2024 08 18 Quick Rail for Australia's Future

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Synopsis

Significantly increasing Australia's (**National Security and Regional Productivity**) desperately depends on the re-engineering of Australia's Long-Haul Rail Network to be upgraded with (**"Quick Rail" Technology for Australia**) being highly capable of safe and reliable 250 – 350 km/h Freight and Passenger Rail Transport interconnecting our Metropolitan Cities and all our main Regional Centres.

My vision is to have (**Australia's National Quick Rail Network**) being Australian developed and manufactured to be nationally utilised throughout much of Australia for Long Haul (>100 km) transport – between "Inter-modal" Terminals, where other forms of pre-existing transport infrastructure can economically provide / facilitate Short Haul (<100 km) transport with a minimum of delay.

With "Quick Rail" technology – the (**Standard Width Rolling Stock**) of all Cars and Engines shall be 3040 mm (10' 0") and the (**Standard Australian Wide Rail Gauge**) shall be 2540 mm (8' 4").

Most of Australia's "Quick Rail" network can be constructed by using pre-existing rail alignments and by (**Straightening Railway Alignments**) that were manually constructed (CE 1850 – 1910). Several locations will require rebuilds that will in most cases be very advantageous for the land holders and involve minimum tunnelling.

Widespread use of this "Quick Rail" transport infrastructure for Freight and Passengers at 250 – 350 km/h (nominally 300 km/h) between Regional Inter-modal Terminals shall significantly reduce Australia's Inter-regional (**Comparative Transport Times**) that will substantially (**Building Australian Productivity**) and significantly reducing Australia's imported diesel and avgas fuel volumes / costs and facilitate (**Cost-Effective Inter-Region Transport**) and substantially reduce expensive road maintenance costs.

Concurrent with this highly innovative "Quick Rail" infrastructure build, it is imperative to include multiple high-capacity 144 strand Single Mode Optical Fibre (SMOF) cables alongside these "Quick Rail" easements for highly reliable "Quick Rail" infrastructure comms – and massively increase the capacity of Australia's very thin inland Regional telecom infrastructure. (**Australia's Telecom Infrastructure Debacle**)

This deliberate extra SMOF capacity will very inexpensively facilitate Fibre to the Homestead (FTTH) for thousands of Farms, Mines, Villages, and backhaul connect thousands of regional / remote Radio Black Spots – while making Australia's telecom infrastructure far more robust. (**National Security and Regional Productivity**)

(**The Melbourne Sydney Rail Fiasco**) and (**The Inland Melbourne – Brisbane Rail Fiasco**) and (**NSW Western Sydney's Airport Fiasco**) and (**The Sydney - Newcastle Rail Fiasco**) are all parts of the entangled deceitful web of (**Australia's Treasonous Anti-Rail Lobbyists**) who, promote against the (**Hidden Economics of Rail V Road Freight Transport**) for the massive expenditure on Road Highways and Airports for bulk Passenger and Heavy Freight transport using fuel guzzling Heavy Road Vehicles and Freight Aircraft will further cripple Australia's Gross Domestic Product (GDP) while maximising our negative Balance of Payments (BOP) which minimises Australia's International (AU$) currency value – which in turn cripples Australia's economic future – without (**Building Australian Productivity**).

Contents

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"Quick Rail" Technology for Australia

This engineering vision came from the realisation that there are three different rail “gauges” in Australia: 3’ 6” (1067 mm), 4’ 8.5” (1435 mm) and 5’ 3” (1600 mm), and that these gauges are much narrower than the rail cars - that are nominally: 8’ 0” (2440 mm) and 10’ 0” (3040 mm)! (**Australia’s Different Rail Gauges**)

My research into the history of rail technology identified that circa CE 1820 “portable” steam engines in the UK were the catalyst for rail transport that was a very awkward marriage of existing Mine Carts (with narrow rails) and much wider Bullock Drays and Horse drawn Trolley Busses etc. (**Background on Early UK Rail Transport**)

