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Australian freight railways for a new century

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AUSTRALIAN FREIGHT RAILWAYS FOR A NEW CENTURY

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SUMMARY

After a decade of reform, Australian rail has demonstrated that it can be cost-efficient in moving bulk freight such as coal and iron ore along with the lion's share of the non-bulk freight market on the east–west corridor. However, on the north-south corridor, rail has less than 20 per cent market share of contestable freight. This paper looks at one particular aspect, rail infrastructure, which can be improved to give faster transit and reduced rolling stock inventory and fuel costs to contribute to reduced train operating costs, while at the same time reducing the ongoing cost of infrastructure maintenance.

This paper considers track alignment, and explores the aspects of cost and benefit that are relevant to the justification of such work. By way of example, construction of a 67 km Karuah Valley railway could replace the existing 91 km Hexham - Stroud Road section with its poor alignment plus halve transit times and reduce fuel use by 40 per cent. A new 67 km Grandchester - Gowrie crossing of the Toowoomba Range, replacing the existing 107 km section, would cut freight train transit times from about three hours to one hour and almost halve fuel use. Appreciable reductions in external costs would also result in both cases. The paper concludes with some commentary on the issue of funding where there are benefits to the community in general as well as specifically to the project participants.

1. INTRODUCTION

Australian freight railways begin the 21 st Century with a mixed legacy from the 20 th Century. The last ten years to 2005 have seen significant changes to ownership of rail assets and operations within Australia. The changes have been mostly due to part privatisation of former Government rail freight assets and the implementation of National Competition Policy that, inter alia, provided conditional third party access rights to former government rail track.

As at June 2005, the Australian hire and reward rail freight task is now mostly performed by two larger private operators (Pacific National and Australian Railroad Group - ARG) and one public operator (Queensland Rail). Their freight trains move over track controlled by the Federal Australian Rail Track Corporation (ARTC - which was formed in 1998 to own track in South Australia, and now leases mainline interstate track in Victoria and New South Wales), along with ARG in West Australia, RailCorp in the Sydney region of NSW and Queensland Rail. Two large iron ore railway companies (BHP Billiton and Pilbara Rail Company) operate over their own captive networks while there are a number of smaller rail freight companies operating over 'access' track, including Freightlink between Adelaide and Darwin.

1.2 The growing land freight task

The growing rail and road freight tasks in Australia are shown in Table 1. There are severe limitations on the quality and quantity of data publicly available on land freight in Australia. Land freight data deficiencies were acknowledged by the Productivity Commission [1], with the Department of Transport and Regional Services [DOTARS - 2] and the Senate Rural and Regional Affairs and Transport Legislation Committee [3] recently proposing improvements in transport data.

From Table 1, in 1994-95, private rail freight accounted for about 44 per cent of Australian rail freight. With the changes outlined above, the percentage of private rail freight operations had reached some 74 per cent by 2002-03, with the remaining 26% being QR.

The Australian road freight industry has sectors that operate at world best practice. For many years, truck operators have taken advantage of relaxation of mass limits, and increased expenditure on roads by all levels of Government, which by 2005-06 was estimated at $10.4 bn [8]. Road pricing for heavy trucks is an emerging issue, which we consider in Section 4, after performance and track issues are outlined in Sections 2 and 3. Funding issues are touched on in Section 5 and our conclusions are given in Section 6.

Table 1 Australian Land Freight Tasks Billion tonne kilometres

	1994-95	1998-99	2002-03
Rail			
'Govt.' rail *	61.6	67.4	41±
Non-Govt. **	48.2	60±	117
Total	**109.8**	**127 ±**	**158**
Coal	28	33±	44
Iron Ore	47.3	50±	67
Other			
Intrastate	17.9	24±	21
Interstate	16.6	20±	26
Road			
B-Doubles	9	19	35
Road trains	15	20	19
Artic. trucks	89	99	116
Interstate	26	30 ±	37 ±
Total	**119**	**127**	**153**

* Includes QR, FC, NR, WR and V/Line Freight in 1994-95, QR only in 2002/03
** Includes SCT, Toll and V/Line Freight in 1998-99, all except QR in 2002/03

References include: For rail, Steering Committee on National Performance Monitoring [SCNPM - 4], Bureau of Transport and Regional Economics [BTRE - 5], various Annual Reports, Australasian Railway Association [ARA - 6] and some estimates (indicated by ±).
For road. Australian Bureau of Statistics [7].

1.3 The Australian rail network

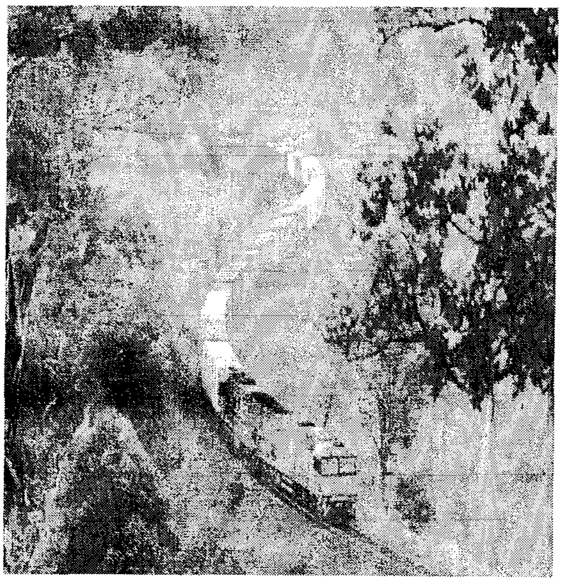
Towards the end of the 20 th century, Australia had some 35,690 route kilometers of railway track (excluding the 610m gauge used on the sugar cane railways). This comprised 16,303 km of standard gauge (1435 mm), 15,063 km of narrow gauge (1067 mm), 4028 km of broad gauge (1600 mm) and 296 km of dual gauge [9].

