MAINLINE TRACK UPGRADES: AUCKLAND – WELLINGTON AND SYDNEY - MELBOURNE

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SUMMARY

Auckland and Wellington are linked by the North Island Main Trunk (NIMT) narrow gauge railway of length 681km. Sydney and Melbourne are now linked by a standard gauge railway of length 960 km. Both railways have to traverse some areas with challenging terrain that in places are 800 metres above sea level. Each railway has a spiral.

The paper will outline former improvements for each of the NIMT railway and the Melbourne to Sydney railway that include deviations for grade easing. For many of the NIMT deviations, these have led to a reduction in distance along with minimal curvature. By way of contrast, each New South Wales main south line deviation has resulted in extra distance with tight radius curvature. Further contrasts include electrification of most of the NIMT during the 1980s, and, the NIMT gaining Centralised traffic control signalling for most of its length some 42 years ahead of the Melbourne to Sydney railway.

Some planned and possible upgrades are outlined for the NIMT. The paper concludes that in order for the Sydney Melbourne railway to win more freight and passenger traffic, track straightening in New South Wales is essential.

NOTATION

- ARTC - Australian Rail Track Corporation
- c/ntkm - cents per net tonne kilometre
- CTC - Centralised traffic control
- km - kilometres
- MLU - Main Line Upgrade
- mtpa - million tonnes per annum
- NIMT - North Island Main Trunk
- NSW - New South Wales
- NZ - New Zealand
- NZR - New Zealand Railways

1 INTRODUCTION

In 1921, the only viable competitor to rail for the movement of freight and passengers between the two largest cities of Australia and the two largest cities of New Zealand was that of ships.

In 2021, aviation provides strong competition for the movement of passengers on both corridors, whilst almost all freight moving between Sydney and Melbourne goes by trucks, moving on the Hume Highway. This highway was rebuilt for its entire length, by 2013, to modern engineering standards, with dual carriageways and bypasses of all towns. At about 860 km in length, the highway is appreciably shorter than the rail distance of some 960 km.

As noted many years ago in a New Zealand context that applies to Australia [1] “Competitive trains need competitive tracks.”

The North Island Main Trunk (NIMT) at 681 km is also longer than the 643 km road distance between Auckland and Wellington; however, most of this road is a two lane road, with dual carriageways mainly limited to between Auckland and Hamilton, and north of Wellington.

Section 2 will briefly outline the construction of the NIMT narrow gauge railway from 1885 to 1908, and the subsequent upgrades of this railway. These upgrades included deviations over many decades, some with

duplication and most with a reduction in distance. Other improvements included Centralised traffic control signalling for most of the NIMT by 1966 and electrification with track upgrades between Palmerston North and Hamilton was completed in 1988.

Section 3 notes the reversal of plans announced in 2016 to cease using electric traction on the NIMT and outlines firm proposals for further upgrades, with a note on other options.

Section 4 briefly outlines the construction of the Sydney to Melbourne railway by 1883 with broad gauge in Victoria and standard gauge in NSW. It will note that a series of duplication with deviations within NSW that took place during the 1910s and the early 1920s resulted in extra point to point distance along with tight radius curvature. It will also outline other improvements including allowing for standard gauge operations between Sydney and Melbourne in 1962 along with the work of the Australian Rail Track Corporation (ARTC) since its take up of a 60 year lease of the Sydney Albury track in 2004 and a 60 year lease on the Melbourne Albury track in 2008.

In 2008, despite much remedial work by the ARTC the tracks linking Australia's three largest cities were rated as “Inadequate for current and future needs” by Len Harper on behalf the Chartered Institute of Logistics and Transport [2].

This includes Sydney and Melbourne where former Prime Minister Gough Whitlam 30 years ago noted on TV [3] that "...there are no cities in the world as close to each other with such large population as Sydney and Melbourne which are linked by so bad a railway.”

On the same TV show, former State Rail Chief, Mr Ross Sayers noted that at a cost of $1 billion a “... tilt train would travel between Sydney and Melbourne on upgraded alignment at over 200 km/h. We could set the passenger transit time at five, or perhaps five and a half hours.”

Later, Mr Whitlam noted [4] that improving the railway would require a national effort and “With or without electrification, improvement of the track and services between Melbourne and Sydney is unquestionably a national priority.”

Section 5 sketches long standing proposals noted in the 2001 ARTC Track Audit [5] for the improvement of the Sydney Melbourne railway for freight and passengers. Section 6 looks briefly at Sydney Canberra rail passenger services and our conclusions follow in Section 7.