This very awkward mechanical combination of a far too narrow rail gauge is why most Rail Cars are generally inherently unstable. (**Rail Gauges and Rail Car Instability**)

In the CE 1830, Isambard Brunel really questioned and then corrected this obvious engineering misfit, as he came up with his 7’ 0” (2140 mm) rail gauge for 8’ 0” (2440 mm) rail cars / engines. This “Broad” rail technology was later proven with the very highly successful with the London – Bristol (170 km) “Great Western Railway” that was completed in CE 1836. (**Brunel’s “Broad” Rail Gauge**)

This “Broad” rail technology was so successful that the “competing” private railway owners in the UK (with their extensive narrower gauge rail networks), conspired to have the UK Parliament pass the “Standard Rail Gauge Act” in CE 1846 that effectively killed off this very sensible “Broad” stable / strong rail gauge; and promoted George Stephenson’s 4’ 8.5” (1435 mm) narrow rail gauge for use on what were / are much wider 8’ 0” (2440 mm) rail cars. (**Why the “Standard” Rail Gauge was Law**)

In that era, the British Empire had an enormous political and trade influence over most of the rest of the development world, most emerging countries followed the UK “Standard Rail Gauge Act” without any question – and the “blinkered vision” continued through to today with fast trains that have immense instability problems (because the rails are far too narrow for the now even wider rail cars / engines)! (**The Five Monkey Experiment**)

In the CE 1930s, to compete with luxury travel by Steam Ships and Air Planes; the then standard width 8’ 0” (2440 mm) Passenger rail cars were made two foot wider, to 10’ 0” (3040 mm). These cars were totally unstable on 3’ 6” (1067 mm) gauge rails and quasi-stable on 4’ 8.5” (1435 mm gauge rails. Since that era, the term “Standard” (as applied in the UK Rail Gauge Act) has an added meaning to imply “world’s best practice” – and therefore “do not question”! (**Passenger Rail Cars Became Wider**)

The prime key for my vision of (**“Quick Rail” Technology for Australia**) is that most Passenger Train’s Cars are now 10’ (3040 mm) wide. By re-engineering the Freight Rail Cars to also be 10’ (3040 mm) in width this also aligns with the Passenger Rail Car width, so all the Rail Cars are then a common width of 3040 mm. (**Standard Width Rolling Stock**)

With the common Standard Rail Car Width, the optimum rail gauge of 2540 mm (8’ 10”), keeps the wheels inside the 3040 mm Car Width profile and facilitates far greater Rail Car stability. (**Standard Australian Wide Rail**)

With these Rail Cars / Rails properly engineered – these Rail Engines / Cars can very safely travel much quicker on this (Australian) wide rail infrastructure - hence the term “Quick Rail”! (**Rethinking Australia’s Railroad Engineering**)

This New "Quick Rail" Inter-Urban (Wide) Rail Technology includes that (at least):

