumed different costs and productivities. Two cases were considered: Option B1, which assumed the 'efficient' costs used in the RIC study, and Option B2, which assumed a set of world-standard 'technically-achievable' costs;
- (iv) Option C was Option B2 but with selected high-priority investments. This also had two sub-options, Option C1 with existing rates and Option C2 which assumed selected rate increases;
- (v) Options D and E are based on Option C2, with the addition of major investment programs. Option D included standardisation of the Melbourne-Adelaide link whilst Option E included the Fast Freight Train project between Sydney and Melbourne.

A traffic forecast was developed for each of these options, reflecting both the assumed underlying growth (which averaged about 3% pa) together with growth flowing from the various investments and rate changes assumed in the scenarios. An operating plan was also developed for each option, taking advantage of the various infrastructure improvements included in each option. For example, one of the capital projects included in Option C was the extension of the crossing loops between Parkes and Broken Hill. This was reflected in the operating plan for that option by increasing train sizes on that link accordingly.

Table 2 summarises the key results.

Table 2 NFI key results

| | 1988/89 | A | B | | C | | D | E |
|-------------------------------------|---------|-------|-------|------|------|------|------|------|
| | | | B1 | B2 | C1 | C2 | | |
| Tonnes (millions) | 9.8 | 12.1 | 12.1 | 12.1 | 12.8 | 10.5 | 10.6 | 13.1 |
| Tonne-km (billions) | 15.2 | 18.3 | 18.3 | 18.3 | 19.2 | 16.7 | 17.3 | 19.3 |
| Revenue (\$m) | 490 | 594 | 594 | 594 | 622 | 582 | 596 | 682 |
| LRAC (excl. capital) ⁽¹⁾ | 443 | 532 | 393 | 341 | 332 | 291 | 288 | 346 |
| Capital charges (renewable assets) | 189 | 225 | 198 | 177 | 185 | 157 | 159 | 183 |
| Fully-distributed costs (FDC) | 792 | 937 | 718 | 618 | 637 | 545 | 544 | 635 |
| Revenue less FDC | (302) | (343) | (124) | (24) | (15) | 37 | 52 | 47 |
| <i>Capital Expenditure</i> | | | | | | | | |
| Renewable (annual) | 94 | 112 | 99 | 89 | 92 | 79 | 80 | 92 |
| Major Projects (once-off) | - | 55 | 55 | 55 | 178 | 178 | 428 | 388 |

⁽¹⁾ Long-run avoidable cost.

The analysis demonstrates a viable NFI requires a combination of cost reductions and selective rate increases:

Option A is the future reference at current productivity rates - rail should in practice improve on this as presently planned productivity initiatives are implemented.

Option B1 assumes RIC input productivity - where rail thinks it can get to given its institutional constraints. However, the revenue shortfall indicates improved costs alone are not the answer.

Option B2 assumes 'world-standard' costs - these would require major institutional changes, particularly to obtain the projected rollingstock operational productivity. However, even this deeper cost-cutting does not recover all costs over the system as a whole.

Option C1, (minor investments) gives a return of approximately 8% on project capital. However, small scale investments, whilst well-justified in their own right, do not provide the absolute benefits required for NFI to be viable.

Option C2 assumes selective rate increases for poorly-contributing traffics. This has a major impact, equivalent to that obtained from \$250-\$500 million of minor investments.

However, a viable NFI does not critically rely on major investments.

Option D (Melbourne - Adelaide standardisation) generates significant benefits. However, these are still small in absolute terms.

Option E (FFT) also generates relatively small absolute benefits, although there would be a significant increase in tonnage. The viability of this project will critically depend on the freight rates achieved by rail.

Both these projects have the potential to generate wider benefits than those considered in the NFI study, both internally and externally to the rail systems. However, they are not critical to the success of NFI.

Finally, a word of caution. The financial results in Table 2 provide a realistic view of the costs of each option. They are, however, not directly comparable to a conventional profit and loss statement based on historic capital charges and should not be interpreted as such.

Conclusion

What do all these analyses and results mean? In many respects they reinforce commonly-held views. Rail's comparative advantage is greatest in coal and minerals. It is competitive, or can be made to be, in grain, although this may also require improvements by handling authorities in loading and unloading arrangements. Passengers look set to be a financial headache for the foreseeable future and intrastate wagonload general freight is unlikely to survive in significant volume into the 21st century unless it is carried in trainloads or semi-trainloads.

Interstate general freight poses the greatest challenge. It can be made profitable from a technical view-point but will almost certainly require major institutional change for this to be possible. Service quality must be improved to ensure rates can be maintained or increased and this will undoubtedly be best achieved by a national enterprise which is not subject to the vagaries of State operational and investment priorities. At the same time, a national body will be far better equipped to implement the productivity improvements required for this traffic to survive in the long-term.

The 1980's have seen many changes in railway organisation, attitudes and performance, particularly in regards to freight. The operations-dominated bureaucracies of the 1970's have become business-led organisations, in probably the biggest change in railway structure and attitudes since their formation. This change in basic outlook has been accompanied by many changes to time-honoured service patterns and operating methods. However, although traffic levels continue to increase, market share is generally stagnant at best and financial results are disappointing. The railway industry will clearly have to make many changes yet if it is to remain viable in the 21st century for anything other than bulk freight. The RIC and NFI studies demonstrate the required strategies; it remains a matter of collective political will for them to be achieved.

Acknowledgements

The RIC analysis was undertaken by Travers Morgan in conjunction with rail systems. The NFI analysis was undertaken as part of a joint study by Booz-Allen and Hamilton and Travers Morgan.

The authors would like to express their appreciation to both RIC and the NFI for permission to publish this paper, which draws extensively on material published in their respective reports. We would also like to thank the various rail systems, whose data, inputs and assistance contributed greatly to the successful completion of the analyses.

References

"Rail into the 21st Century - A Railway Industry Council Discussion Paper", AGPS, Canberra, May 1990.

Booz-Allen & Hamilton Ltd and Travers Morgan Pty Ltd *"National Freight Initiative - Final Report"*, April 1990.

Bullock, R G, Wardrop, A W and Galbraith, R A *"The Analysis and Costing of Rail Freight Operations"*, Australian Transport Research Forum, 1980.