2 THE NORTH ISLAND MAIN TRUNK

Auckland is now New Zealand’s largest city with a population of about 1.5 million (almost one third of New Zealand’s population). In 1865, Wellington became New Zealand’s capital and for decades has been the second largest city. Due to many factors including difficult terrain to traverse requiring no fewer than nine large viaducts and many tunnels, it took until 1908 for these two cities to be linked by rail.

This was on a narrow gauge which was due to a decision of the central government in the 1870s under Premier Julius Vogel. The highest point is near the former Waiouru station which is at 814 m above sea level.

In 1870, work commenced, under the former Auckland Provincial Government, of a railway [6]. Work then stopped, and it was restarted by the New Zealand Government [7]. By 1880, this railway had, in stages, reached Te Awamutu south of Hamilton. Work then stopped, pending negotiations with Maori interests. On 15 April 1885 Premier Robert Stout, Wahanui Huatare and Rewi Maniapoto representing Maori interests ceremonially turned the ‘first sod' of the central section near Te Awamutu. It would then take another 23 years of parliamentary enquiries to settle on a “central route” going near the centre of the North Island, exploration and surveying, and sheer hard work to complete the NIMT.

There were many engineering challenges between Te Awamutu and Marton (near Palmerston North). To accomplish the steep climb up to the Waimarino plateau from south of Taumarunui, the Raurimu Spiral with two tunnels, three horseshoe curves and a complete circle was surveyed and later constructed. Massive steel viaducts, partly manufactured on site, bridged deep ravines at Makatote, Hāpuawhenua, Mangaweka, Makōhine and elsewhere.

The 135 km southern section between Thorndon (just north of Wellington) and Longburn (about 7 km from Palmerston North) had been mainly constructed by the Wellington and Manawatu Railway Company that was formed in 1881. This was when the New Zealand Government, that had started work from Thorndon to Johnsonville and faced financial problems, stopped construction. Responding to calls for a railway, the NZ Government then passed enabling legislation for this company to build a railway. The railway was completed in 1885. After many years of good management and innovation (for example, the use of telephones when the New Zealand Railways (NZR) used telegraph; the use of electric light in carriages as opposed to gas, and the use of modern steam locomotives), and paying shareholders good dividends, the railway was transferred to the Government in December 1908 [8].

When the NIMT was officially opened on 6 November 1908, at Maunganui o te Ao, it was single track for almost all of its length. It soon needed improvements including a heavier weight of rail. Two major upgrades were proposed in 1924 by the Minister of Railways, the Hon Gordon Coates, as part of a "Programme of Improvements and New Works". These were the Auckland - Westfield deviation and the Tawa Flat deviation.

Both deviations (and others) were supported by an independent Royal Commission conducted in 1925 by Sir Sam Fay and Sir Vincent Raven in NZR (who incidentally had then recently conducted a review of New South Wales railways and tramways) [9].

The Auckland - Westfield deviation was completed in 1930, with easier grades and curves. By mid 1937, a major 13.5 km Tawa deviation with two tunnels (4.3 km and 1.2 km) was completed north of Wellington to replace a limited-capacity single-track section through difficult country with steep grades. The new track was some three km shorter than the track it replaced, and had minimal curvature. This led to much improved train operations with initially steam traction followed by electric traction and many years later, diesel traction for some trains. The Tawa deviation was officially opened 19 June 1937 along with the Wellington Railway Station (with a five story head office for NZR, and then the largest building in New Zealand).

Part of the original line, from Wellington to Johnsonville, was retained with electric multiple unit trains commencing operations in July 1938. This 11 km line, in part climbing a gorge, has 7 tunnels [8]. It was retained and electrified following strong community support, as opposed to abandonment, or being used as a tramway.

Other NIMT deviations have followed over the decades [7]. These have included in 1959 Longburn to Milson with a new station for Palmerston North (that had been recommended by the Fay Raven commission in 1925) and in 1960 Porirua to Plimmerton with duplication on a much improved alignment. In 1980, a new tunnel at Porootarao was built on a small deviation to replace an older tunnel.