The ARTC [10] currently has responsibility for the management of 5861 route kilometres of standard gauge interstate track in South Australia, Victoria and Western Australia, and New South Wales. ARTC also leases the Hunter Valley Coal Rail network in New South Wales (311 km) and manages other regional rail lines in New South Wales (651 km). The remainder of the interstate rail network is controlled by other agencies as follows:

- Brisbane to Queensland Border (QR)
- Sydney Metropolitan Region - including Wollongong - Sydney - Newcastle (RailCorp)
- Kalgoorlie to Perth (WestNet)

Table 2 gives aggregate lengths of rail track with gradients steeper than 1 in 66 and curvature tighter than 800 metres for the East West corridor linking Melbourne and Perth via Adelaide, the North South linking Melbourne and Brisbane via Sydney, and the Queensland North Coast corridor between near Brisbane and Townsville. Photo 1 shows a superfreight on one of the many reverse curves on the NSW North Coast line.

PHOTO 1: ' .. curves tighter than 800 m .. '



Yumbunga NSW Photo Credit GRMS Media

Table 2 Major corridor alignment overview

Section of Track	Length	Grade steepe than 1 in 66	Curves of radius less than 800m
	km	km	km
East West Corridor Perth - Melbourne (Mlb)			
Perth - Adelaide	2641	0	49
Adelaide - Mlb	835	85	49
Total	3476	85	98
Percentage of corridor		*2 %*	*3 %*
North South Corridor Mlb - Brisbane (Bne)			
Mlb - Glenlee	898	102	145
Strathfield - Bne	962	70	396
Total	1860	172	541
Percentage		*9 %*	*29 %*
Queensland Caboolture - Townsville			
Caboolture - Rocky	587	42	83
Rocky - Townsville	701	19	67
Total	1388	61	150
Percentage		*4 %*	*11%*

Reference [11] Compiled from rail system computer file data with aggregate data rounded to 100 metres. Data is qualified and for track as at end of 1996, with Caboolture Townsville post Main Line Upgrade, Rocky = Rockhampton. Bethungra Spiral is excluded on the Main South line. Glenlee is 53 km South of Sydney, Strathfield is near Sydney, Brisbane is taken as Acacia Ridge and Caboolture is 50.5 km north of Brisbane.

2. AUSTRALIAN RAIL PERFORMANCE

During the early 1990s, all rail systems gained major improvements in labour productivity with former Government railways averaging at 2.2 million net tonne km (ntkm) per freight employee in 1994-95 [4]. Rail freight productivity gains have been recorded by other various Government agencies such as the BTRE and the Productivity Commission [1]. With current data restrictions, it is difficult to gauge the number of rail freight employees and hence productivity.

Energy efficiency for 'hire and reward' (formerly Government Rail) appears to have increased from 2.6 net tonne km/MJ (ntkm/MJ - using Full Fuel Cycle (FFC) or primary energy) in 1994-95 to 3.2 ntkm/MJ in 2002-03 [Apelbaum 12] with improvements in part due to new National Rail locomotives and a better wagon fleet. However, this trails both the 2003 implied averages for Canadian and United States Class I Railroads of 3.7 ntkm/MJ [13] or a Canadian Pacific Railway [14] impressive energy efficiency of 4.2 ntkm/MJ.

During the 1990s, aggregate Government rail freight deficits (of about $500 million in 1989-90, reduced to around $200 million by the mid 1990s [15]) were turned into rail freight profits.

For 2002-03, aggregate 'hire and reward' freight income (excluding iron ore) was $2914m plus $23m CSO payments [6] (an average of about 3.2 cents per net tkm) with an overall rail operating profit (mostly freight) before income tax of $188m.

As noted in Table 1, during 2002-03 the Australian rail freight task was approximately 158 billion tonne kilometres (btkm) compared to 110 btkm in 1994-95. Rail freight efficiency is at world best practice for the Western Australia iron ore operations with over 60 btkm, and is high for Queensland and NSW coal operations with 44 btkm, along with Adelaide - Perth general freight operations. However, grain lines, with their seasonally variable demand, are in need of rehabilitation in several mainline states to avoid closure, whilst rail freight operations between Australia's three largest cities of Melbourne, Sydney and Brisbane continue to be impeded by track that has severe speed weight restrictions.

