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EAST COAST MAINLINE RAIL TRACK: OPTIONS FOR 2014

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SUMMARY

The alignment of the track linking Melbourne, Sydney, Brisbane and Cairns is outlined, along with the current North - South interstate rail upgrade, and the former Queensland MainLine Upgrade. Summaries are given of the 2006 - 07 draft AusLink Corridor Strategies for each corridor along with the ongoing upgrading of the Hume, Pacific and Bruce Highways.

Comment is made on track straightening and other upgrading options for each corridor. Such upgrades during 2009 - 2014 would lower transport costs and assist rail to reach a target of 50 per cent mode share on the East Coast (as opposed to less than 12 per cent on the North - South corridor and 25 per cent on the Queensland North Coast line). In turn, this would deliver by 2014, estimated savings in diesel use of 185 million litres per annum along with reductions of greenhouse gas emissions (nearly 500,000 tonnes CO2e pa) and external costs ($325m pa).

1. INTRODUCTION

This paper shall be concerned with the North - South coastal corridors linking Australia's three largest cities (where it updates an earlier paper [1]) and shall give particular attention to the Brisbane Cairns corridor. The paper commences with reference to four relevant draft AusLink corridor strategies that were placed on exhibition during 2006 - 07 by the federal government.

Section 2 will briefly outline the upgrading of the Hume, Pacific and Bruce Highways. Section 3 will examine the existing Melbourne - Sydney - Brisbane - Cairns railway whilst Section 4 will outline some 2009 - 2014 corridor upgrade options with particular attention to external costs and energy use. The conclusions are given in Section 5.

The Sydney Melbourne draft strategy [2, p12] notes this corridor is *"...at the heart of the Australian transport system"*. It notes that substantial population growth is expected in Sydney, Melbourne, Canberra and regional centres; thus transport growth is expected for both passengers and freight, and this, with increasing commuting will pose road congestion problems. Even with rail competing more strongly for line haul freight, intercity truck movements are expected to increase 2-3 per cent per year so by 2025 there could be 5-6000 heavy trucks moving each day on the Hume Highway. Currently, the Melbourne - Sydney corridor now has about 10 million tonnes per annum (mtpa) of intercity road freight and only about one mtpa of intermodal intercity rail freight.

The Sydney - Brisbane corridor strategy [3] notes that this corridor has relatively high volumes of non - bulk freight and passengers that is second only to Sydney - Melbourne in Australia. Freight on the Sydney to Brisbane corridor will almost triple over the period to 2029, rising from approximately 7 million tonnes (mt) in 2004 to approximately 17 mt. This is due to strong projected population growth and compares to an expected doubling of freight on most other AusLink corridors.

This draft strategy [3, p6] notes that despite extensive work now underway to upgrade both highways and railways on the Sydney - Brisbane corridor, present *"road congestion and capacity constraints"* are expected to become increasingly severe and that the rail corridor *"...will continue to have capacity and alignment problems."*

The Melbourne - Brisbane draft corridor strategy [4] notes, inter alia, intercity freight rising from 4.5 mt per annum (mtpa) in 2004 (mostly by road) to 12 mtpa by 2029 (most likely scenario - by rail). The draft strategy

notes limitations on both road and rail infrastructure (with more emphasis on road) and suggests some relatively modest improvements for each mode. These infrastructure upgrades do not extend to either a dual carriage ways for the entire Newell Highway or an inland Melbourne - Brisbane railway.

In regards to Brisbane - Cairns, the draft strategy [5, p6] notes that this corridor "…*has 58% of Queensland's population living along it (1.3m outside of Brisbane). Brisbane-Cairns is a highly decentralised corridor with major urban areas; industry and agricultural production; and tourism spread throughout its …length."* Limitations are again noted on both current road and rail infrastructure. The corridor is of interest in that [5, p10] *"intermodal/containerised freight accounts for about 6 million tonnes of the total freight task and approximately 25-30% of this is carried by rail."*

Even at a 25 per cent modal share (less to Gladstone but around 50 per cent to Cairns), rail is moving about 1.5 mtpa of intermodal freight. This exceeds either Melbourne - Sydney or Sydney - Brisbane rail tonnages.

Each corridor strategy (and in total 23 were released as part of the AusLink planning process) lists various strategic issues along with key challenges and an outlook for 2030. Overall [2,3,4,5] "*A Corridor Strategy is a statement of the shared strategic priorities of the Australian and State/Territory Governments for the long-term (20-25 year) development of the corridor. Corridor strategies provide guidance to decision-makers and project proponents formulating network initiatives, and most importantly, inform development of the next and subsequent National Land Transport Plans.*

All four East Coast corridor strategies note the involvement of not only the former Department of Transport and Regional Services (DOTARS) but various State Government agencies.