In 1981, a 9.5 km rail deviation south of Taihape with three large viaducts was constructed with a high level of earthquake resistance was opened by the Prime Minister of the day, Mr Muldoon. This deviation replaced a route with challenging geotechnical issues along with steep gradients, tight curves and narrow tunnels. This deviation was followed by modern high voltage electrification (25 000 volts AC) along with civil engineering works on the 408 km NIMT section between Palmerston North and Hamilton [10]. The civil works included the "daylighting" of tunnels and a further major deviation with a new Hapuawhenua viaduct near Ohakune on an improved alignment. Here, the New Zealand Treasury questioned the need for a new viaduct. A resourceful railway engineer within NZR was able to provide the evidence to support management's case for a new viaduct as part of a rail deviation. A key requirement was to demonstrate that the extra cost was justified by improvements to rail productivity.

The overall NIMT project was well described by a NZR journalist Philip Hoskin in 1985 in part as follows. *"The decision to proceed with electrification has led to many major civil engineering projects, including massive earthworks, to improve the NIMT central section. These track improvements include making it straighter and flatter through easing curves and gradients; alterations to 10 tunnels either by lowering floor or 'daylighting' and providing longer, and some new, crossing loops."*

"It is improvements to the track such as these, together with the new signalling and communications systems, which will enable trains to travel faster. Electrification and modern electronics allow energy conservation through regenerative braking - locomotives when going downhill can convert energy to electricity for use by other trains in the area. In the hilly country in the centre of the North Island as much as a fifth of the energy required could be recovered in this way."

In July 2003, New Zealand gained a new underground railway station in Auckland with funding from Auckland City Council and the NZ Government. The new station assisted in the rise in rail passenger numbers from a low base of two million per year in the early 1990s (using older Diesel Multiple Units from Perth) to about 6 million per year by 2008. Following some track duplication, new and upgraded stations along with electrification by 2015, Auckland's rail patronage had grown to over 20 million passengers per year by 2019.

Centralised traffic control (CTC) is used to remotely control electrically operated signals and points over sections of track from a single train control centre. CTC was first used in NZ in 1938 over a short NIMT section and this was the first time CTC had been installed outside of the United States (where it had been invented) and Canada [9]. It was followed shortly followed with CTC between Tawa Flat and Paekakariki. By 1966, CTC was operating over all single-line sections of the NIMT between Wellington and Auckland.

The NIMT is important for the movement of freight. Traffic of note includes Auckland Wellington intercity freight (some then proceeding by interisland ferry to Picton and then by rail to Christchurch), and freight moved on sections of the NIMT. This includes a container shuttle between the Port of Tauranga (via the 8.8 km Kaimai tunnel completed in 1978) to Frankton Junction near Hamilton where it joins the NIMT to go to Metroport near Wiri in South Auckland. It also includes milk trains along with general freight.

Since 1908, the NIMT has supported regular passenger train services, with those in 1909 taking some 18 hours for the full journey. For decades, until 1979, when day trains were running, the main services were run overnight. Up to 2006, daily return trains, called the Overlander were on offer. NZR had been privatised in 1993, and the track taken back in 2003 by the NZ Government (in somewhat poorer condition than when leased in 1993). In 2006, NIMT passenger trains were being operated by a subsidiary of an Australian company Toll, who then wanted to close down the Auckland Wellington passenger train. A vigorous public campaign assisted in the retention of the service, albeit three times a week. It is now called the Northern Explorer and attracted many overseas tourists, pre COVID-19. Its attractions include passing near Mt Ruapehu (a sometimes active volcano) in Tongariro National Park (the fourth oldest National Park in the world and a World Heritage area) and coastal scenery north of Wellington.

In 2008, the NZ Government paid Toll good money to take back the trains, and formed KiwiRail. An account of rail privatisation in New Zealand (and also Tasmania) is given by this writer [11]; in brief summary, where traffic on offer is such that subsidies are required, they are better directed to a government agency, charged with the responsibility of providing efficient rail freight and passenger services. This is now the current situation, where KiwiRail is an integrated railway.

In April 2021, KiwiRail with the support of the NZ Government and the Waikato District Council introduced a new Hamilton to Auckland commuter train service, Te Huia [12]. It has two return services each weekday.

3 PLANNED AND FUTURE NIMT OPTIONS

In 2016, when Kiwirail was under some financial pressure, it was proposed to convert all rail operations between Palmerston North and Hamilton from electric to diesel traction. Subsequently, with a change of government in 2017, and $35 million of government support to refurbish electric locomotives, it was decided to retain electric traction on this section.

Two projects affecting rail operations in Auckland and the NIMT received bipartisan support in the lead up to the 2017 New Zealand election. The first project was construction of a third track between Wiri and Westfield, to separate freight train movements from passenger trains. This is now proceeding, albeit between Wiri and Middlemarch (south of Westfield Junction) with other work, at an estimated cost of $315m, with the aim for completion in 2024 before commissioning the large City Rail Link project [13].

