REDUCING RAIL FREIGHT COSTS IN AUSTRALIA

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ABSTRACT

The paper is mainly concerned as to how improvements can be made in the efficiency and competitiveness of government rail freight services through the upgrading of sections of mainline track that currently have severe speed-weight restrictions.

Recent improvements in rail freight efficiency are discussed, with emphasis on two indicators: average unit costs (cents per net tonne km), and average energy efficiency (net tonne km per MJ). Details are given on grades and curvature for the mainline track in New South Wales and Queensland, where 40 per cent of this track fails to meet basic Fast Freight Train standards with a ruling grade of 1 in 66 and no curve to radius less than 800 metres. The constraints on efficient rail freight operations imposed by severe terrain, and how the effects of terrain may be reduced by improving track alignment, are noted. Some rail track investment measures are outlined, including those identified for the National Transport Planning Taskforce. Factors affecting competitive neutrality between road and rail freight outside the present scope of National Competition Policy, from development of the National Highway System and low levels of road cost recovery from heavy trucks, are broadly considered.

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Introduction

Australia has a land area of nearly 7.7 million square kilometres, and in 1995 had a population of about 18 million people. The relatively small population for such a large land area is one factor that has inhibited the development of new rail links such as Alice Springs - Darwin, and, the reconstruction of the poorest aligned sections of rail track linking Australia's three largest cities of Melbourne, Sydney, and Brisbane.

Rail freight services are performed by both Government and private operators, with respective freight tasks in 1990-91 of 52.0 and 37.0 billion net tonne kilometres (btkm) (Cosgrove and Gargett, 1992, who also note the road freight task was 90.75 btkm and the domestic sea freight task was 97.0 btkm in 1990-91). Most of the private rail freight task was accounted for by the movement of iron ore in the Pilbara Region of Western Australia. One such operation is the movement of more than 30 million tonnes of iron ore a year from Mt. Newman to Port Hedland using trains with 240 wagon trains (each with a 105 tonne payload) over well aligned and maintained track laid with easy grades and high axle loadings. Using modern locomotives with such trains, the average unit cost of this operation, including track costs, is understood to be less than 1 cent per net km.

The remainder of this paper will mainly be concerned with the freight operations of six Government rail systems. These systems are:
The four State systems of Queensland (Queensland Rail), New South Wales (State Rail Authority known as State Rail with Freight Rail separate as of 1 July 1996),Victoria (Public Transport Corporation with V/Line Freight), and, Western Australia (West Rail);
The Commonwealth (Federal Government) system, the Australian National Railways Commission (Australian National) formed in 1975 to operate, inter alia, rail services in South Australia and Tasmania; and,
National Rail Corporation (National Rail), formed in 1991 to provide interstate rail freight services, and now jointly owned by the Federal, NSW and Victorian Governments.

There are many reasons for the ongoing multiplicity of Government rail systems offering freight services in Australia, but they basically reduce to history and politics. These factors, compounded by varying safety and technical standards with operations over three different gauges, have resulted in unnecessarily high rail freight operating and maintenance costs. As well, some systems need to operate freight trains over sections of track with severe speed - weight restrictions.

The plan of this paper is as follows. Section 2 briefly examines improvements in rail freight efficiency, with emphasis on two indicators: average unit costs (cents per net tonne km), and average energy efficiency (net tonne km per MJ). Section 3 outlines physical limitations constraining efficient rail freight operations and outlines remedial measures, including those identified for the National Transport Planning Taskforce. Section 4 broadly considers the impact on rail freight finances and rail track development from development of the National Highway System and low levels of road cost recovery from heavy trucks. Our conclusions follow in Section 5.

Improvements in past performance

Sources of information for rail freight data include the Annual Reports of the rail systems, the Inter-State Commission (1987, 1990), the Industry Commission (1991), the Bureau of Industry Economics (BIE, 1995), the Bureau of Transport and Communications Economics (BTCE, 1996 a), and, the Steering Committee on National Performance Monitoring Government Trading Enterprises Performance Indicators (1995).

Table 1 presents the net freight task for each government rail system for 1979-80 and 1983-84 and from 1989-90 to 1993-94. These freight tasks include the freight task undertaken by, or on behalf of, National Rail, that amounted to 16.9 btkm in 1994-95.

The total government freight task also includes significant export coal haulage in Queensland and NSW, that amounted to 23.7 btkm in 1993-94 and 25.6 btkm in 1994-95. Despite the sustained strong growth in coal exports the average annual growth in the total government rail freight task over the 14 years to 1994 was only 3.6 per cent.

In Table 2, estimates of average unit costs per net tonne km (tkm), due to the BTCE (1996 a), are given for each system from 1989-90 to 1993-94. Over these five years, there has been a reduction in unit freight costs for each system. As discussed in the next section, there is scope for further reductions. In respect of NSW rail freight operations, the 1994-95 Annual Report of State Rail notes average unit costs falling from 9.1 cents/tkm in 1985-86 in 1994 terms to 5.3 cents/tkm in 1994-95.