2.1 Performance at world best practice

The iron ore railways in the Pilbara continue to operate at world best practice with respect to operating costs and energy efficiency. The high efficiency is due in part to world class track (some 1200 route kilometers in 1999 [16] and still increasing) which has the characteristics of good alignment, excellent formation, complete with sleepers and weight of rail capable of high axle loadings. Efficient operations are also assisted by updated locomotive fleets (including Dash 8 locos and AC traction locos with BHP Billiton Iron Ore, and Dash 9 locos with Hamersley Iron), plus well maintained wagon fleets. The unit cost of the Pilbara iron ore rail operations is understood to be appreciably less than one cent per ntkm, with high aggregate energy efficiency. For BHP Billiton Iron Ore, during 2000 an average of about 0.75 litre of diesel was used to move one tonne of iron ore a distance of 426 km from Mt Newman to Port Hedland [17]. This gives an outstanding energy efficiency of about 15 ntkm per MJ.

Queensland Rail's export coal haulage, mostly in Central Queensland under electric traction (25,000 volts AC) on narrow gauge is also regarded as world best practice. QR moved about 156 million tonnes of coal in 2004-05 [18], mostly in Central Queensland with a primary energy efficiency exceeding 5 ntkm/MJ.

Adelaide - Perth freight trains are Australia's best interstate general freight operations, having captured over 80 per cent of the interstate land freight moving in and out of Perth. Along with rail - rail competition, a major factor contributing to this high modal share is the ongoing infrastructure upgrades spanning four decades (starting with Kalgoorlie - Perth gauge standardisation and major deviations completed in the 1960s). Double stacked container capacity west of Adelaide and Parkes also contributes to this good result for rail.

2.2 Severely constrained performance

We consider briefly the North South corridor linking Australia's three largest cities of Melbourne, Sydney and Brisbane. However, we shall not further consider the grain network (which is in need of rehabilitation in many mainland states), and Tasmania's rail system (where trains on the entire network have a maximum speed of 60 km/h with no shortage of further permanent and temporary speed restrictions).

2.2.1 The North South corridor

Much attention has been focused on the poor market performance of rail on the North South corridor. This is due mainly to unchanged inadequate track condition and alignment, with increased rail congestion in and near Sydney along with continuously improving intercity highways coupled with Australia's extensive 'highway subsidisation'. In respect of track condition, an Infrastructure Report Card [19] noted, inter alia, *Melbourne to Sydney to Brisbane - poor track condition, steam age alignments [and some signalling] severely impact on transit times and make the running of a rail operation almost non viable. Rating F.*

Modal shares of about 11 per cent between Melbourne and Sydney and 19% between Sydney and Brisbane [10] speak for themselves.

The present average speeds for Superfreighters between the Sydney and Brisbane terminals are only about 53 km per hour. If the time for numerous stops at crossing loops etc is removed, the average speed is slightly more than 60 km per hour. As observed by a major 1995 report [20] in respect of Sydney - Brisbane rail, "*Transit times, reliability and costs are so poor that the corridor may not survive as a commercial freight alternative unless improvements are implemented.*"

This situation is being exacerbated by large scale upgrading of the Pacific Highway without rail track straightening. The Railway Technical Society of Australasia has urged [21] that consideration be given to shared road and rail corridors where practical for highway and rail track upgrading, as is the case with the Tugun bypass behind the Gold Coast.

2.3 The Queensland North Coast corridor

From 1992 to 1997, Queensland Rail undertook a MainLine Upgrade (MLU) between Brisbane and Cairns [22] which raised the line limit to 20 tonne axle load as well as 120 km of high quality rail deviations with easy grades and curves, supplementing about 40 km of deviations between Nambour and Gladstone undertaken as part of Queenslands Main Line Electrification project completed in 1989. The MLU allowed improved rail freight services particularly intermodal to and from North Queensland (including livestock trains which are now unique to Queensland). It also facilitated the direct service to bring fruit and vegetables from North Queensland to Sydney and Melbourne markets (with a change of gauge at Brisbane). The benefits of further track straightening at numerous locations in Queensland are discussed in a Straight Track Study [23].

Caboolture - Landsborough duplication, with some realignment, is now long overdue for improvement to be able to cater for existing train operations. This coincidently would facilitate the creation of the planned rail link to the Sunshine Coast. Freight trains are now subject to limited peak hour curfews, and a 'railway bus' has augmented train services between Caboolture and Nambour for some years. This section is now the most congested section of single track in Australia. Consistent with a then progressive approach to rail development, the 1997 Queensland State Budget included an allowance for detailed planning of part of this section. However, the actual commencement of work has been subject to extended delays with a detailed study leading the Queensland Government to propose in late 2003 an option, which was subsequently put on hold early in 2004 prior to a State election. At the time of writing, a new route was still to be formally announced.

3. AUSLINK

Three major federal government rail inquiries were undertaken during the late 1990s [1,24,25]. Their reports agreed with the earlier National Transport Planning Taskforce report [20] that there is a need for a national integrated transport policy, to upgrade '*...substandard national track*', lift Federal rail track investment, and harmonise rail operating standards. The delayed response of the Federal Government to these inquiries included release of an ARTC Track Audit in 2001 [26] and release in 2002 of a Green Paper proposing an integrated national land transport policy called AusLink.

Subsequently, a National Transport Commission was formed on 15 January 2004, (to replace a National Road Transport Commission formed in 1991) and an AusLink White Paper was released in June 2004 [2]. This proposed an ARTC investment of $872 million over five years to June 2009 (mostly loan funds) complemented by AusLink grants of about $1 billion to upgrade interstate mainline track [2]. This was to include track straightening between Brisbane and Sydney at 14 locations (over 121 km of track).