The second project announced in 2017 was extension of electrification some 19 km south from Papakura to Pukekohe with track and signalling upgrades. This project has also been slow to start with preparatory work starting in late 2020. Funding of $371 million, as part of an "infrastructure spendup" was announced on 30 January 2020. [14].

In line with carbon emissions reduction targets (by 2030 - to achieve a 30% reduction in carbon emissions below 2005 levels in line with the Paris Agreement (using FY12 as a proxy) and by 2050 – achieve net zero carbon emissions), KiwiRail in 2020 and again in 2021 noted [15] further electrification options, extending to all of the NIMT, and from Auckland via Hamilton to Tauranga.

These options would include the extension of electrification from Pukekohe to Hamilton, with one cost estimate at $2.2 billion, with the further option of improved alignment (from Pukekohe to Te Kauwhata) [16]. There is also the option of electrifying Waikanae to Palmerston North at 25,000 volts AC, and by either converting Wellington to Waikanae from 1500 volts to DC, or by use of dual voltage locomotives, having electric locomotives operating between Auckland and Wellington.

Other options for reducing transit time and energy use include further deviations. The installation of longer crossing loops and more grade separated road and rail crossings may also be a good investment.

4 SYDNEY MELBOURNE

An account of the history of rail track linking Melbourne and Sydney, and the numerous proposals made from the 1970s to upgrade this track, with particular reference to deviations considered by the ARTC Track Audit [5] is given by this and other writers [17]. An account of proposals to build a new High Speed Railway was given by Tim Fischer [18], who also related [19] a marked reluctance of the NSW Government to upgrade the rail track between Goulburn and Yass in conjunction with the building of a new section of the Hume Highway.

In brief, broad gauge line from Melbourne reached Wodonga in 1873 [20]. It took until 1881 for the NSW Main South line to reach Albury near the NSW/Victoria border. This was standard gauge line, constructed in stages. After crossing of the Murray River, and an official opening in June 1883, the first intercapital city express commenced in August 1883. Including changing trains at Albury until 1962.

During the late 1890s, several small grade easing projects were undertaken in NSW. By 1908, a 15 hour “limited” Sydney - Melbourne train service was offered. By the early 1910s, NSW traffic had built up to the extent that a Royal Commission in 1912 recommended immediate duplication of the line from Picton to Junee. In response, the construction of new country lines was suspended to advance the duplication work with deviations to ease ruling gradients for loaded north-bound trains to 1 in 75 (or 1 in 66 when compensated for curvature). This work was completed in stages [17]. It is of note that these NSW Main South deviations completed between 1912 and 1922 led to the overall length of track being extended by some 24.6 km.

By way of example, the section between Goulburn and Yass was extended in length from 84.6 kilometres to 93.1 kilometres after duplication on a new alignment. Whilst easing the ruling gradient for north bound trains, this deviation had a total of 39 curves of radius 400 metres (20 chains) or less (with 7 curves as tight as 280 metres) whilst the Whitton alignment it replaced had a ruling curvature of 400 metre radius applying at only 7 curves. Not only was the track 8.5 km longer, but M – Train simulation [17] has demonstrated that a modern superfreighter moving over the 19 th Century alignment would give transit time savings of 12 per cent and fuel savings of 12 per cent when compared with the present track.

On a more positive note, Victorian Railways introduced in 1937 the Spirit of Progress train between Melbourne and Albury [20], as the "finest and fastest train in the Southern Hemisphere."

Between 1942 and 1946, the track from Cootamundra to Junee was duplicated. This included reinstatement of 1.6km of the original Whitton line that had been used between 1878 and 1898 with a 1 in 40 gradient; and completion of the Bethungra Spiral for north bound traffic (with an increase of length of about 2.8 km).

Following detailed inquiries during the 1920s, the 1940s and the 1950s, the Albury to Melbourne standard gauge line was opened in 1962. This used federal funds including loans to each of NSW and Victoria (over 50 years). This allowed for through running trains, some 54 years after Auckland Wellington had its through running trains.

This Melbourne - Albury standard gauge track had CTC signalling. This was extended in the early 1980s between Junee and Albury with Federal loan funds. In was only in 2008 that CTC signalling extended for most of the Sydney to Melbourne track, some 42 years after the NIMT.