The reduction in average unit rail freight costs for each system, as shown in Table 2, has been due to many factors. One factor is declining staff numbers for each rail system. It is of note that employee numbers for the five Government rail systems were over 110 000 on 30 June 1979 falling to less than 55 000 as of 30 June 1994; also, NSW State Rail numbers fell from 41 071 on 30 June 1986 to 20 186 on 30 June 1995.

Improvements in efficiency have resulted in reduced rail freight deficits. The Industry Commission (1991, p119) estimated that freight accounted for about one quarter of a $2.1 billion rail deficit in 1989 - 90. By 1993-94, the aggregate rail deficit was $1.4 billion (as estimated by the BTCE, 1996 a). Of this, the BIE (1995, p7) estimated that the freight component was possibly " *.....less than $200 million*".

It is appreciated that within a given system, there can be significant variation between unit costs for various freight tasks. By way of example, the unit costs of rail haulage of export coal in the Hunter Valley are much lower than to Port Kembla. On the Hunter Valley main tracks, over undulating terrain, three 90 class locomotives (8580 kW) can haul 84 wagons with 95 tonne payloads (7980 net tonnes). However, Western coal hauled to Port Kembla needs south of Sydney four 86 class locomotives (10 800 kW) to haul just 32 wagons with 75 tonne payloads (3200 tonnes) through the congested inner - west Sydney network over sustained steep grades and the poorly aligned Waterfall - Thirroul track.

A further example is that coal train operations in Central Queensland are done at lower unit cost than between Ipswich and Brisbane's Fishermans Island Port.

Table 1 Rail freight net tonne kilometres

Rail System	Billion Net Tonne Kilometres						
	1979-80	83-84	89-90	90-91	91-92	92-93	93-94
SRA	10.66	11.13	14.40	14.22	13.81	14.84	16.20
QR	11.46	15.39	22.31	22.62	24.46	24.39	25.01
V/Line	3.89	3.12	3.67	3.70	3.25	3.68	4.21
Westrail	4.73	3.90	4.87	4.58	4.88	4.97	5.45
AN	5.62	5.91	8.11	7.79	7.80	8.48	9.16
Total	36.37	39.45	53.36	52.91	54.20	56.36	60.03

Reference: For 1979-80 and 1983-84, Australian Bureau of Statistics (1986), otherwise the Steering Committee on National Performance Monitoring of Government Trading Enterprises (1995) who notes a National Rail freight task of 17.18 million tonne km for 1993-94. This is included in the data above.

Table 2 Rail freight unit costs by system and year

Rail System	Cost (cents) per net tonne km				
	1989-90	90-91	91-92	92-93	93-94
SRA	6.42	6.57	6.97	6.17	5.57
QR	4.34	4.20	3.94	4.40	4.29
V/Line	na	9.76	10.34	9.00	7.48
Westrail	5.83	6.26	5.80	5.38	5.14
AN	4.1	4.0	5.8	4.2	3.7

Reference: BTCE (1996 a, various tables, p25 - 67).

Table 3 Inter-capital city freight tonnages, 1979-80, 1994-95

	Million tonnes				Kilometres	
	1979-80		1994-95			
	Road	Rail	Road	Rail	Road	Rail
Sydney - Melbourne	3.21	1.60	6.47	2.59	863	940
Sydney - Brisbane	1.00	1.19	2.39	2.41	967	960
Sydney - Adelaide	0.61	0.34	1.31	0.88	1430	1692
Melbourne - Brisbane	0.68	0.18	1.33	0.46	1664	1947
Melbourne - Adelaide	1.08	0.80	2.35	2.00	740	777
Syd/Mlb/Bne/Adl - Perth	0.38	1.11	0.80	2.42		
Total	6.96	5.22	14.65	10.76		

References: For freight tonnages, BTCE (1990) and NTPT (1995) where Sydney includes Newcastle and Wollongong for both years, whilst Melbourne includes Geelong and Westernport for 1979-80 only.

Industry concern about export coal rail freight rates, along with an estimated $400 million of rail revenue in Queensland and NSW that "*.....could be regarded as mining taxes rather than rail revenue*", was noted by the Industry Commission (1991, p122). In turn, a recommendation by Hilmer et al (1993) that private companies be able to gain access to essential facilities such as rail track, was adopted by the Federal, State and Territory Governments in 1995 with the adoption of a National Competition Policy. Thus, the 1990s will be a period of change for the NSW and Queensland Government rail systems in regards to their dominant freight traffic. Queensland rail freight rates for coal have been compared by the BIE (1995) with a 'benchmark' rate in America of 2.87 cents per net tkm adjusted for length of haul. The 'best observed' rates in America for 1993-94 were an 'average price to industry' from Burlington Northern (BN) at 1.86 cents per net tonne km. As well, the average unit revenues in 1994 for all Canadian National (CN) and Canadian Pacific (CP) operations, both allowing for a small profit, from Annual Report data, were about 2.60 and 2.24 cents per net tonne km respectively.