These rail allocation funds compare with an allocation of about $8 billion over this five year period to roads; also Federal allocations in the 30 years from 1974 to 2004, in 2004 values $24.6 bn to a National Highway System with $58.0 bn on all roads, $2.2 bn to rail capital works, and about $1.8 bn to urban public transport [27]. In December 2004, enabling legislation for AusLink was introduced along with national guidelines for transport system management and investment [28]. Following a Senate Committee inquiry [3], the legislation was enacted in June 2005.

3.1 The ARTC North - Coast programme

ARTC, since taking up its NSW main line lease in Sepember 2004, has developed a strategic North – South plan for investment in the corridor over the next three to four years. The plan calls for provision of comprehensive facilities to permit 1800 metre trains between Melbourne and Sydney and more frequent 1500 metre trains between Sydney and Brisbane, improved track stability and hence curving speeds, replacement of the Murrumbidgee bridge at Wagga, improved freight access to the centre of Melbourne and Sydney and replacement of outdated signalling and centralization of all signal box activity.

A considerable sum will need to be directed to remediation of deferred maintenance, a pernicious outcome of past Treasury driven funding arrangements. Complementary works will be undertaken between Sydney and Newcastle over tracks owned by RailCorp which will continue to have shared passenger and freight traffic operations. The objective is to reduce transit time to 11 hours between Melbourne and Sydney and 15.5 hours between Sydney and Brisbane, and these to be achieved within three to four years.

While the current ARTC plans do not include any realignment, these initial improvements will set the stage for these more significant projects to be planned and designed ready to start off a second tranche of corridor investment. This will require an early start on advanced planning including route selection of new deviations, environmental impact assessment and land reservation.

4. INTERSTATE TRACK UPGRADING

Concise reasons for proceeding with the Queensland MLU Project with its extensive deviations were given by Hunter [22]; *"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. ...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."*

By way of contrast, the One Nation interstate track work of the early 1990s included only two minor deviations, and these were more to remove grades than to change horizontal alignment. As noted by the South Australian Minister for Transport, the Hon Diana Laidlaw MP [29] *The Adelaide-Melbourne standard gauge program has been done on the cheap - the sharp curves and grades through the Adelaide Hills remain as an impediment to efficient operations. The standard gauge Melbourne to Albury line is slowly disintegrating, with only minimal funds for rehabilitation. The Albury-Sydney line retains its steam alignment and the Sydney to Brisbane line remains the most difficult line in the country to operator, despite the high level of freight traffic between the two Pacific seaboard capitals.*

The challenge for the rail industry and policy makers is to find an acceptable process to evaluate alignment improvements in particular, with improved rigour on cost identification (including externalities) and more robust forward freight opportunity forecasting. It is quite clear that without continuous improvement rail will be condemned to a progressive contraction of its business as long as competing modes continue improving at the rate they are.

Axle loads are one area where interstate rail has made significant gains over the last few decades. The general limit of 19 tonnes axle load (tal) in the 1980's is now 21 tal for high speed trains and 23 tal for heavy trains over all main interstate routes with some sections where there are specific traffic needs now at 25 tal. While these limitations are lower than those seen on most Canadian and US mainlines they really only present train loading problems where double stacking of containers is possible or where there are substantial opportunities for heavy (mainly bulk) traffic

4.1 The North - South corridor

The National Transport Planning TaskForce [20] considered that an investment of about $2 billion was necessary to bring the Melbourne - Sydney - Brisbane rail corridor towards US Class I railroad standards. This is appreciably less than at least $5 billion outlaid in today's terms on the Hume Highway linking Melbourne and Sydney over the last 30 years [27], and, over the $3 billion invested between 1996 and 2006 to upgrade the Pacific Highway.

There is also a major benefit to be had from rail deviations to reduce the point to point distances, and provide easier grades and less curvature so as to allow for heavier and faster trains. Here, the construction to modern engineering standards, of three proposed NSW rail deviations in southern NSW, between Campbelltown and Mittagong, Goulburn and Yass, and Yass and Cootamundra of combined length 164 km would replace 219 km of track on "steam age" alignment. The benefits for a 'standard' intermodal freight train of three NR locomotives with a 3900 tonne trailing load include a time saving of 84 minutes and a fuel saving of over 1500 litres of diesel. The beneficiaries of track upgraded for faster and heavier freight trains include regional freight such as grain and ores and could include high-speed tilt passenger train services [30].

4.1.1 Sydney - Newcastle

The worst aligned sections of track linking Sydney and Newcastle are also long overdue for realignment. More details, including of 'red sectors' with tight radius curves (less than 800 m) on steep grades (steeper than 1 in 66) are given in [31], including a Booragul Bypass. Other work that could usefully be done would be to make a direct freight link from near Teralba to Hexham.

The section between Hornsby and Broadmeadow is now the most congested section of double track in Australia, albeit more from frequent passenger trains rather than from commercial freight activity. A more useful strategy would be to improve the line to provide competitive passenger times between Sydney and Newcastle, provide adequate passenger capacity south of Gosford and to incorporate provision for 'full time' freight activity over the length of the line (freight curfews reduce the time available for freight trains to around 16 to 18 hours per weekday). Portions of the existing route could be kept as an alternative freight track at suitable locations.