Other work on NSW track included transition curves in the early 1980s for XPT trains, and in the early 1990s, deferred maintenance as well as “rectification” of the Bethungra Spiral took place under the Keating Government’s “One Nation” programme. From 2004 to 2008, ARTC work on the Albury Macarthur Track included a new bridge over the Murrumbidgee River, concrete resleepering, passing lanes, along with a CTC signalling upgrade. In 2013, ARTC completed a 36 km dedicated Southern Sydney Freight Line.

Between Albury and Melbourne, the main work was Victorian north east rail gauge standardisation project between Seymour and Albury. However, this $501m project did not achieve the stated aim in 2008 to build "…an interstate rail freight super-highway and deliver major passenger rail service improvements ...". A further $235m upgrade is now under way. This complements a two year $68m ARTC project nearing completion to re-rail part of the Sydney to Goulburn track and related works.

In 2008 the ARTC [21] gave ambitious targets for rail market shares for 2017 - 18, including, on Melbourne – Sydney, a low share of 30 - 40% and under a high scenario, which is "potentially the most plausible scenario in light of recent experience", rail achieving around 60% market share on Melbourne – Sydney.

However, despite this work, projections made by the ARTC for rail to gain an increased modal share of intercity freight were not achieved. Worse still, rails share of freight on the Sydney Melbourne corridor continued to decline.

In 1970, rail and road held about equal shares of land freight moving between Sydney and Melbourne. Trucks then took about 15 hours to traverse a deficient two lane Hume Highway that passed through numerous towns. We have noted how the entire Hume Highway was rebuilt to modern engineering standards with four lanes by 2013 - at shorter length with concrete pavements and town bypasses. As a result of this federal funding exceeding $10 billion in today's terms, heavier trucks including B-Doubles can now move freight between Sydney and Melbourne and this can be done under 10 hours. Intercity freight trains take at least 12 hours, and this does not include the time taken at intermodal terminals.

As noted by Pacific National in 2019 [22], rail's share of Sydney - Melbourne intercity palletised and containerised freight (now about 20 million tonnes per annum) has fallen to less than one per cent.

Clearly, slow transit times for freight trains (let alone no double stacking of containers and light axle loads) are part of the answer for the failure to turn around the decline in rail's modal share on the busy Melbourne - Sydney corridor.

Other factors include the total reconstruction by 2013 of the Hume Highway, current access pricing for freight trains to the rail track, and arguably low road cost recovery from the operation of heavy trucks in Australia, with a hidden subsidy estimated by this writer [23], on the basis of the mass distance charges applying in New Zealand, at about one cent per net tonne kilometre for semitrailers and B-Doubles. Here, the 2010 Henry Tax review recommendation that Australian governments "should accelerate the development of mass-distance-location pricing for heavy vehicles" is relevant to improving competitive neutrality between road and rail.

Some guidance to improve the appeal of rail to those moving freight was given in the above cited 2008 ARTC report [22] as follows (see also section 5B below) **" For rail to move to the next step in competitiveness, or even in fact to maintain competitiveness against a constantly improving road network, there is no alternative but to start to consider deviations of the current poorly aligned sections of the network."**

5 MAIN SOUTH UPGRADING PROPOSALS

An account of numerous proposals made over the decades since the 1960s to upgrade the Sydney Melbourne railway is given by this writer [17]. During the 1970s, two proposals to improve Sydney – Melbourne train services are of note.

The first proposal was of a rail deviation with the then NSW Department of Main Roads, who, with full federal funding, were building a new Campbelltown – Mittagong dual Hume Highway (opened in 1980). However, this rail deviation, later called the Wentworth deviation, did not proceed.

The second proposal, arising from a personal interest of the Hon. Gough Whitlam as Prime Minister (1972-75), was to initiate modern 25,000 Volts AC electrification between Sydney and Melbourne, leading to later studies. In 1980, an offer was made by the Fraser Government to assist in the electrification of the Sydney - Melbourne railway. Neither the NSW nor Victorian Governments, or their rail systems, favoured the proposal and it did not proceed. However, this technology was introduced into Queensland in 1979.

We have noted that most of the NIMT has had electrification since 1988.

Main South deviation proposals go back to the 1970s. Many have been studied, restudied, and recycled into new reports. The ARTC Track Audit [5] noted many of these proposals, including three major NSW Rail Deviations as follows.

	Distance (km)	Indicative cost (year 2000)
Glenlee - Mittagong (Wentworth)	48	$218m
Goulburn - Yass (Centennial)	88	$255m
Bowning - Frampton (Hoare)	99	$300m

As well, the ARTC Track Audit [5, p63] noted four smaller rail deviations near Maldon, Werai, Cullerin and Harden together with the construction of realignments at 12 locations, with indicative costings.