However, BN, CN and CP operations are mainly over track capable of supporting 30 tonne axle loads at 100 km/hr. Such track conditions for Government rail in Australia are only approached on the Hunter Valley coal lines. In addition, the ruling gradients for long heavy coal, grain and other bulk trains in Canada and the USA are often more favourable than in Australia. By way of example, CN and CP loaded bulk trains from the Prairies through the Rockies to Vancouver face a ruling grade of only 1 in 100 compared with 1 in 80 for Hunter Valley coal trains, and 1 in 66 for loaded grain trains bound for Port Kembla. The easing of ruling grades through the Rockies to Vancouver for loaded bulk trains was undertaken by CP at several locations during the late 1970s at a cost exceeding $500 million.

In regards to interstate general freight, the BIE notes a best observed rate for BN at 2.87 cents per net tonne km. However, the BN rate includes the cost of its own first class track, whereas the same National Rail rate partly reflects favourable track access agreements to date, at some cost to Australian National and the relevant State systems.

There is also considerable variation in unit costs of interstate rail freight between various corridors. In the late 1980s, it appeared from data given in Inter-State Commission (1987, 1990) reports, that Adelaide - Perth unit costs were approximately 3 cents per net tonne km, and Melbourne - Sydney - Brisbane unit costs were over 6 cents per net tonne km. More recently, the BTCE (1995) noted that average operating and track maintenance cost for Sydney - Brisbane rail freight was about 5.5 cents per net tonne kilometre.

This advantage to rail on the East-West corridor is in part due to Australian National management drive during the 1980s towards commercial operations, along with easy ruling grades, good track alignment (generally straight or easy curves) and the ability to move double stacked containers or tripled decked car-carriers. The higher unit cost in Eastern Australia was due to various factors including management and work practices along with steep ruling grades and poor track alignment with many tight radius curves on the Melbourne - Sydney - Brisbane or North - South corridor. Rail's modal share of inter - capital city land freight on the North - South corridor is appreciably lower than the corridor in and out of Perth, as shown in Table 3.

Thus, there is a strong relationship between higher rail efficiencies, lower unit costs and higher modal shares for rail. As noted (NTPT, 1995, p11): *"A comparison between the Melbourne - Brisbane and Adelaide - Perth corridors illustrates some of the factors in determining modal splits. Rail moves some 80 per cent of the freight on the Adelaide - Perth corridor where the longer distance favours rail and the quality of the rail infrastructure is relatively good. Double stacking is possible. The road length between Melbourne and Brisbane is 1 570 km, a distance over which rail should be competitive. However, rail only carries 21 per cent of the long-distance freight. Rail traffic has to pass over more difficult terrain than road, through Sydney, and over a distance 24 per cent longer than road. Road traffic travels along the Newell Highway, covering the door-to door distance in 22 hours, compared with rail which requires 37 hours from terminal to terminal."*

Energy use and efficiency

A further indication of increased efficiency in rail freight is the reduction in energy inputs for a given freight task- either diesel or electricity. Diesel use for rail freight operations by each system to 1993-94 is given in Table 4. The resulting average energy efficiency is given for each system to 1993-94 in Table 5, after an adjustment has been made for use of electric traction in freight operations in Queensland and NSW.

Whilst each system is generally showing increasing energy efficiency, no system has achieved the average energy efficiency of all United States Class I railroads, which steadily increased each year from 235 to 320 revenue ton miles per US gallon of fuel consumed from 1980 to 1989 (AAR, 1990). This translates to 2.18 to 2.95 net tonne km per MJ of primary energy. Thus, the best performing system in Australia (Queensland Rail) in terms of energy efficiency, had achieved in 1993 an average energy efficiency equal to the aggregate energy efficiency of all US Class One Railroads in 1989.

The average energy efficiency of BHP iron ore trains in the Pilbara was noted as about 10 net tonne km per MJ in 1991 (Laird and Adorni-Braccesi, 1993), and is understood to have since reached 12 net tonne per MJ. The energy efficiency of the Pilbara iron ore rail freight operations are considered to be the best in the world.

The BIE (1995, p97) gives a discussion on fuel use by freight trains, noting inter alia, a variation from just over 3 litres per thousand gross tonne km (l/000 gtk)"..... *(for 4000 tonne freight trains hauled by modern locomotives, to over 10 l/000 gtk (for trains crossing the Great Divide"* (eg. Sydney Melbourne). A similar ratio (with 4.2 l/000 gtk for Adelaide - Perth and 10.2 l/000 gtk) was noted by Railways of Australia (1980). Fuel use in freight train operations in Australia was also examined by Quarterman (BTE, 1981) who, like the BIE (1995), noted energy efficiency increasing with train mass.

However, whereas the BIE (1995, p97) considered that *"....Terrain is the major physical influence on fuel consumption"*, Quarterman (BTE, 1981, p xii) noted that *"..... The disparity between the efficiencies of different parts of the railway system suggests that there is also considerable potential for lifting the maximum attainable efficiency of some railways by improvements to grading and alignment ....."*.