For each corridor, road agencies are listed 'up front' and are clearly more involved than the various rail agencies in developing strategies. In addition, the four draft strategies are somewhat 'Business as usual' and give more priority to ongoing Highway improvements (including reconstruction of older highway sections) as opposed to building rail deviations to replace mainline track with substandard alignment.

Other limitations of each of the four corridor strategies are addressed in more detail in Section 4. These include a lack of consideration of external costs and overlooking oil vulnerability.

2. HIGHWAY UPGRADES

From 1974 when the National Highway System (NHS) was formed, the Federal government outlaid, during the 30 years to 2004, in 2004 values $24.6 billion on the National Highway System (NHS) with $58.0 bn on all roads, $2.2 bn on rail capital works (including the 2004 allocation of $450m to the Australian Rail Track Corporation (ARTC)), and about $1.8 bn on urban public transport [6]. The AusLink 2004 to 2009 programme marginally improved rail's funding, but to date has given no assistance to urban public transport.

2.1 The Hume Highway

In 1974, for most of its length, the Hume Highway between Melbourne and Sydney was a basic two lane sealed road connecting towns with some steep grades and winding sections [7]. It is now some 860 km long. By 2009, all but 20 km is due to be dual carriageways. The estimated cost of reconstructing most of the Hume Highway plus maintenance over the 35 year period to 2009 is now approximately $7 billion in 2009 terms (with full Federal funding).

The benefits to the road freight industry of the reconstruction of the Hume Highway have included the use of faster and heavier trucks, a reduction in transit time for Melbourne - Sydney line haul road freight from about 15 to 10 hours, and heavier loads (from 36 tonnes Gross Vehicle Mass (GVM) in 1970 to the option of B-Doubles with a GVM of 65 tonnes).

2.2 The Pacific Highway

In 1996 some 65 km, or 9 per cent, of the Pacific Highway from Maitland to the New South Wales/Queensland Border (total length 672km) had four lanes [8]. Since 1996, a high priority has been given by the NSW and Federal Governments to upgrading the Pacific Highway and by mid 2009, both governments will have spent a total of $3.6 billion on upgrading this highway. As of March 2008, 263 km were dual carriageway standard with a further 91 km under construction or with a construction contract awarded [9]. The remaining kilometres are either approved for construction or have had a preferred route identified.

An AusLInk 2004 White Paper goal was to have the entire Pacific Highway upgraded to dual carriageway standard by 2016. The 2007 Federal election saw Coalition commitments of $2.4 billion to upgrade the NSW Pacific Highway in NSW. The NSW Minister for Roads claimed at the time it would cost $8 billion to upgrade the entire Pacific Highway to dual carriageway standards.

On Queensland's Pacific Motorway (91km), extensive upgrading has taken place since 1996 including an eight lane section over 35 km. Further upgrading is in place in Queensland, and straddling the NSW/Qld border, the 14 km Tugun bypass was opened ahead of schedule in June 2008 at a cost of $543m ($423m Queensland, $120m federal and NSW $0m). The road includes a tunnel and the easement allows for a later extension of the Gold Coast railway to the airport.

2.2.1 Wider issues

There is strong government and much community support to upgrade the Pacific Highway and this is reflected in the Sydney - Brisbane corridor strategy [3]. However, community concern about more trucks on the Pacific Highway is growing, as shown by an inquiry of the NSW Legislative Council's General Purpose Standing Committee (GPSC) No.4 into the Pacific Highway. The GPSC 2006 report [10] found much community disquiet and stated that there had been an increase in heavy vehicle numbers from 340 per day in 2001 to 1230 in late 2002.

A GPSC recommendation called on the NSW Government to accept its responsibility for strategic freight planning and [10, page xiii] to "…*outline measures to encourage a shift from road to rail freight, including through integrated strategic planning for both road and rail upgrades."*

From NSW Roads and Traffic Authority (RTA) data,for the ten years to 31 Dec 2003 and for road accidents on the Pacific Highway from Maitland to the Qld Border, articulated trucks were involved in 30 per cent (163) of all 551 road fatalities [8].

The issue of truck traffic impacts was noted by the Productivity Commission [11, page C.14] which noted that participants to the above cited GPSC inquiry *'frequently attributed their road safety fears to the mixing of passenger and heavy vehicles on the one road.'*

2.2.2 Tolls

One question is whether tolls will be used to expedite Pacific Highway upgrades. Tolls were in place to 1988 at Berowra and were used to fund highway upgrades. A 2005 agreement between the NSW and Federal Government established a Working Party including officers from NSW Agencies and DOTARS. This was to undertake economic and financial analysis to include options to accelerate completion such as tolls and private sector involvement.