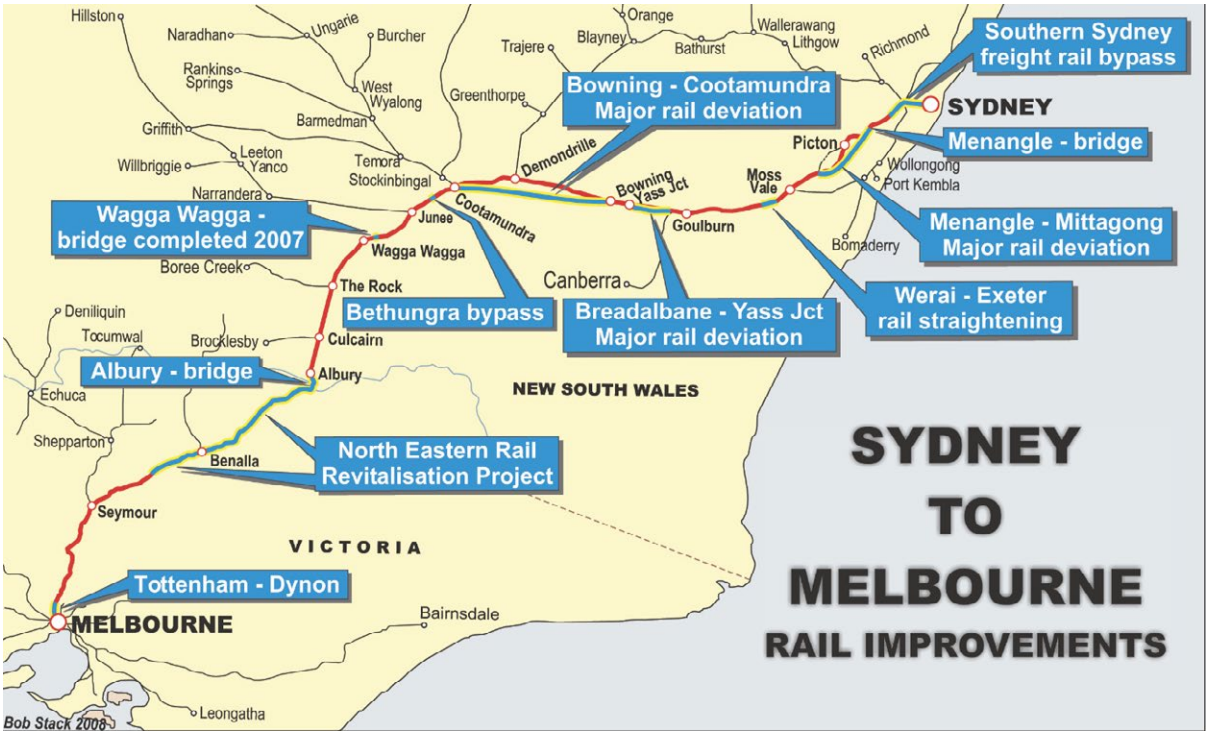

Figure 1: From Railway Digest, February 2009

The combined length of three larger modified deviations from Menangle to near Mittagong, Breadalbane to Yass, and, Bowning to Cootamundra is 164 km and they would replace 219 km of track on “steam age” alignment [17]. Coupled with two further and smaller deviations: Werai to Penrose, and to bypass the Bethungra Spiral, the 5 deviations would require construction of 197 km of new track. The new track would replace about 257 km of 'steam-age' alignment which require trains to traverse about 50 circles of curvature.

The appreciable benefits for a 'reference' intermodal freight train with three National Rail Class locomotives include a time saving of 105 minutes, and a fuel saving of about 2000 litres of diesel. There are also appreciable train and track maintenance savings and a reduction in net external costs from inter-city land freight.

The failure to date of the NSW Government and now the ARTC to even start construction work on just one NSW Main South deviation (apart from relocation of a small section of track south of Picton due to mining activity) stands in contrast to the work done in New Zealand on the NIMT over the past 90 years and that in the 1970s of the 8.8 km Kaimai tunnel as part of a major deviation. The failure to reduce the Sydney to Melbourne rail distance and ease curvature is also in contrast to Australian initiatives including the following.