Table 4 Rail freight fuel use by system and year

Rail System	Fuel Use in Rail Freight Operations (Million Litres)					
	1979-80	1989-90	1990-91	1991-92	1992-93	1993-94
SRA	196	194.4	167.5	149.4	158.3	174.9
QR	157	91.5	86.3	80.1	78.8	81.2
V/Line	67	40.3	46.9	43.3	45.5	48.7
Westrail	58	48.7	44.1	44.1	43.8	47.1
AN	93	86.1	86.7	85.8	85.7	88.3
Total Freight	571	461.1	431.5	402.7	412.1	440.2
Freight and passengers		524.1	483.8	448.3	453.6	484.1

Reference: For 1979-80, ARRDO (1981, p11). From 1989, based on advice from rail systems, with recent rail freight fuel use for V/Line and AN estimated on the basis of estimates of gross tonne km for freight and passenger trains. Note that this broad assumption may overstate rail freight fuel use.

Table 5 Rail freight primary energy efficiency by system and year

Rail System	Net tonne km per MJ				
	1979-80	1990-91	1991-92	1992-93	1993-94
SRA	na	1.50	1.55	1.62	1.63
QR	1.75	2.81	2.97	2.95	2.92
V/Line	1.39	1.89	1.80	1.94	2.31
Westrail	1.95	2.49	2.65	2.72	2.77
AN	1.45	2.15	2.18	2.37	2.48

Reference: Based on Tables 1 and 4 with 1 litre of diesel equivalent to 41.77 MJ and for electricity use in Queensland and NSW, 1 kWh = 10.54 MJ in NSW and 1 kWh = 10.92 MJ in Qld (Apelbaum, 1993), with electricity use for QR freight trains from 1990-91 advised by QR, and estimated for NSW from overall SRA electricity use.

Table 6 Rail system freight and passenger train energy costs

Rail System	$ million (then current values)				
	1989-90	1990-91	1991-92	1992-93	1993-94
SRA	118	120	117	137	143
QR	83	88	86	88	93
V/Line	na	58	51	53	53
Westrail	25	26	25	25	30
AN	43	44	40	42	45
Total	na	336	319	345	364
Estimated fuel excise	123	122	116	119	134

Reference Energy costs, BTCE (1996). Fuel excise, Laird (1996), as based on Table 4.

Whilst terrain does affect fuel use, the extent to which fuel use is affected is critically dependent on track alignment. One striking example as shown by M-Train computer simulation (Laird and Adorni-Braccesi, 1993) was for freight trains with two 81 Class locomotives hauling a 1600 trailing tonne load, Whitton's 19th Century alignment between Goulburn and Yass would have been 12 per cent quicker and about 12 per cent more energy efficient than the present alignment that in the 1910's replaced the Whitton alignment: also, if the present track was to be replaced by a new alignment built to modern standards, savings of about 25 per cent in both transit time and fuel use would result.

The cost of energy to the rail systems, for freight and passenger train services, is given in Table 6. The imposition of fuel excise as of August 1982 on the rail systems has had an appreciable impact on rail finances. The estimated fuel excise paid by the various rail systems is also shown in Table 6.

The Industry Commission (1991,1994) has consistently argued that the Government rail systems should receive a full exemption for their use of diesel fuel. A similar recommendation was made by the former Inter-State Commission (1990). In 1994-95, all Government rail systems were making some use of light fuel oil which had an excise rate of about 7 cents a litre, as against about 32 cents per litre for diesel. However, in the 1995 Federal Budget, the excise rate for light fuel oil was raised to that of diesel.

In addition, Queensland Rail was able to achieve a 5 per cent increase in energy efficiency in the transition from diesel electric locomotives to 25 000 electric locomotives for Central Queensland coal train operations (Laird and Adorni-Braccesi, 1993). This transition also reduced diesel consumption by about 100 million litres a year, with appreciably reduced locomotive maintenance costs (Read and Drake, 1989).

Improving future rail freight efficiency

The BIE (1995) gives an extensive discussion on ways and means of improving rail freight operating efficiency and moving towards World Best Practice (WBP). This includes (BIE, 1995, p69), analysis by a consultant, Symonds Travers Morgan, of potential cost savings in several areas that could have made a reduction in total 1993-94 operating costs of $2097 million by $497 million, or 24 per cent. The areas identified for savings, by moving to WBP adjusted for Australian conditions, (with share of total saving in brackets) were Train Crew (13%), locomotive maintenance (16%), wagon maintenance (12%), fuel (0%), terminal marshalling (8%), signalling/control (3%) infrastructure maintenance (16%) and, corporate and business overheads (32%).

The BIE (1995, p 51) also compared changes in operating cost from 1991-92 to 1993-94 and concluded that in 1993-94, AN was the most efficient railway with 1993-94 costs needing to be reduced by around 12 per cent to match WBP costs.

The BIE (1995, Appendix A3.3) gives a discussion of the major factors influencing operating costs, including those listed above. This discussion cites the terrain over which the trains are operated as affecting: locomotive maintenance (requiring more sustained effort, and with any accompanying sharp curvature *"....greatly increasing the wear on* *wheels and bogies"*), wagon maintenance (with track curvature affecting *".....the wear of wheels"* and gradients affecting *".....the wear of brakes"*), fuel (where*".....descending grades seem to generate comparatively few, if any, savings compared to travelling on the flat, ... ascending grades increase consumption ....."*), and track and structure maintenance (via curvature and topography).