In addition to generating funds for road upgrades, tolls can contribute to vehicle use demand management on congested roads.

2.2.3 Shared road - rail corridors

Shared road - rail corridors are land corridors used for both road and rail. They feature extensively in Perth and throughout Queensland.

With the exception of Tugun, the NSW RTA has declined to date to make provision for shared corridors with Pacific Highway upgrades. Two cases in point are the Moorland to Herons Creek Pacific Highway upgrade and Kempsey to Eungai. [12]. Shared corridors have been raised with the RTA by the Railway Technical Society of Australasia (RTSA) [13].

The GPSC [10, page 109] report conveyed the view of the RTSA re shared corridors that: *"... if you are going in there with roads, look at it for rail because it is only very marginal to acquire a bit more land while at the same time doing a road, or while you are doing the bulk earth works for the road you can do the bulk earth works for the rail, and the marginal costs to complete the rail line are insignificant… Surely in the concept stage we could look at the combined rail – road corridor from an environmental and social point of view."*

2.4 The Bruce Highway

As noted in the AusLink Brisbane - Cairns corridor strategy [4] *"The Bruce Highway is approximately 1640 kilometres in length. It is a divided multi-lane road for 100 km north of Brisbane becoming an essentially two lane rural highway for the remaining distance to Cairns with sections of four lanes in the regional centres."*

Of concern is the road crash rate for the Bruce Highway which is noted as approximately 40% higher than the average of the other AusLink

Network roads, while the fatality rate is at the higher end of the range. Short term initiatives to address road safety are noted along with a goal to duplicate the highway beyond Gympie (by 2020). The growth in traffic has led to current capacity constraints, with road traffic congestion growing between Brisbane and Childers.

The 2007 Federal election saw Coalition commitments of $2 billion to upgrade the Bruce Highway in Queensland.

Road vehicle use on the Bruce Highway continues to be subsidized by the Queensland Fuel Subsidy Scheme, amounting to 8.1 cents per litre for fuel excise.

2.5 Road pricing for heavy trucks

There is ongoing debate on recovery of road system costs from heavy trucks, with claims and counter claims [see, for example, 14]. The issue has attracted the attention of CoAG, and following a political decision not to implement a 2006 determination of the National Transport Commission (by postal vote), a determination occurred in February 2008. Meantime, as estimated by the Productivity Commission [11, Table 5.3, page 125] under-recovery of road system costs under recent charges from 9 axle B-Doubles hauling the 75th percentile distance is some $23,000 per year.

Such subsidies are accentuated by the current NTC road cost allocation methodology which do not require heavy trucks to fully pay for capital upgrades including rigid pavements, climbing lanes and town bypasses.

3 THE EAST COAST MAINLINE RAIL CORRIDOR

Both the Melbourne - Sydney and Sydney - Brisbane tracks have excessive length and poor horizontal alignment. Further details of the substandard 'steam age' alignment are given in Appendix A (which also has details of Brisbane - Townsville). With a 23 tonne axle load (TAL) limit for wagons moving no faster than 80 km per hour, or a 21 TAL limit for wagons moving no faster than 115 km per hour, the track standards are someway below US and Canadian Class I standards of 32.5 TAL moving at up to 100 km/h.

Both tracks were also rated as F (*Inadequate for current and future needs*) by Engineers Australia [15] in an Infrastructure Report Card. Subsequently, Brisbane - Cairns was rated C+.

Brief comment on these rail corridors now follows. For further information on the North - South corridor see [1,7 and 8] and for the Brisbane - Cairns corridor see [16].

3.1 Melbourne - Sydney

The excessive curvature on the NSW Main South line is mostly due to a series of deviations constructed between 1912 and 1922 as part of duplication to ease ruling gradients for loaded north-bound trains from 1 in 40 to 1 in 75 (or 1 in 66 when compensated for curvature) [7]. This was at the expense of increasing point to point distance by about 24.5 km and more curvature.

From Appendix A, trains moving between Melbourne and Sydney traverse some 72 circles of curvature (excluding the 1946 Bethungra Spiral).

3.2 Sydney - Brisbane

There are severe constraints on the Sydney to Broadmeadow line [3 and 8]. The Maitland to Kyogle rail track is basically a string of branch lines built to steam age alignment and joined together in the early twentieth century. At present, the average speed of Sydney Brisbane freight trains is only 50 km per hour.

From Appendix A, a train moving between Sydney and Brisbane negotiates a total of about 177 circles. This reflects the original ‘Branch Line’ status of this 'long and winding' track. No less than 47 per cent of the Maitland - Grafton track has curvature of radius less than 800 metres. The corresponding percentage for the Melbourne - Perth "East - West" rail corridor, with its easier terrain and better standards, is 3 per cent.