A. During the 1960s, gauge standardisation between Perth and Kalgoorlie in the 1960s included a dual gauge route through the Avon Valley from Midland to Northam, with high clearances and easy ruling grades. This replaced an older section with steep grades and poor alignment, and assisted in reducing Kalgoorlie - Perth freight train times from 31 hours to 13 hours. Today rail wins about 80 per cent of interstate freight in and out of Perth. It is suggested that would simply be impossible with the old track.

B. The extensive Queensland Main Line Upgrade (MLU) between Brisbane and Cairns from 1992 to 1997. This MLU project of Queensland Rail included 120 km of high quality rail deviations with easy grades and curves. The work supplemented about 40 km of deviations between Nambour and Gladstone undertaken as part of Queensland's Main Line Electrification project completed in 1989. The MLU allowed improved rail freight services to and from North Queensland [including livestock trains]. It also facilitated the rail transport of fruit and vegetables from North Queensland to the Sydney and Melbourne markets. In November 1998, Queensland Rail introduced a highly successful electric passenger tilt train service between Brisbane and Rockhampton.

Concise reasons for proceeding with the Queensland MLU Project were given by Project Manager Mr R. Hunter [4]: "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."

This salient observation also gives support to the earlier quoted finding of the ARTC [21]. In addition, the MLU project with, further deviations at Mackay and concrete resleepering, did allow for faster and heavier freight trains. By 2006, rail had gained over 1.5 mtpa of intermodal freight on the Brisbane Cairns corridor (over 25%) which was more than the then 1 mtpa on the Sydney Melbourne corridor (about 9 %) and about 1 mtpa on the Sydney Brisbane corridor (about 16%) [25]. Subsequently, and, after some delays, the Caboolture - Beerburrum track was duplicated on an improved alignment in 2009. It is due to proceed to Landsborough, with upgrades to Nambour due by 2024 [26].

C. Other recent Australian examples include track upgrades (including a deviation and also duplication) on the Ballarat line as part of Victoria's Regional Fast Rail projects [27]

Each of these rail deviations outlined above in Australia, and New Zealand, have been good investments. In general, the benefits of replacing sub-standard alignment include: Reduced point to point distance; Faster and heavier freight trains and improved rail passenger service; Transit time, fuel and less brake wear savings to train operators; Reduced track maintenance costs; Reduced road accidents involving heavy trucks due to rail's ability to more effectively compete with trucks; and, the potential for elimination of level crossings, flood mitigation, and improved clearances.

The construction of about 200 km of new track between Menangle and Junee to modern engineering standards, coupled with competitively neutral access charges for rail and road, could well allow rail to gain 50 per cent modal share of Sydney - Melbourne freight. Line haul road freight between these two cities uses a broadly estimated 19 litres of diesel per tonne of freight as opposed to about 7.5 litres for line haul rail freight, which would reduce to about 6.5 litres if the 200 km of new track was built. The difference, allowing for road pick up and delivery when rail line haul is used if rail was now winning 50 per cent of freight is about 100 million litres of diesel on 20 mtpa of general freight. As one litre of diesel produces about 2.7 kg of carbon dioxide, the reduction in emissions would be about 270,000 tonnes per annum.

Sydney-Melbourne 25,000 volt AC rail electrification, as proposed by the Federal Government in 1980, would give further reductions in emissions.

External costs of road and rail freight in both urban and non-urban areas were addressed in the ARTC Track Audit [5]. These estimates were revised and in 2012, the NSW Independent Pricing and Regulatory Tribunal [28, page 31 and 32] two sets of values for external costs for road and rail freight in non-urban areas. The higher value unit cost (that include an allowance for unrecovered road system costs from articulated trucks of one cent per net tonne kilometre (c/tkm)) is 3.88 c/tkm in urban areas and 2.79 c/ntkm in non-urban areas along with 0.61 c/tkm for rail haulage in urban areas, and 0.24 c/tkm for rail haulage in non - urban areas.

These estimates (which are in need of updating) suggest that, for 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 $19.66 per tonne. This assumes a road distance of 840 km, a rail distance of 940 km, urban hauls of 50 km for each line haul mode, plus a total of 50 km urban road pick up and delivery for each rail line haul. The external cost for each tonne of road hauled intercity freight is about $24 as against $2.40 per tonne for rail line haul and about $1.90 per tonne for road pick up and delivery.

With an estimated 20 mtpa of general intercity Sydney Melbourne freight, with one per cent on rail, the external costs are estimated as $475 million per annum for road line haul, and $0.86m per annum for the rail haul with road pick up and delivery. If rail (with road pick up and delivery) was to gain 50 per cent of mode share, the expected external costs would be $283 million per annum. This is a reduction of about $193 million per annum, reflecting lower road maintenance costs, safer roads, lower emissions and less road congestion.