- All “Quick Rail” technology should be 100% Australian manufactured.
- All "Quick Rail” Cars shall be (nominally) 3040 mm (10') wide.
- The "Australian Wide Rail Standard" gauge shall be 2540 mm (8' 4.0" or 100").
- The Distance between Intermodal Stations shall typically be 100 - 500 km.
- Intermodal Terminals shall be located in (or near) Metropolitan cities, and near but not in Regional Cities.
- Intermodal Terminals for Passengers shall be co-located at very few Metropolitan Rail Stations, and near Regional Cities.
- Intermodal Terminals for Freight shall be co-located with Bulk Freight Transfer facilities at local / international Sea Shipping Ports, in Metropolitan Cities and near Regional Cities – for transfer to/from Road / Rail / Sea / Air Freight Transport.
- The “Quick Rail” nominal speed range shall be 250 to 400 km/h.
- Long Haul (>100 km) “Quick Rail” Freight and Passengers shall be safely and quickly transported to/from Regional Intermodal Terminals at nominally 300 km/h.
- All "Quick Rail" Trains shall have a pointed shape "nose" and "tail" to minimise air friction, and further stabilise these rail vehicles.
- All “Quick Rail Engines and cars shall have a common profile to minimise air friction and maximise rail car stability.
- Where practicable "Quick Rail” alignments shall use existing Rail Easements.
- Rail curves with radii of less than 5 km shall be “straightened” to maximise stability / safety and minimise rail etc. maintenance.
- All “Quick Rail” curves shall be (progressively) “banked” to minimise centrifugal (outwards) forces at nominally 300 km/h (and maximise Rail Car stability).
- “Quick Rail” Bogies shall have a (very) narrow arc with tight suspension and be integral to the Cars for maximum stability.
- Close parallel to these “Quick Rail” lines, multiple shallow-buried 96 and/or 144 strand SMOF transmission cables shall provide telecoms connectivity.
- Communications between the “Quick Rail” Trains and distributed “control” shall primarily be via SMOF and short hop radio.
- Deliberate gross over-provisioning of SMOF cables shall provide ample telecoms Backhaul / Access connectivity to future-proof Australia’s Regional areas.
- National and Regional Telecoms Network shall be made significantly more robust by utilising extensive spare capacity in this high-capacity SMOF network / grid.
- Telecoms connectivity near (within 10 km) these “Quick Rail” easements, shall facilitate FTTH (Homesteads), and back-connect Radio Base Stations.

This proposed mainly Regional Rail (and telecom) infrastructure is one of the prime keys for an enormous and long term productivity growth in Regional Australia to bring isolated cities much closer and facilitate geographically distributed businesses to be far more cost effective.

I have absolutely no doubt at all there will be deceptive, continuous and repetitive massive pushbacks against this relatively simple (and straightforward) “Quick Rail” technology to advance Australia. (**Australia’s Treasonous Anti-Rail Lobbyists**)

How Much Will "Quick Rail" Save?

The first question that any politician will ask is **"How much will this cost?"**

What these politicians are really asking is: "Is this inexpensive and quick to roll out, and if so, can I have (several) photo opportunities before next election"?

The straight answer is that this programme will cost about $2 to $10 Billion and take less than 5 years to start showing a solid return on investment. That is plenty of time for inept politicians to look really stupid wearing a Safety Helmet / High Visibility Vest for far too many photo-opportunities, and have lots of stupid Media appearances!

According to the report **"Benefit of Rail to New Zealand"** (August 2024), their rail infrastructure generates $3.3 billion pa for the New Zealand economy, including almost $1 billion pa towards GDP and $2.3 billion pa in environmental, safety, health and reduced road congestion benefits, while full time employing about 1,000 staff.

By "normalising" the population ratio this comes out at about 26.7/5.3 = 5.0 and that times the NZ area is about 1.35 M km^2 or about 18% of Australia's area. Considering Australia is about 3,800 km east-west; 18% is about 700 km west of the east coast – to about Barcaldine / Broken Hill / Cooper Pedy! Considering that the Australian population is about 5 times that of NZ; the rail industry in (eastern) Australia should be generating about $16.5 Bn every year for the Australian economy, and full-time employ about 5,000 staff (i.e. not contractors)! Australia's "Quick Rail" technology should at least quadruple that to save our Australian economy at least $68 Bn pa.

In other words – increasing the amount of Rail transport for Freight and Passengers will significantly increase Australia's GDP, and utilising "Quick Rail" technology will significantly lower the maintenance costs and substantially reduce diesel (and avgas) fuel import requirements while significantly increasing Australia's GDP.

Yes – there are a very few years of (Australian) "Quick Rail" technology development will cost – but then with (**Building Australian Productivity**) and manufacturing, the annual savings / profits will be enormous.

The build and operate programme will involve several highly associated projects that need to be well co-ordinated so that everything "comes together" in growth steps with a minimum of delays and a substantially increasing national productivity.

My over 50 years lived work experience in advanced telecoms research development and production / installation and resolution of intractable service issues; made it very clear to me that doing any research and development / manufacturing processes by Tenders and Bids is extremely susceptible to systemic graft and massive corruption, resulting in systemic inefficiencies that result in immense cost blowouts.