3.3 The ARTC rail programme

In September 2004, the Federal ARTC assumed a 60 year lease over NSW mainline track including from Macarthur to Albury and from Broadmeadow to the Queensland Border. By 2009, ARTC and their alliance contractors will have completed extensive work on this track, and also on the standard gauge link from Albury to Dynon. As well as extensive and deferred maintenance, crossing loops, passing lanes the work is to include concrete resleepering. Other work includes a South Sydney Freight line and long overdue upgrade of the safeworking system between Macarthur and Junee, and Casino and Acacia Ridge.

At the conclusion of this work by the ARTC during 2009, transit times for 1500 metre superfreighters from Melbourne to Sydney are due to decrease from 13.5 to 10.5 hours, and Sydney to Brisbane are estimated to decrease from 19.4 to 15.1 hours [16]. Melbourne to Brisbane times will also decrease from 32.9 to 25.6 hours. On time reliability for interstate rail transport is also expected to improve on the North South Corridor.

Other work underway to improve rail on the Sydney to Brisbane corridor [3, page 14) includes: RailCorp Clearways Projects with platforms to allow freight and inter-city trains to by-pass terminating passenger trains at Berowra and Hornsby; Acacia Ridge level crossing grade separation at Beaudesert Road; and, certain Hunter Valley Rail upgrades including the Sandate flyover completed in late 2006.

Despite this work, the Sydney - Brisbane draft strategy [3, page 14] notes that *"The rail network is heavily capacity constrained for freight services, particularly between Sydney and Newcastle, … Freight trains are timetabled outside of the morning and evening peaks due to the priority given to passenger trains. ... In addition, performance issues also arise from track curvature, alignment and gradients which limit capacity and wheel loads of trains, and there are several bridges with structural deficiencies. .... Steep hills to the north of Sydney at Cowan Bank also make it difficult for freight trains as their heavier loads mean they travel more slowly than commuter trains and their greater length adds to line congestion."*

In looking to 2030, this draft strategy [3, page 14] notes that *" Train paths on the rail corridor, presuming it continues to serve Melbourne to Brisbane, will be limited because of the single track north of Maitland, conflicts with passenger trains in Sydney and Newcastle and, in northern Sydney, track congestion, gradients and environmental limitations like National Parks and waterways. Insufficient intermodal capacity in Sydney and Brisbane also needs to be addressed in the early part of the strategy period."*

3.4 Brisbane - Cairns

Up to 1986, the Brisbane-Cairns line was characterized by having low axle loads with numerous speed-weight restrictions. Track straightening and strengthening was completed as part of Main Line Electrification (MLE) in the late 1980s, the Main Line Upgrade (MLU) of the early 1990s, and subsequent works.

As part of the civil works carried out in association with MLE, four major deviations with combined length of 42.5 km were completed. A further 120 km of rail deviations in some 45 locations were completed under MLU by 1996. Over 95 % of the Brisbane and Rockhampton track following MLU was laid on concrete sleepers. This was subsequently extended to Rockhampton - Townsville.

As a result of these works, the transit times for freight trains between Brisbane and Cairns fell from 40 hours to 27 hours. Axle loads increased from a low 15.75 tonnes to 20 tonnes and freight train gross loads were progressively lifted from 760 to 1500 tonnes per new locomotive. Along with faster and heavier trains, and as noted by the former Chief Executive of QR Mr Bob Schueber at AusRail 2005, the completion of MLU resulted in an improvement in reliability of freight train movements.

The main reasons for the MLU project as seen by Project Manager Mr Ross Hunter [18] were: *"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."*

Following MLE and MLU track upgrades, plus completion of new stations and track at Bowen and Mackay, the Brisbane - Cairns point-to-point distance decreased by some 26 km (now some 1669 km [5, p11]. Other work to accommodate faster freight trains and tilt trains included, changes to signals, level crossing protection and the Automatic Train Protection (ATP) system. To travel between Brisbane and Rockhampton, passenger trains in the mid 1980s took some 14 hours. In November 1998, electric tilt train services taking 7 hours commenced. In 2003, Brisbane- Cairns diesel tilt train services commenced.