With regard to fuel use in rail freight, the BIE (1995, p70) also noted that this was *".....efficient given the existing (age) profile of the locomotive fleet"*. Thus, ongoing upgrading of locomotives, including new ones due for QR in 1996, and then NR, will assist in improving energy efficiency. However, as noted above, these is scope for further gains in energy efficiency by improving the mainline track alignment. The easing of grades and curvature on mainline track that currently has steep ruling grades or tight curvature will also reduce maintenance costs, and mitigate the effect of terrain.

We have noted above that CP invested during the 1980s over $500 million to improve the ruling grades, and alignment, for loaded bulk trains moving to Vancouver through difficult terrain. More recent outlays have been made to allow for passage of double stacked containers. New Zealand's North Island Main Trunk (NIMT) line linking Wellington and Auckland was extensively upgraded in the 1970s and 1980s to give an improved alignment with higher clearances. Part of the civil engineering work was done in connection with high voltage electrification of the central section with rugged terrain. Whilst the economics of electrification have since been questioned, there is no question that improvements in track alignment were cost effective. The track upgrading was essential to allow New Zealand Railways freight services to remain competitive in a deregulated freight market.

In Australia, extensive grade and curve easing was undertaken as part of Kalgoorlie - Perth gauge standardisation in the 1960s. The Tarcoola - Alice Springs railway constructed in the 1970s also gave a much improved railway, with further gains in the early 1980s from a standard gauge link to Adelaide. In,the late 1980s, there was Queensland Rail' s Brisbane - Rockhampton upgrade with four major deviations as part of Mainline Electrification (MLE). In 1992, Queensland approved a Mainline Upgrade Project (MLU) that is now nearing completion that includes nearly 120 km of high quality rail deviations between Brisbane and Cairns. The combined result of MLE civil works and MLU track works has been to increase axle loadings, increase the trailing load behind a locomotive (from 760 tonnes to 1200 tonnes with MLE, then 1350 tonnes with MLU), and reduce transit times for both freight and passenger trains (with Brisbane - Rockhampton tilt trains due in late 1997). Table 7 gives some data on track alignment.

An outline of the MLU project, and compelling reasons for proceeding with it, were given by Hunter (1994): *"Without substantial upgrading, the quality of rail freight services possible could not keep pace with the quantum improvements enjoyed by our major competitor, road transport. Rail would continue to lose market share, compounding the losses from having to retain services. The Mainline Upgrade Project is targeted at improving services and picking up market share, and reducing the costs of providing these services to enable rail to compete more effectively on price."*

Table 7 Aggregate lengths of rail track with gradients steeper than 1 in 66 and/or curve radius tighter than 800 metres.

Section of Track	Length km	Grades steeper than 1 in 66	Curves less than 800 m radius	Steep grades on tight curves	Steep grades and/or tight curves
CABOOLTURE - ROCKHAMPTON (POST MLU)					
Caboolture-Gympie Nth	123	9.2	39.5	4.1	44.6
Gympie - Bundaberg	177	14.2	23.1	3.4	34.0
Bundaberg - Gladstone	178	16.8	8.8	2.0	23.6
Gladstone - Rockh'n	109	2.4	11.6	1.4	12.6
Sub-total	587	42.6	83.0	10.8	114.7
STRATHFIELD - ACACIA RIDGE (BRISBANE)					
Strathfield - Gosford	69	22.2	28.4	10.8	39.8
Gosford - Maitland	112	9.2	28.3	3.0	34.5
Maitland - Taree	186	0	96.8	0	96.8
Taree- Kempsey	125	0	46.6	0	46.6
Kempsey - Grafton	195	0	94.1	0	94.1
Grafton -Border Loop	175	21.0	68.0	9.4	79.6
B.Loop -Acacia Ridge	99	17.9	34.2	4.4	47.7
Sub-total	962	70.3	396.4	27.6	439.4
GLENLEE - ALBURY					
Glenlee - Goulburn	165	2.1	49.9	0.0	52.0
Goulburn - Yass	93	17.1	30.9	5.5	42.5
Yass - Junee	167	30.9	56.1	11.5	75.4
Junee - Albury	161	10.9	2.2	0.0	13.1
Sub-total	586	61.0	139.0	17.0	183.0

Reference. Laird and Adorni-Braccesi (1996). Compiled from State Rail and Queensland Rail computer file data with aggregate data rounded to 100 metres, and Bethungra Spiral excluded on Main South. The Grafton -Border Loop section includes the new Lawrence Rd and Rappville deviations that were commissioned in 1995.

There have been few, if any, deviations to improve track alignment for NSW over the last four decades, save for two small ones north of Grafton as part of the Federal Government's 'One Nation' rail capital works program from 1992 to 1995. However, despite this program, the track linking Melbourne, Sydney and Brisbane continues to have deficient 'steam age' alignment. From Table 7, some 622 kilometres, or 40 per cent, of mainline interstate track in NSW and Queensland fails to meet basic Fast Freight Train (FFT) standards for track to have a ruling grade of 1 in 66 and no curve radius tighter than 800 metres to allow through running at 115 km per hour.