It is understood that design work was undertaken by consultants for the former Rail Access Corporation on a high speed Newcastle line that would have allowed reduction of the XPT transit time from Sydney to Broadmeadow from over 2 hours to 90 minutes. Complex engineering, high costs and unrealistically high expectations seem to have condemned these plans to the archives. Transit time savings of approximately one hour for freight trains in each direction are envisaged. A modified proposal with steeper grades for passenger trains (all passenger trains are electric multiple units or high power diesel multiple units) might be more realistic.

4.1.2 A Karuah Valley option

The existing 90.8 km Hexham – Stroud Road route has poor alignment (22.0 km of track on curves of radius 400m, 12.2 km on curves of radius 400 to 600m, and 7.2 km on curves of radius 600-810m). It requires trains to traverse the equivalent of 18.5 complete circles of curvature. Photo 2 shows one of the many reverse curves on this section.

PHOTO 2: ' ... Stroud Rd the long way ... '

Stroud Road NSW Photo Credit GRMS Media

A potential 67.2 km rail deviation with a ruling gradient 1 in 80 has for most of its length a ruling curvature of 2200 metres and was considered by Stoney [32]. Trains (going either way) would reduce the equivalent curvature to less than one circle.

Train simulation using Simtrain indicates that for a 'standard' intermodal freight train of three NR locos (of mass 132 tonnes each) hauling a trailing load of 3900 tonnes and 1500 metres long, averages (of north and south bound train movements) are shown in Table 3.

Assumed updated cost parameters in 2009 values (at 3 per cent per annum inflation) for a model developed for Queensland Transport [23, 31] for such a train are as given in Table 4 for the reference train.

Table 3 Reference train simulation outputs

	Extg	New	Reduction
Track length (km)	90.8	67.2	23.6
Transit time (min)	82	40	42
Fuel Use (litres)	1582	952	630
Brake Work (kWh)	1335	207	1128

Table 4 Reference train cost inputs

Time penalty	$8.36 per minute
Fuel cost	$0.75 per litre
Braking	$0.13 per kWh

Track maintenance cost in 2009 terms (variable only) $0.61 per thousand gtkm plus $1.30 per thousand gtkm on track with curves of less than 400m radius, $0.91 on curves of radius 400 to 600m, and $0.41 on curves of radius 600-810m). Base cost is about $7700 per km of track.

Applying these parameters to the simulation results gives the following savings for use of new track as compared with the existing track for the reference train:

To the train operator - about $960 per train movement; and,

To the track owner variable costs - $240 per train movement

The present estimated intermodal interstate freight volume (Sydney - Brisbane and Melbourne - Brisbane) on this section of track is 4.7 million gross tonnes per annum (mtpa). With about 2.4 mtpa net requiring 1094 trains per annum, this would generate a saving to operators of $1m per annum. The present bulk (mainly coal) and steel freight and the XPT is about 5.8 mtpa gross which has a potential $1.3m pa saving on the above basis. The overall train operator savings are then some $2.3m pa.

For the track owner overall annual savings are about $0.8m. These are variable costs (reduced maintenance costs, less distance and less curvature for 2444 trains per year) plus an annual per kilometre base cost saving.

The total is about $3m pa in 2009 terms on present traffic (which would be expected to increase over time). Like all Pacific Highway projects, rail deviations will need inclusion of external benefits to get an acceptable cost - benefit ratio.

Recently derived year 2000 unit external costs [33] adjusted to 2009 values (inflated by 3 per cent pa) in cents per ntkm are 3.57 for road haulage in urban areas, 2.57 for road haulage in non - urban areas, 0.56 for rail haulage in urban areas, and 0.22 for rail haulage in non - urban areas. With use of assumptions including a road distance of 920 km, an upgraded rail distance of 940 km, urban hauls of 50 km for each line haul mode, plus an average 25 km urban road pick up and delivery for each rail line haul, there is an external cost of $24.20 for each tonne of road hauled intercity freight. This is against $2.20 per tonne for rail line haul and $1.80 for road pick up and delivery. Accordingly, for each tonne of intercity freight moving between Sydney and Melbourne by road diverted to rail line haul, with road pick up and delivery, there is a net reduction of external costs of about $20.

The ARTC Track Audit [26] found that the Option 'So' capital works would give rail a 30 per cent modal share of intercity intermodal freight, while a further 90 minute reduction of transit time from Option 'S2' works would give a 36 per cent modal share. By linear extrapolation, a 30 minute reduction in transit time gives rise to a two per cent increase in modal share. On this basis, the 42 minute reduction in transit time would translate into a 2.8 per cent increase in modal share.

With this assumption, and assuming an estimated 8.3 million tonnes of Sydney - Brisbane freight in the year 2009 [34], there is an estimated reduction of about $4.6m in external costs. The sum of these benefits (and there are others) for 2009 would be $7.7m. This is when there is no change in road user pricing for heavy trucks. However, it is clear that an increase in road pricing for heavy trucks (with no change in rail access pricing) would lead to a further increase in rail's modal share.