After some delay, work started in July 2006 on straightening and duplicating 14km of rail line between Caboolture and Beerburrum. ((http://www.qr.com.au/seqip). This is currently due to be completed well ahead of the due date of mid 2009, and is being delivered by QR and the TrackStar Alliance. After the above

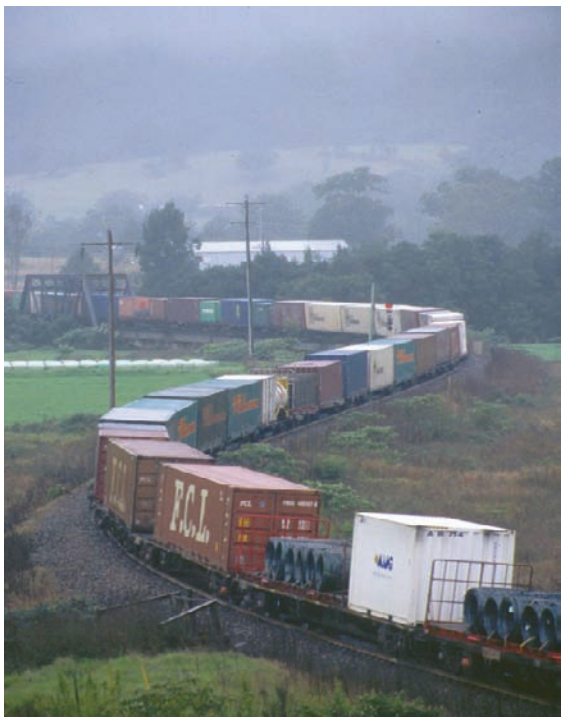
project is completed, the single track line between Beerburrum and Landsborough (17km) is planned to be straightened and duplicated with similar work over the next 20 years between Landsborough and Nambour.

4. TRACK OPTIONS FOR 2014

Just as highways continue to be upgraded, with some new construction on improved alignment, there is a need to improve speed - weight constraints on existing mainlines. The Neville Committee noted [19, p 128] that *"… the greatest need for Australia is the reconstruction and realignment of the main freight networks. This would:*

**allow faster speeds and greater axle loads;*
**clear the way for longer trains and double stacked containers;*
**make it possible to reduce the steepness of grades, straighten lines and remove loops; and*
**allow for the elimination of many level crossings."*

PHOTO 1: ' … Stroud Rd the long way … '



Stroud Road NSW Photo Credit GRMS Media

The train traverses a total of 18 circles in moving from Hexham to Stroud Road

As a case study, the Neville Committee noted the benefits of construction of a new 67 line from Hexham to Stroud Road. This would get rid of 97 km of steam age' alignment (with 18 circles), cut train transit times from 82 to 42 minutes, and reduce fuel use in the track section by 40 per cent.

Both Australia and overseas experience demonstrate that rail deviations built to modern engineering standards give wide ranging benefits. One example is the Queensland MLU as noted above another is the gauge standardisation between Perth and Kalgoorlie in the 1960s that included a new section to replace an older section with steep ruling grades and poor alignment. This is one of several factors that today allows rail to win 81 per cent of interstate freight in and out of Perth on the East – West corridor (as opposed to rail's 12 per cent share of Sydney – Brisbane intercapital freight.

As noted [20] by Queensland Transport Minister, Hon Paul Lucas MP, there is now a need to *"…reserve rail corridor land before it becomes a costly issue."*

We examine the North - South and Brisbane Cairns corridors in turn.

4.1 The North - South Corridor

A major question for the next stage of North - South Rail upgrading will be to further improve Melbourne - Brisbane rail freight. There are two main options.

A Construct an inland route through Parkes by extensive use of existing Victoria and New South Wales track with new construction in Northern NSW and South-East Queensland

B An major upgrade of the coastal route with extensive track straightening and strengthening.

Both options offer significant benefits. Over time, both should be built and land should be acquired for future deviations on both routes.

Proposals for an inland route go back to at least 1979 [21] with 1979 by Ken Thomas (founder of TNT) including Brisbane - Wallangarra - Orange - Albury - Melbourne. Further proposals were made in the 1980s and 1990s and in 2006 a major report [22] was released by the federal Government. In March 2008, the ARTC was commissioned to conduct

a study at a cost of up to $15 million to include location of optimum alignment of the inland railway and the likely order of construction costs within 20 per cent. The results are due August 2009. Meantime, a corridor has been reserved from Gowrie to Grandchester in Queensland where construction is project noted as part of the SEQIP $6.6 billion Rail Program.

In regards to the coastal route, as noted above, the ARTC has anticipated significant train operational and economic benefits from the track and signal upgrades that are committed for completion by 2009. Further benefits would result increased capacity between Strathfield and Hornsby ($834m committed during the 2007 federal election campaign along with over $13 billion for roads) and from increased intermodal terminal capacity within Sydney. Limitations on intermodal freight terminals in Brisbane and particularly Sydney with capacity constraints were noted in a 2006 National Intermodal Terminal Study [23] and the 2007 Neville freight report [19].

However, it is quite possible that by 2012 with completion of dual carriageways for the entire length of the Hume Highway, B-Triple trucks will be running between Melbourne and Sydney. Further construction of the dual carriageways on the Pacific Highway will also improve line haul trucking competitiveness between Sydney and Brisbane.