Clearly, the mainline interstate track alignment in NSW and Queensland has scope for improvement. This has been recognised for some time, and no fewer than 10 proposals were made from 1977 to 1993 for upgrading the existing Albury - Sydney track (Laird and Adorni-Braccesi, 1996)

In addition, there is scope for reducing point to point distances on the Albury - Sydney - Brisbane track by a total of 125 km (BTCE, 1996 b), by use of major deviations. A further proposal is for an inland standard gauge railway linking Brisbane and Melbourne, with a potential to reduce distance by 182 km from the present 1940 km via Sydney, reduce transit times from 33 to 23 hours, and reduce unit costs from $23.16 to $17.56 a tonne (BTCE, 1996 b). A further benefit would be to improve port access for agricultural produce from northern NSW. However, the BTCE, (1996, p.xiv) concludes, with qualifications,"*.....the proposed inland railway emerges as an investment of uncertain economic merit for implementation in the near future.*" also, it is unclear "*.....whether the inland railway makes more economic sense than investing a similar amount in the existing coastal railway, which would make the proposed inland railway partly redundant.*"

In a positive move, QR (1996) notes that a study is now underway for "*.....a future upgrade of the railway linking Helidon and Toowoomba (as) the current corridor is built to low engineering standards that are inappropriate to a modern railway*" with new standards requiring grades of 1.5 per cent (1 in 66) and no curve tighter than 2200 metres. This would require a new tunnel under the Toowomba Ranges. Although it is noted that construction of the Toowoomba bypass '*.....could commence in the next 10 to 30 years*', QR is about to reserve a new corridor now to service future demand.

In regards to NSW bulk traffic, one gain would be to ease the ruling grade on the main tracks to say 1 in 100 for the loaded coal trains in the Hunter Valley. This would allow three 90 Class locomotives to lift their everyday load from 84 to 91 wagons.

National Transport Planning Taskforce overview on rail

A report prepared by the BTCE for the NTPT (1995) identified two competitive goals for rail. The first was to improve reliability and transit times, and to reduce interstate rail freight full unit costs down to 3 cents per net tonne km (tkm) over a few years (from a peak level of about 5.5 cents per tkm for Sydney-Brisbane). The second competitive goal would further reduce these costs to 2 cents per net tonne km, the NTPT (1995, p57) BTCE report notes *"About $3 billion of investment is estimated to be warranted over the next 20 years"* including about $1 billion for the Sydney Melbourne corridor, and another $1 billion for the Sydney Brisbane corridor. More detail is given in Table 8.

The NTPT (1995) BTCE report also notes that the estimated cost of maintenance over the next twenty years for the mainline interstate track plus Brisbane - Cairns is likely to be $3.5 billion if the $3.2 billion investment is made; however, if this investment is not made, then maintenance costs may be expected to be about $1 billion more. These costs may be compared with the estimated warranted expenditure for widening and adding lanes, with town bypasses on intercity national highways to 2014-15 to $11.27 billion, with a projected total outlay on maintenance to 2014-15 as $6.5 billion.

Table 8 Rail corridor warranted investment
($ millions)

Corridor	NR Bid	Competitive Goal 1	Comp. Goal 2	Basic Program
Sydney - Melbourne	368	455	980	185
Sydney - Brisbane	163	535	970	90
Brisbane - Cairns	-	445	445	50
Adelaide - Melbourne	152	170	540	90
Adelaide - Perth	28	38	288	15
Sub-total	711	1643	3223	430
Terminals	-	65	145	-
Adelaide - Alice Springs	11	-	200	-
Adelaide - Perth 60 kg/m rail	-	-	500	-
Total	722	1708	4068	430

Reference National Rail (NR) Bid and Competitive Goal estimates due to Maunsell consultants cited by NTPT (1995) BTCE report, pages 68 and 71, and for the basic program, Laird (1996). Note Comp. Goal 1 effectively includes the NR Bid projects, and that Comp. Goal 2 investments include the upgrading projects for Comp.Goal 1.

The costings to the sub-total are noted from the NTPT (1995) BTCE report as projects excluding terminals, Adelaide - Alice Springs and 60 kg/m rail for Adelaide - Perth. Note that the total NR bid includes $69 million for a nation wide first level automatic train control system and that Sydney - Melbourne includes $21 million of works in the Sydney Metropolitan Region and $75 million to ease restrictive gradients.

A basic intercity rail upgrading program

As noted above, the East - West rail corridor performs better than the North - South corridor. Its main problem now appears to be *"....speed restrictions applied on track considered temporarily unsafe at normal speeds"* in Victoria, South Australia and Western Australia (National Rail, 1996). In Victoria, this includes sections of track from Geelong via Ararat to Wolseley with old, worn out wooden sleepers. Also, in Victoria, the Melbourne - Albury standard gauge track for most of its length is in need of rerailing and resleepering, or rationalising with the adjacent broad gauge track. Other useful works includes minimal deviations on the North - South rail corridors (e.g. realign the red sectors and adjacent sections of track with steep grades or sharp curves), and lift Melbourne - Adelaide clearances so as to allow for double stacking of containers.

The incoming Government prior to the 1996 election made financial provision for establishment of the proposed National Rail Track Infrastructure Corporation. It is also recommended (Laird, 1996) that a start should be made on remedying some of the above physical limitations as part of a five year $430 million program. The level of such funding is $86 million a year, which should also include an allocation towards upgrading Brisbane-Toowoomba/Gympie rail track.