In this regard, it is of note that a Pacific Highway Upgrade (Moorland to Herons Creek) cites a BCR of 3.5 [35 Table 6.12]. This is based on assumptions including a cost of $223 million for the project, analysis over 35 years to 2040, a 7 per cent discount rate, NPV maintenance savings of about $10 million, vehicle operating costs reduced $42m, travel time savings $443m and accident cost savings $12m. This suggests a very small benefit to the Roads and Traffic Authority itself and the favourable BCR is largely due to travel time savings.

4.2 Maldon - Port Kembla

Following NSW enabling legislation in 1983, an environmental impact assessment and land acquisition, work started on a Maldon – Port Kembla railway. It was effectively half-built during the 1980s with work including half a bridge, over 30 km of formation, two tunnel portals, and Dombarton – Unanderra duplication. Its completion, coupled with a new Wentworth rail deviation between Menangle and Mittagong [26] would require completion of a 25 km Dombarton - Wilton section and provide a valuable Illawarra – Macarthur rail link.

As recognized in 2005 by the NSW State Development Committee [36], the new link would provide rail access to Port Kembla that is less congested than the present route via Sydney and an alternative to Moss Vale-Unanderra. A new Dombarton - Wilton - Menangle line would put Wollongong City about 65 km by rail from Campbelltown.

4.3 An Inland Route

The potential for an inland route between Melbourne and Brisbane via Parkes has long been recognised [see for example, 37], and gained increasing attention between 1999 and 2002 when a total of about $1m was advanced in Federal grant towards feasibility studies. Such a route could use the existing secondary lines in NSW west of the Great Divide with limited but carefully targeted upgrading, and major new works in South West Queensland.

This would include a new tunnel under the Toowoomba Range with standard gauge capability, and overhead clearances high enough to allow for passage of double stacked containers. A pre-feasibility study conducted in 2000 with the support of the Commonwealth and three State Governments suggested that an inland Melbourne - Brisbane route showed some promise [38].

By 2004, the proposal was still elusive, with one positive gain being protection of land for a new Toowoomba Range rail crossing during that year. A further major study was commissioned by the Federal Government in April 2005, the results of which are expected during 2006.

A standard gauge route could be extended north through an inland route towards Gladstone and its deep water port, and possibly eventually further into North Queensland or even the Northern Territory if the need arises.

4.3.1 Grandchester - Gowrie

After many studies and community consultation extending back to 1996 [39], route identification and land reservation took place in 2004. This would provide security for future implementation.

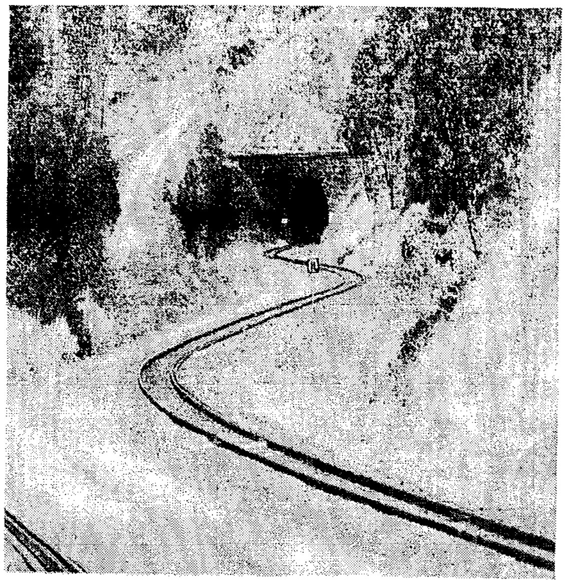
The existing Grandchester - Gowrie route is about 107 km length with a ruling gradient of 1 in 50, and poor horizontal alignment (34.5 km of track on curves of radius 400m or less, 4.7 km on curves of radius 400 to 600m, and 4.9 km on curves of radius 600-810m). This requires a train to traverse 37.6 complete circles of curvature. The line also has low and narrow clearances. Adverse curvature and tight clearances are shown in Photo 3.

The proposed new track is 67.5 km long, has a ruling gradient 1 in 60 and for most of its length has ruling curvature of 1500 metres. This requires trains to traverse the equivalent of only 2.4 complete circles of curvature as opposed to 37.6 circles on the existing route.

Selected Simtrain computer train performance modelling results are given Table 5.

The simulation indicates that freight trains take nearly three hours to traverse the existing route in one direction, and, take about an hour to traverse the new route.

PHOTO 3: ' ... 37.6 complete circles ... '



Ballard Qld Photo Credit Mr John Hoyle

Table 5 Coal train simulation outputs

	Extg	New	Reduction
Track length (km)	107.3	67.5	39.8
Transit time (min.)	330	120	210
Fuel Use (litres)	1620	870	750
Braking (kWh)	2770	2350	420

Reference: Distances as per QR track file data, simulation results by SIMTRAIN of coal trains in recent use with two 2300 class locos (95 tonnes each) hauling a pay load of 1980 tonnes and tare 680 tonnes, for a return east bound (loaded) and west bound (unloaded) train movement.