For rail freight to be competitive with trucks on the North South interstate corridor, it is suggested that some track straightening will be required. As demonstrated by the NSW Roads and Traffic Authority in their highway upgrades, detailed advanced planning including environmental impact assessment and land acquisition does take time.

Rail deviations for NSW were examined during the 2001 Track Audit [24], and for the North Coast line noted in the 2004 Federal budget and AusRail White Paper [25]. They were further examined during 2004-05 by the ARTC [26] who then decided to defer them for more pressing work.

For the NSW Main South line, there are five potential major deviations:

- Glenlee - Mittagong (Wentworth),
- Werai to Penrose
- Goulburn - Yass (Centennial),
- Bowning - Frampton/Cootamundra
- A bypass of the Bethungra Spiral

Construction of 196 km of new track, in these five locations would replace about 256 km of 'steam-age' alignment [7]. The current track the deviations would replace requires trains to traverse about 50 circles of curvature. This is most of the 72 circles of curvature noted above. For an intermodal freight train with two 4000 HP locomotives, the benefits of the 196 km of new track include a time saving of 105 minutes, a fuel saving of about 1340 litres of diesel and a cost saving per train of at least $1700.

For the NSW North Coast line, in addition to the Hexham - Stroud road deviation noted above, there are no shortage of sections of former branch lines north of Maitland that would benefit from reconstruction [8, 26].

In any event, there is a need to address the severe operational constraints on the Short North line between Strathfield and Hexham. This could be done by construction of a new passenger line on the Southern sections and a freight link from near Fassifern to Hexham (and onto Stroud Road).

4.2 Brisbane - Cairns

Despite the gains made by MLE and MLU, the Brisbane - Cairns track still has significant speed constraints. There is also an issue, as noted by the AusLink corridor strategy, about the length of crossing loops which restrict the length of many freight trains to 650 metres.

As noted in the 2007 Neville report [19 page 103] a submission by the Railway Technical Society of Australasia indicated for the Brisbane – Townsville route that there is a *"demonstrable need to expedite Caboolture-Landsborough duplication and re-alignment and to start planning for other rail deviations and bridges..."*

As an example the bridge on the Burnett River near Bundaberg *"..is now subject to a 15 km/h 'flat' speed restriction (i.e. no acceleration or braking)."* Any failure of this rail bridge would have significant adverse consequences for Central and Far North Queensland.

Most NCL 'permanent' speed restrictions are now due to tight radius curves. There are approximately 550 curves of radius less than 800 metres between Landsborough and Townsville. A minimum curve radius of 800 metres is necessary to sustain normal train running operations at 90 km/h on narrow gauge track. However some locations have

speed restrictions for special reasons including just north of Rockhampton station where trains move along the centre of Denison St at 25 km/h.

Currently, the tilt train averages only 55 km/h between Landsborough and Nambour, and 66 km/h between Gympie and Maryborough West. This compares unfavourably with average speeds of about 94 km/h between Maryborough West and Bundaberg and 107 km/h between Bundaberg and Rockhampton. Freight train operations are adversely affected south of Maryborough West.

As noted in Appendix A, track alignment remains poor between Caboolture and Maryborough West with trains traversing 15 circles per 100 km (which is deficient as some NSW interstate mainline sections).

The speed restrictions currently in force partly reflects the fact that MLU did not meet the full extent ($912m) of upgrading recommended in a detailed 1992 report [27]. This included easing all necessary curves to allow 100km/h through running, and, grade easing to 1:75 south of Rockhampton and 1:100 north.

In 1994, the Bureau of Transport Economics (BTE) completed a report on infrastructure. To quote [27, p63] regarding Brisbane - Cairns. *"There are deficiencies in curvature, track structure, and clearances and, in the long term, in passing loop lengths. Average speeds and transit times are currently deficient and will become more so by 2014-15. Congestion currently occurs north of Brisbane (Caboolture – Nambour) where freight trains encounter large numbers of commuter passenger trains. Queensland's Main Line Upgrade program of investments will substantially remedy this."*

Although MLU made many gains in track quality, it was envisaged by the BTE that further upgrading would be required after MLU.

The draft AusLink Brisbane - Cairns corridor strategy [5] notes reports including a Brisbane-Cairns Corridor Study Report (Economic Associates 2005) North Coast Line Corridor Study (PWC, unpublished 2005).

Of particular interest is a 2007 unpublished Brisbane - Cairns Freight Development Plan which includes a first stage proposal to be funded under AusLink 2 during the period 2009-10 to 2013-14 to provide significant outcomes and benefits.