This entire Research / Development stages of "Prototype" / "Proof of concept" / "Small Scale Production" all needs to be done in-house in multiple practical workshop environments where there is full collaboration and minimised competition / conflict. (**Building Australian Productivity**)

One of the first projects involves the location of a few suitable test sites that are near rail tracks that are relatively straight (for about 20 km) and not far from well-appointed (Government owned) rail workshops – with experienced practical engineering staff in these workshops where train engines, and rail cars, and rail tracks can be very inexpensively built and quickly modified / trialled for immediate field testing / proving.

While the various technologies of this new “Quick Rail” are researched past “Prototype” to “Proof of Concept” – virtually all of the “bugs” can be co-operatively removed and plans made for “Small Scale Production”. All this development should take less than a year and this should quickly open the doors for much larger scale manufacturing and production being done entirely in Australia – to rebuild Australian Engineering.

There are massive (national and international) "opportunity cost savings" to be made by maximising the technology of (Australian) “Quick Rail”:

- Long Haul (>100 km) Freight and Passengers shall be safely and quickly transported to/from Regional Intermodal Terminals at nominally 300 km/h.
- The use of road damaging Heavy Road Freight and avgas guzzling Air Planes for Long Haul (>100 km) Freight transport shall be significantly reduced.
- Fully imported diesel fuel required for Heavy Road Freight would be slashed by about 70% - saving Australia tens of $Billions in every year.
- Highways that currently require expensive annual maintenance should not require repair / maintenance for at least a decade - saving Australia tens of $Billions in otherwise lost “opportunity productivity” every year.
- Highway Road Maintenance cost overheads would be slashed by over 80%.
- Intra-Regional Road traffic will be centralised around each Region’s Intermodal Terminal and not in Central Business Districts (CBDs) or in Regional cities.
- Australia's Regional / Rural / Remote telecoms connectivity will be very significantly increased, and close a serious gap in Australia's National Security.

There should be no highly significant changes to the pre-existing “Standard” gauge Metropolitan / District Rail and Highway / Road infrastructures.

For Passenger Transport; the purpose of this "Quick Rail" inter-Region technology is to significantly increase the practicability for people to quickly and inexpensively commute between long distances (>100 km) between major metropolitan / Regional Centres on a far more regular basis – making Australia far more “business efficient”.

A further saving is that “Quick Rail” inter-Regional Rail transport technology shall to a very large degree utilise much of the same Rail easements as have been used for inter-Regional Rail services – but these rail easements shall be considerably straightened and “made safe” so that “Quick Rail” transport can safely travel at nominally 250 – 350 km/h between Regional / Metropolitan intermodal Nodes.

Intermodal Nodes will be at locations near major Regional Centres and in Metropolitan areas. The prime purpose of these Intermodal Nodes is to provide Quick Rail interface with intra-Regional (<100 km) / Metropolitan Rail and Road transport services.

On the “Local” side of these Freight Intermodal Terminals, semi-automated transfer of containers will load/unload Road / Rail Heavy Freight Vehicles for Short Haul (<100 km) pickup / delivery to/from Factories / Warehouses / Shops / Farms / Local Storage etc.

Standard Australian Wide Rail Gauge

Circa CE 1831 – 47; Isambard (**Brunel's "Broad" Rail Gauge**) 7' 0.25" (2140 mm) for the then standard width 8' 0" (2440 mm) Rail Engines / Cars unequitably proved to be far superior in all aspects (far greater stability, far stronger, considerably increased load bearing, minimised maintenance, maximised ride comfort etc.) than all the other earlier (much narrower) rail gauges that were really engineered for (narrow) coal carts.