Using assumed updated 2009 cost parameters for the coal train of a time penalty of $5 per hour, and other cost parameters as in Table 4, and the track maintenance costs in 2009 values as per the Karuah Valley option, the simulation results in Table 4 gives the following savings for use of the proposed new track as compared with the existing track for the above train:

To the train operator - approx $ 1640 per return coal train movement; and,

To the track owner variable costs $280 per return train movement

Assuming that by 2009, coal traffic valumes would have reached 5 mtpa (which would appear to be the maximum the present line will take) means 2525 trains per year would be required. The use of the new line for this coal traffic would then give estimated annual savings of about $4.1 million per year to the train operator and about $1 million per year to the track owner (base and variable costs). If we further assume that other intrastate freight traffic would be 2 mtpa by 2009, and assign cost savings based on those of the coal trains the total savings to the train operator and track owner from use of the new line as opposed to the old line would be about $7.3 million per year.

In addition, the new line would have good potential to allow for heavier coal trains (allowing for further savings) and to attract new coal and general freight along with an extra 3 mtpa of intermodal interstate freight on completion of an inland route. This estimate is based on rail winning 70 per cent of the an estimated 4.23 million tonnes of Melbourne - Brisbane intercapital city land freight in 2009 [34]. Even with the lower costs and extra freight, a benefit cost ratio of less than one would result. However, with suitable inclusion of the potential reduction in external costs, a benefit cost ratio greater than one would result.

Based on the potential savings to train operators and the track owner plus significant reductions in external costs, it is recommended that early and further consideration of the proposed new Grandchester to Gowrie route be given.

4.4 The Adelaide Hills

The section of track over the Adelaide Hills has some of the worst gradient/curvature characteristics not only between Melbourne and Perth, but also the North-South corridor between Melbourne, Sydney and Brisbane.

In the 122 km from Murray Bridge to Adelaide, no less than 67 km (55 per cent) fails to meet basic FFT standards [11] of a ruling gradient of 1 in 80 and ruling curve radii of 800 metres.

A 1997 proposal by M. Michell [40] advocates realignment of the 65 km Murray Bridge - Mt. Lofty section to ease the present severe ruling gradients for west bound trains to eliminate the need for banking locomotives for the heavier west bound freight trains.

This proposal includes minor work between Murray Bridge and Callington, followed by a major deviation between Callington and Nairne, and significant but smaller deviations between Nairne and Mt. Lofty.

5. CONTESTABLE LAND FREIGHT

From Table 1 the Australian rail freight task was about 158 billion tonne kilometres (btkm) for 2002-03. Most, but not all of the bulk rail freight task (136 btkm) is captive to rail. For the rail freight task, up to say 8 btkm (including say 4 btkm intermodal interstate) has a potential of transferring from rail to road. The road freight task includes over 45 btkm for freight movements in smaller vehicles (LCVs, rigid and smaller articulated trucks) which may be regarded as captive to road. At least 7 btkm of line haul interstate road freight, and a further 5 btkm of intrastate road freight is regarded as being subject to potential transfer to rail.

The factors affecting the modal split include the level and structure of road user charges, the extent of regulation of the road freight industry, the level of international oil prices (which at the time of writing were rising sharply), the condition of interstate mainline rail track infrastructure, whether an inland Melbourne – Parkes - Brisbane railway is developed, and, whether grain lines in several states are rehabilitated or abandoned. The estimated 20 btkm of contestable land freight is some 6.4 per cent of Australia's 2002-03 land freight task noted in Table 1. This compares with an estimate of Friedlander [41] that at most 10 per cent and more likely 5 per cent of land freight in New Zealand is contestable between road and rail.

5.1 The role of road reform

The Productivity Commission [1] recognised that rail reform will also require road reform, and to this end, recommended an inquiry into road provision, funding and pricing. A Senate Select Committee on National Competition Policy [42] recommended more attention to road-rail competition. However, the relevant recommendations were rejected by the Federal Government in 2000. Recently, the Productivity Commission [43] proposed that

CoAG should drive reform in both freight and passenger transport.

During the 1980s, a series of Government agencies found under recovery of road system costs from the heavier long distance truck operations. The highest aggregate estimate, by the BTRE in 1988 [44], that found all articulated truck operations failed to cover their fully allocated road costs when offset by all registration charges and all fuel taxes by some $1.28 billion in 1985-86. Both the BTRE [44] and the former Inter-State Commission [45] noted the option of mass - distance taxes. For 1997-98, Laird et al [46] noted an under-recovery of road system costs from articulated trucks of approximately $1.23 billion.

Under an intergovernmental agreement, the NRTC [47] in 1992 determined annual charges, comprising $4000 for six axle articulated trucks and $5500 for 8 axle B-Doubles, and, a notional road user charge of 18 cents per litre of diesel. In commenting on the NRTC charges, which abolished mass-differential charges then in place in NSW and Victoria and halved NSW annual fees, the Industry Commission [48, p197-198] noted in part that "*...the heaviest travelling long annual distances - will meet less than 20 per cent of their attributed costs. . . . The charges, as recommended, will therefore potentially distort the long-haul freight market as rail reforms take effect.*"

Second generation NRTC charges which came into effect around 2000 retained many of the anomalies of the first generation charges. The NTC is now progressing to a third determination of charges. This involves a Road Pricing Reference Group in which both road and rail freight interests are represented.

During the late 1990s, the Federal excise rate for diesel was about 43 cents per litre. This level of taxation was reduced to 20 cents per litre as of 1 July 2000 as part of a New Tax System. As part of the New Tax System, rail was exempt from diesel fuel excise as of 1 July 2000.