For rail freight to be competitive on the Sydney Melbourne corridor with big trucks, track straightening will be required. As discovered by the NSW road agencies in their upgrades of the Hume Highway and the Pacific Highway, it does take time to plan, assess environmental impacts and acquire land for major road deviations. The road builders take this advanced planning very seriously. In recent years, the ARTC has gained valuable experience in upgrading existing lines and planning for new lines as part of the Inland Rail projects. These projects have also been facilitated with intergovernmental agreements between the Australian Government and the State Governments of Victoria, New South Wales, and Queensland.

It is recommended that the ARTC along with the NSW Government should start advanced planning for NSW Main South deviations.

Infrastructure Australia's 2020 list of priorities and proposals [28] includes a NSW Government proposed initiative for Newcastle-Sydney and Wollongong - Sydney rail line upgrades, to include new deviations to eliminate curvature and flatten grades. However, the same list does not include Sydney-Albury track upgrades.

Infrastructure Australia [28] also lists Inland Rail as a Priority Project. Inland Rail includes all of Tottenham (in Melbourne) to Albury, and Albury to Junee. There are some sections of track between Albury and Junee with I in 40 gradients for both north and south bound trains, and with ruling curvature of 440 metres. The grades and curves could usefully be eased to a ruling grade of 1 in 80 and 1200 metre radius curves as used for the Alice Springs to Darwin railway completed in 2003, and also Stockingbingal to Forbes completed c1920.

A truly upgraded Sydney-Melbourne railway, with deviations as outlined in the 2001 ARTC Track Audit, would allow for more efficient and competitive freight train operations, and in turn, a curb on the growth of truck numbers on the Hume Highway. There would also be the capability of running tilt passenger trains at speeds up to 200 km/h.

6 SYDNEY CANBERRA

Sydney – Canberra has a passenger rail transit time exceeding four and a quarter hours over 320 km of substandard track. There are only three return train trips per day. Since the 1950s, bus times on the now fully upgraded highway have been halved and they are now both noticeably faster than trains and operating, for most of the day and night, of at least one bus on the hour every hour.

There have been many recent calls for a much improved train service, including by the ACT Government. In 2018, the NSW Government [29] appointed Professor Andrew McNaughton to lead an expert panel to provide advice on how to develop a fast rail network to connect Sydney to NSW regional centres and Canberra, and in 2020, Infrastructure Australia [30] listed improved Sydney–Canberra rail connectivity and capacity as a Priority Initiative.

This and other writers have proposed [31] medium speed (by world standards) through track upgrades between Sydney and Canberra and new trains on suitable candidate sections of railway that might in time become part of the proposed Melbourne – Canberra – Sydney – Brisbane High Speed Rail line.

The objective of the incremental approach would be to achieve near term door to door transit times better than other forms of land transport. Such projects would capture the imagination of the public, who have to a large extent lost sight of rail as an alternative, and could provide a leader to eventual upgrading to full High Speed Rail standards.

At the very least, some upgrades of the existing track to allow new trains to offer three hour Sydney – Canberra train services are recommended. The operation of at least four trains per day is also recommended.

7 CONCLUSION

On at least three counts, New Zealand is way ahead of Australia in the condition of the railway linking the respective two largest cities of each country. These three counts are Centralised traffic control signalling being installed for most of Auckland to Wellington some 42 years ahead of the Melbourne to Sydney railway; most of Auckland to Wellington being electrified; and, Auckland to Wellington having past deviations that have actually shortened point to point distance and reduced curvature. This is opposed to NSW Main South past deviations to ease ruling gradients increasing both point to point distance and curvature

It would appear that in order for the Sydney Melbourne to win more freight and passenger traffic, some track straightening is necessary.

As part of the new Inland Railway, Melbourne to Junee needs upgrading to modern engineering standards. For Junee to Sydney, advanced planning of rail deviations should now commence with a view to starting some actual construction by the end of this decade. Reconstruction of about 200 km of new track in five locations would reduce point to point distance by 60 km, remove the worst of the “steam age” alignment and give significant benefits to Sydney - Melbourne intercity freight. It would also allow for the option of intercity tilt trains.

The recommended track upgrades would also support an improvement in Southern NSW regional and Sydney Canberra rail passenger transport. This would complement the successful Queensland electric tilt train service and the Victorian Regional Fast Rail projects.

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