The recommended funding level of $86 million a year could be based on a transfer of 18 cents a litre of the fuel excise paid by the rail systems on the current use of some 480 million litres a year of diesel. This would be consistent with Coalition transport policy that provides, inter alia, *".....users of transport systems will get a better deal for the charges collected from them through funding for maintenance and improvement of infrastructure.."*

This level of 18 cents a litre is also the level officially determined by the National Road Transport Commission (NRTC, 1992) as a partial road user charge for the use of heavy trucks on public roads.

Road freight track competitive factors

This paper is primarily concerned with driving down rail freight costs to international standards. It has been outlined above how in recent years the rail industry has improved its performance and reduced its deficits. However, as seen by Kain (1995), *"....rail is probably fast reaching the point where the scope for marginal productivity improvements from operational (e.g. work practice) reforms may be limited. Future significant gains in productivity will rely increasingly on effective track investment initiatives."*

As the NTPT (1995) BTCE study noted, rail investment of some $3 billion is warranted for the interstate mainlines. Further funds may be required for other mainlines. If such track investment is to take place, it will need either public funds or private funds. In the past, from 1 July 1974 to 30 June 1994, the Commonwealth has advanced grants for upgrading and maintaining the National Highway System amounting to $12.56 billion in 1994 terms (Laird, 1996). This is in stark contrast with an estimated net Commonwealth expenditure (after loan repayments), over this time, on rail capital works of about $0.82 billion in 1994 terms (of which $0.58 million was for Australian National).

The National Highway System (NHS) was formed by the Federal Government in 1974 when it included the major roads linking all mainland capital cities, plus certain main Tasmanian roads, with a combined length of about 16,000 kilometres. Between Melbourne and Sydney, the Hume Highway was chosen, and from Sydney to near Newcastle, the Pacific Highway was used along with the New England Highway to Brisbane. The Pacific Highway north of Newcastle did not form part of the NHS. The major gains resulting from sustained Commonwealth full funding over time have included the sealing of the entire length of highway by 1989, and, the reconstruction of most of the Hume Highway from a deficient two lane sealed road to a modern four or more lane highway throughout all of Victoria and from Liverpool to south of Yass.

In November 1992, the NHS was extended to 18,500 kilometres to include the Sturt Highway (Adelaide - Sydney) and the Newell Highway followed by the Goondiwindi - Toowoomba road (Gore Highway). As of January 1994, the NHS was extended to include certain urban arterial roads in the mainland State capital cities. In 1996, the Federal Government agreed to commit $750 million over 10 years as part of a $2.9 billion upgrade to fast track existing works, and new work, to upgrade the Pacific Highway.

In place of public funding of rail track upgrading, the suggestion is sometimes made that the users of rail freight should be prepared to meet the relevant costs. This then raises the issue of why users of freight services should invest in rail track, when there are ongoing road improvements and advances in truck productivity, with road track access to heavy trucks provided at rates much cheaper than rail track access.

This in turn opens up the subject of whether there is a hidden subsidy to road freight operations. This was subject in the 1980s to vigorous debate (see, for example, Laird, 1993), with almost all Government reports then finding under-recovery of road system costs from the heavier articulated trucks driven long distances.

In an effort to gain full recovery of road system costs from the road freight industry, and to deal with a wide range of charges and regulations between the States and Territories, a National Road Transport Commission (NRTC) was formed in 1991. The Industry Commission (1991) recommended that road user charges should be introduced "*.....which reflect more accurately the amount of road use and pavement damage caused by all classes of vehicles. A national vehicle registration scheme is a key element in achieving these change"*. However, in determining its charges, the NRTC (1992) chose uniform charges for each type of articulated truck. The NRTC charges were subsequently adopted for the ACT by the Commonwealth and by Queensland to come into effect on 1 July 1995, and Victoria on 1 January 1996. Following pressure from the Commonwealth in 1995, all States and Territories agreed to implement the NRTC charges no later than 1 July 1996.

These charges have deep problems. As recognised by the NRTC (1992), they result in under-recovery from six axle and larger articulated trucks. As seen by the Industry Commission (1992) "*.....Annual fixed charges are not efficient because costs vary with the distance travelled and the mass of the vehicle. The result is that some vehicles - the heaviest travelling long annual distances - will meet less than 20 per cent of their attributed costs..... Differences between the recommended charges and road-related costs are greatest for vehicles competing with rail. The charges, as recommended, will therefore potentially distort the long-haul freight market as rail reforms take effect.....*"

New Zealand has had, since 1978, a system of road user charges for heavy trucks that is based on mass-distance charging. This system was introduced as a considered decision to put into place full road cost recovery from heavy trucks before lifting rail protection. The NZ road user charges were a necessary condition for rail freight profitability and NZR privatisation in the early 1990s. The New Zealand Ministry of Transport (1996) is now reviewing road pricing, and environmental costs. In a spirit of competitive neutrality, this review is likely to see a move to higher road user charges for the heavier trucks.