The issue of the cost of road crashes involving heavy trucks has demanded more attention. Although the incidence of trucks involved in road crashes has fallen, the BTRE [49] has increased its estimated cost of road crashes. Based on BTE data on the cost of road crashes, and NSW road crash data, an estimate of 0.6 cents per net tonne km road crash risk for road freight is now considered appropriate whilst the cost of crashes attributable to rail freight appears to be about 0.03 cent per net tonne km in Australia [33]. Other externalities from road and rail freight include air pollution (respectively 0.65 cents and 0.22 cents per net tkm in urban areas [33]) along with noise and greenhouse gas emissions.

There is a good case for externality charging for road and rail, recognizing that the road charge would appreciably higher than the rail charge due to their higher level of costs imposed on the community at large.

6. INFRASTRUCTURE FUNDING

Separation of rail functions to above and below rail, and implementation of access charging for use of the rail track has developed along the lines of 'user pays'. This works satisfactorily as a means of recovering the cost of retaining the existing asset and is even capable of generating funding for ongoing small scale improvements.

However given the relatively low traffic base on long haul interstate main lines it is virtually impossible to generate sufficient income to be able to fund more significant improvements. While infrastructure of the national road network is in a state of continuous improvement the rail system is at best standing still. The recent Federal investment funds directed to rail will allow a start to be made on rail upgrading, but there needs to be a mechanism to allow a predictable process of continuous improvement.

As has been demonstrated above there are significant benefits that can be identified under the umbrella of 'externalities'. These benefits do not accrue to the rail owner or operator but to the community at large. A concept of 'user pays' is inappropriate for these since the benefits accrue to 'everyone'. In these circumstances it is appropriate to balance off the social benefits by socialising the costs – funding the social aspect of major rail improvements from government funds, rather than from the track owner's earnings.
The other side of this approach is to establish the same process for all land transport investment. At the present time all major road upgrade investment is 'socialised' (funded directly from government coffers) while the 'user pays' aspect has been somewhat loosely

covered by having a nominal 'fuel tax' approach. As noted earlier this is insensitive to the high capacity / high utilisation end of the road freight business which has a significant level of under-recovery of attributable costs. A 'user pays' mechanism on road that deals appropriately with the mass and distance, in conjunction with an equitable approach to socializing of social benefits across rail and road, would in fact go a long way toward balancing the cost / benefit issue of land transport and provide a basis where all the participants get an appropriate outcome – the infrastructure owner, the operators (road or rail), and the community.

A 2005 report *The future for freight* [50] noted substantial economic benefits accruing from the present ARTC scope of work for the North - South corridor.

7. CONCLUSIONS

After a decade of reform, rail has demonstrated that it can be cost-efficient in moving bulk freight such as coal and iron ore. It also scores well with non-bulk freight on the east–west corridor, which raises the question as to why similar results are not seen on the north-south corridor.

Land freight transport has made significant strides in the last decade with the principal emphasis being on high predictability of delivery and reduction in real costs. Rail has a 'natural' advantage in costs, although this has been significantly eroded over time by changing relativities with road. In terms of delivery of non bulk freight, rail is not in control of its own destiny, having created a situation where intermediaries generally interpose at both ends between rail and the customer. The market speaks for itself, with less than 20 per cent market share of contestable freight remaining on rail on the north-south corridor. Clearly something needs to be done, preferably to deal with both issues at the same time.

One particular aspect, rail infrastructure, has been the subject of this paper in order to demonstrate how improved alignment can give faster transit and reduced rolling stock inventory, which will lead to reduced train operating costs, reduced maintenance costs of infrastructure and significantly reduced community costs.

Some examples of what can be done to improve rail infrastructure, particularly track alignment, have been identified. The aspects of cost and benefit have been discussed and a basic methodology followed to arrive at the direct benefits that might arise from such work, as well as the externalities (or community costs) that can be identified. This paper suggests that advanced planning should commence now for track straightening.

Particular attention has been given to two major potential deviations. Construction of a 67 km Karuah Valley railway in NSW could replace the existing 91 km Hexham - Stroud Road section with its poor alignment, halve transit times and reduce fuel use by 40 per cent. A new 67 km Grandchester - Gowrie crossing of the Toowoomba Range in Queensland could replace a 107 km section of mainly tortuous alignment, cut freight train transit times from about three hours to one hour and almost halve fuel use. Appreciable reduction in external costs would result in both cases.

The issue of externalities is an interesting one, since under any conventional benefit / cost evaluation process there are benefits accruing to more than one interested group – rail operators and track owners in relation to freight rail business and the 'community' in regard to the externalities. Clearly if proper allocation of costs is to be achieved the funding needed to balance the community benefits should to be sourced from other than the rail users.

This paper proposes that such funding should be from the community purse via the mechanism of the AusLink land transport programme. To balance this approach and in the interests of balance in land transport infrastructure funding and pricing, this paper observes that changes are needed to road pricing of heavy trucks. Accordingly, recovery of directly attributable road freight costs needs to be much more responsive to vehicle weight and mass along with annual distances moved rather than the current 'blunt axe' road pricing using fuel and registration changes alone.

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