4.2.1 Potential new deviation sites

As part of a 2002 study for Queensland Transport [28], a study was done for some 135 sites between Landsborough and Townsville where the indicated speed restrictions are less than 100 km/h for freight trains. By application of a simple model indicative estimates were given for the savings in train transit time and train operator costs that would result from replacing sections of poorly aligned track with modern alignments.

For a 'standard' heavy freight train with a 1500 tonne trailing load hauled by a 2800 class locomotive, the aggregate reduction in train transit time is about 135 minutes, whilst the cost saving to the train operator amounts to approximately $2600 for a freight train haul. The estimate of $2600 for additional train operating costs compares with a broad estimate of total train operator costs of at least $13,000 (including about $5000 for fuel costs) for moving a 1500 tonne freight train with a single 2800 class locomotive from Nambour to Townsville.

These estimates are now conservative, as for the 2002 study, it was assumed that diesel fuel was costing QR 50 cents per litre. This cost is now over $1 per litre.

There would also be reduction in track owner maintenance costs, and where rail improves its competitiveness with road, appreciable reductions in external costs.

As part of a Rail CRC project, further analysis was undertaken for five potential NCL rail deviations between Landsborough and Maryborough West. These deviations would give a total reduction in point to point distance of 5.4 km. With Simtrain computer simulation by Mr M Michell of Samrom Pty Ltd a freight train with one QR 4000 class (or PNQ PN loco) with a 2000 tonne trailing load and would have an average time (both directions) saving of 41 minutes and a fuel saving of 173 litres. The average time saving for the electric tilt train traversing the new track in either direction was found to be 57 minutes. The rail deviation offering the largest reduction in transit time (15 minutes) was Kanyan-Maryborough West.

4.3 Freight mode scenarios

Scenario analysis was used for the Brisbane - Cairns corridor strategy [5] but was not used for any of the three North-South interstate corridor strategies.

The Bureau of Transport and Regional Economics [29, page 59] gives past data and forward projections for road and rail freight on various intercapital city corridors with caveats, including for 2014. Rails modal share of intercapital city intermodal freight would then be less than 10 per cent on the two shorter corridors and 33 per cent on Melbourne-Brisbane. Without the current ARTC work, it is likely that rail's modal share of land freight on this corridor would be even less.

On the other hand, the resulting improvement in rail freight efficiency and competitiveness from construction of a 'fit for purpose' Sydney Brisbane railway combined with improvements in intermodal terminals and the application of 'user pays' and 'polluter pays' road and rail track pricing could well see rail win 50 per cent of Melbourne Sydney rail freight [30]. Toll's Paul Little in 2007 [31] commented that rail's share *" … should really be in excess of 50 per cent."* This was adopted in 2007 as a 2017 goal by the ARA [32].

The construction of a 'fit for purpose' Melbourne - Sydney - Brisbane railway by 2014, coupled with improved road pricing, has the potential to give rail a 50 per cent mode share of line haul intercapital city freight. This option, compared with a projected high road mode shares, would save 155 million of litres of diesel each year as well as reduce greenhouse gas emissions by about 400,000 tonnes per annum by 2016 [1]. It would also reduce transport costs and improve road safety with an estimated potential reduction in external costs of about $275m per year.

Further upgrading of the Queensland North Coast line would also reduce operating costs, fuel use, greenhouse gas emissions and external costs. An accurate quantification of such benefits would require data on the origin and destination of rail and road freight on the Brisbane - Cairns corridor along with projections.

However. on assuming an average payload of 750 tonnes for a freight train, the fuel savings per train load of diverted freight from road line haul is currently about 17,600 litres (some 47.4 tonnes of CO2-e) [8], also, a saving of at least 30 million litres per year by 2014 (80,700 tonnes CO2-e) is expected if the NCL was further upgraded and rail was to win an average of 50 per cent of corridor freight and say 70 per cent of the longer haul freight. The corresponding reduction in external costs would then be about $50m per year.

4.4 Oil vulnerability and emissions

Rail is approximately three times more energy efficient than road for line haulage of non-bulk freight. Rail's energy efficiency can be improved further by track straightening.

Rail also has the option of using electric traction. This is used by Queensland Rail for coal haulage in Central Queensland and this is now saving nearly 200 million litres of diesel per year. In the event that QR was to acquire more electric locomotives and revert to the use of electric traction for Brisbane - Rockhampton freight trains, further savings of at least 20m litres of diesel per year would be possible.

Rail electrification was also proposed for Sydney Melbourne by the Federal Government during 1980 at a time of high oil prices [7].

If oil prices were to continue to trend up to the point that rail electrification was used from Melbourne to Sydney and onto Brisbane (on reconstructed track and not the existing substandard alignment) the reduction by 2014 in fuel use would be about 111 million litres per annum on in addition to the above cited 155m litres per year [1]. These savings would increase over time. Further energy savings are possible with regenerative braking.