In Australia, a series of recent Government reports concerning competition policy and transport reform, have effectively side stepped the issue of road cost recovery as it relates to rail in Australia. These reports include Hilmer et al (1993), Economic Planning Advisory Council (EPAC - 1995), NTPT (1995), BIE (1995), the Australian Transport Council (1995) and Symonds Travers Morgan (1995). Clearly, considerations of competitive neutrality require that this issue, along with the establishment and funding of a proposed national rail track access corporation, be honestly addressed by Government.

Concluding remarks

As starkly recognised by the House of Representatives Standing Committee on Transport, Communications and Infrastructure (1989): "....*The plain fact is that a greatly increased amount of freight could be carried across the continent by rail more efficiently and with greater safety than it ever could be by road. .... If rail were more efficient and carried the amount of freight it should, lives would be saved, less non-renewable resources would be used and less pollution would be generated.......Australia is paying the price of neglect and bandaid solutions in an endeavour to solve problems in its rail systems. .... Rail has been starved of funds and rendered inefficient.'* "

Despite the formation of National Rail in 1991, and some gains the efficiency and safety of road and rail freight, the observations of this Committee remain valid. Vertical disintegration and a proliferation of rail systems will not address the speed weight restrictions due to 'steam age' track alignment. These physical restrictions drive up rail freight operation and maintenance costs, and reduce its efficiency and competitiveness. As it is unlikely that road pricing for heavy trucks in Australia will soon reflect all pavement and environmental costs, it is now time for the Commonwealth to accept responsibility for upgrading the national interstate mainlines - as per the National Highway System in 1974.

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References

Apelbaum Consulting Group Pty Ltd (1994) *The Australian Transport Task and Primary Energy Consumed; The 1990-91 Compendium* (Commonwealth Dept of Primary Industries and Energy: Canberra)

Association of American Railroads (1990) *Railroad Facts.*

Australian Bureau of Statistics (1986) *Rail Transport, Australia 1983-84* Cat. No 9231.0

Australian Railway Research and Development Organisation (1981) *Energy and Railways; Summary Report.*

Australian Transport Council (1995) *National Competition Policy in the Australian Transport Sector.*

Bureau of Industry Economics (1995) *Rail Freight 1995 International Benchmarking.*

Bureau of Transport and Communications Economics
- (1981) *Freight transport energy consumption*
- (1990) *Freight flows in Australian Transport Corridors*
- (1995) *Adequacy of transport infrastructure, Rail* Working, Paper 14.2
- (1996 a) *Analysis of rail deficits*, Information Paper 40
- (1996b) *Economic effects of a Brisbane - Melbourne inland railway*, Working Paper 18.

Cosgrove, D. and Gargett, D. (1992) The Australian Domestic Transport Task, *Seventeenth Australasian Transport Research Forum*, Canberra, pp 231-250.

EPAC (1995) *Private Infrastructure Task Force Final Report*.

Hilmer, F.G., Rayner, M. and Taperell, G. (1993) *National Competition Policy Report by the Independent Committee of Inquiry*

House of Representatives Standing Committee on Transport, Communications and Infrastructure (1989) *Rail: Five systems, One Solution*

Hunter, R. (1994) Queensland Rail's Mainline Upgrade Project, Tenth International Rail Track Conference Proceedings, pp 107-115

Industry Commission (1991) *Rail Transport*
- (1992) *1991-92 Annual Report*
- (1994) *Petroleum Products*

Inter-State Commission (1987) *Federal registration charges for interstate vehicles.*
- (1990) *Road Use Charges and Vehicle Registration : A National Scheme.*

Kain, J. (1995) *A Spirit of Progress? Assessing Australian Rail Transport Policy,* Research Paper No 31, Commonwealth Department of the Parliamentary Library, Canberra

Laird, P. G. (1993) Rational Road User Charges for Heavy Trucks, *Eighteenth Australasian Transport Research Forum*, Gold Coast, Part 1, pp1 -14.
- (1996) *Intercity land freight transport in Eastern Australia* Working Paper 1996/6, Centre for Resource and Environmental Studies, Australian National University: Canberra

Laird, P. G. and Adorni-Braccesi, G. (1993) *Land Freight Transport Energy Evaluation*, Energy Research and Development Corporation, Canberra
- (1996) *Rail track and the elusive level playing field*, 11th International Rail Track Association Conference, to appear

National Rail, *Keeping Track*, No 24, February 1996.

National Road Transport Commission (1992) *Heavy Vehicle Charges: Determination.*

National Transport Planning Taskforce (1995) *Commissioned Work Vol 1:BTCE Report.*

New Zealand Ministry of Transport (1996) *Environmental externalities.*

Railways of Australia (1980) *Saving liquid fuels during a national emergency by diversion of freight from road to rail transport.*

Read, R.G. and Drake, A.M. (1989) *Queensland Railways Main Line Electrification Project*, Proceedings, Fourth International Heavy Haul Railway Conference, Brisbane.

Steering Committee on National Performance Monitoring (1995) *Government Trading Enterprises Performance Indicators 1989-90 to 1993-94.*

Symonds Travers Morgan (1995) *Review of the costs and benefits of establishing Track Australia for the interstate rail network* (via Federal Department of Transport, Canberra).