In regards to oil vulnerability, a commendable recommendation of a 2007 report of the Senate Rural and Regional Affairs and Transport Committee Inquiry [33] stated "… *that corridor strategy planning take into account the goal of reducing oil dependence … Existing Auslink corridor strategies should be reviewed accordingly.*

4.5 NSW Regional fast rail

As demonstrated by Queensland on its North Coast Line, the provision of relatively high speed regional passenger services can be effectively achieved in tandem with faster and heavier freight trains through track straightening.

By way of example, on the Sydney - Melbourne line, the upgraded track could allow, with modest powered tilt trains, services from Sydney taking some 81 minutes to Moss Vale, 2.5 hours to Yass, 3.75 hours to Wagga Wagga and 6.5 hours to Melbourne [30].

Improved NSW passenger rail services are also addressed by Butcher [34] and Gray [35].

5. CONCLUSIONS

The Melbourne - Sydney corridor has the largest inter - capital city freight tonnages (at 11 mtpa) in Australia, whilst freight on the Sydney - Brisbane corridor is expected to almost triple over the period to 2029.

Recent estimates show that rail is moving less than 10 per cent of intercity intermodal freight on the Melbourne - Sydney and Sydney - Brisbane corridors, whilst rail moves more than 25 per cent of intermodal freight on the Brisbane - Cairns corridor. In contrast, rail moves over 80 per cent of the interstate land freight moving in and out of Perth.

Current ARTC track work in hand will assist rail to improve its modal share of intercity freight on the North - South Corridor. However, whilst the Hume and Pacific Highways continue to be rebuilt on an improved alignment, the existing railway upgrades remain on an older 'steam age' alignment with excessive point to point length and curvature. Some track straightening on the NSW interstate mainlines linking Australia's three largest cities is recommended during 2009-14, with the extent determined by whether an inland route proceeds during these five years.

Upgrading of the Brisbane - Cairns railway from the mid 1980s, with extensive track straightening, is a major factor in the fact that rail performs appreciably better on this corridor than the North South Corridor. However, further upgrading of this line with some track straightening south of Maryborough West is now necessary.

Along with lower transport costs, the combined benefits resulting from such upgrading and rail winning a 50 per cent mode share on each corridor, when compared projected high road mode shares, would save 185 million of litres of diesel each year as well as reduce greenhouse gas emissions by nearly 500,000 tonnes per annum by 2014. It would improve road safety with a reduction in external costs of about $325 million per year. These are substantial economic, social and environmental benefits.

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APPENDIX A

Table A1 shows aspects of alignment of most of the Melbourne - Sydney - Brisbane - Cairns track along with the East - West corridor.

Table A1 Aggregate lengths of mainline track with tight curves, number of circles traversed, and steep grades on tight curves

Section of Track	Length	TIght curves	Number of circles	Circles per 100 km	Steep grades on tight curves
	km	**km**		**100 km**	**km**
Melbourne - Glenlee					
Melbourne - Albury	312	6	7	2	3
Albury - Junee	160	11	3	2	0
Junee - Goulburn	263	82	39	15	17
Goulburn - Glenlee	165	50	23	14	0
Total	**900**	**149**	**72**	**8**	**20**
Strathfield - Acacia Ridge					
Strathfield - Maitland	181	57	27	15	14
Maitland - Grafton	506	237	111	22	0
Grafton - Acacia Ridge	274	102	39	14	14
Total	**962**	**396**	**177**	**18**	**28**
North South corridor	**1862**	**545**	**249**	**13**	**48**
Caboolture - Townsville					
Caboolture - MBW	206	62	32	15	7
MBW - Rockhampton	367	25	19	5	4
Rockhampton - Mackay	320	26	16	4	1
Mackay - Townsville	371	21	15	4	1
Total	**1264**	**133**	**82**	**6.5**	**13**
East West corridor					
Melbourne - Adelaide	835	49	42	5	26
Adelaide - Perth	2641	50	70	2.6	0
Total	**3476**	**99**	**112**	**8**	**26**

Reference. Extended from [36] with the use of computer track file data at 10 metre intervals. The radius of any curve is used to calculate the angle subtended by each curve on the track.
Tight curves are those less than 800 metres radius and steep grades are those steeper than 1 in 66. Aggregate data rounded to 100 metres. Data is qualified with Bethungra Spiral excluded on the Main South line and is post Main Line Upgrade and the Mackay deviation for Queensland.

MBW denotes Maryborough West. Glenlee is 53 km south of Sydney and Caboolture is 50.54 north of Brisbane. There are 61 km of grades steeper than 1 in 66 between Caboolture and Townsville. Data is rounded, so columns may not add.