In that CE 1840 – 1900 era, as the British Empire had an almost global political reach – most of the technically emerging countries that were (or were about to be) building large rail transport network infrastructures blindly followed the UK's narrow 4' 8.5" (1435 mm) "Standard Gauge Rail Act". This mindset was/is very much like sheep (habitually) following each other along a track. (**The Five Monkey Experiment**)

Australia ended up with three rail gauges that are all substantially narrower than the properly engineered Brunel "Broad" rail gauge. (**Australia's Different Rail Gauges**)

In the CE 1860s, the introduction of Bogies greatly assisted with the wheels' axles being always near to right angles to the rails – considerably reducing rail/wheel friction around tight rail curves and consequently minimising the number of "derailments". (**Rail Gauges and Rail Car Instability**)

In Australia (**Background on Australian Freight Transport**) from CE 1850 through to about CE 1910 a massive rail network was constructed throughout most Regional areas – providing relatively quick inter-Regional transport that complimented the more local horse-drawn Stage Coaches and bullock/oxen-drawn Drays.

Beside the rail tracks of this comprehensive Rail Network, there was an overhead / aerial wired telegraph / telephone network providing electronic transmission (primarily) for urgent messaging. (**National Security and Regional Productivity**)

In the CE 1930s / 1940s era there was a concerted worldwide effort to make rail travel far more luxurious, resulting in (**Passenger Rail Cars Got Wider**) increasing in width from 8' 0" (2440 mm) to 10' 0" (3040 mm). Freight Rail Cars stayed at 8' 0" (2440 mm).

These 10' 0" (3040 mm) width Passenger Rail cars were far too unstable in Australian States that have 3' 6" (1067 mm) rail gauge. (**Rail Gauges and Car Instability**)

(**Brunel's "Broad" Rail Gauge**) concept made a lot of solid engineering sense – but since then, bogies (located under the ends of the now longer rail cars) had become standard with the wheel bearings located outside the wheels (as there was "plenty of room")!

Considering the "standard bogie structure" – with a 3040 mm width Rail Car and coming in by 250 mm (about 10") from each side, gives sufficient "wriggle room" for bogies.

From this thinking, my proposed (initial) rail gauge would then be 3040 mm – 2 * 250 mm = 2540 mm (100" or 8' 4"). This physical arrangement would also significantly minimise torsional load stresses on the (roller) bearings – and maximise space between the wheels for electric motor traction. (**Rail Gauges and Rail Car Instability**)

Standard Width Rolling Stock

In the CE 1930s the width of most Rail Passenger cars that had a rail gauge of 4' 8.5" (1435 mm) or greater, increased in width from nominally 8' 0" (2440 mm) to 10' 0" (3040 mm) – but the rails stayed the same gauge – making these wider Rail Cars considerably more unstable as the rails had not been widened to counter for the wider Passenger Cars. (**Passenger Rail Cars Became Wider**)

With the 5' 3" (1600 mm) rail gauge (Victoria and Ireland) and the 5' 6" (1676 mm) (Argentina and India) rail gauges - all these 10' 0" (3040 mm) width Passenger Cars and 8' 0" (2440 mm) width Freight Rail Cars are considerably more stable than railways based on the ancient "UK Standard" 4' 8.5" (1435 mm) rail gauge. Queensland, South Australia, Western Australia and the Northern Territory - with their 3' 6" (1067 mm) rail gauge could not use 10' 0" (3040 m) width Passenger cars as this was far too unstable. (**Rail Gauges and Rail Car Instability**)

The common rail car profile width for Freight has worldwide normalised on 8' 0" (2440 mm) – which also really suits fuel guzzling Heavy Road Freight Vehicles (B-Doubles / Triples) for direct transfer of standard sized containers that can be "road transported". (**Australia's Treasonous Anti-Rail Lobbyists**)

Looking at this Rail Car Width issue from a different aspect, Passenger Cars are 10' 0" (3040 mm) in width and the new Australian "Wide" Gauge is 2540 mm (8' 4") – there are several practical advantages in also having Rail Freight Cars also being 3040 mm (10' 0") in width to align with the now common width of the Passenger cars. (**Passenger Rail Cars Became Wider**)

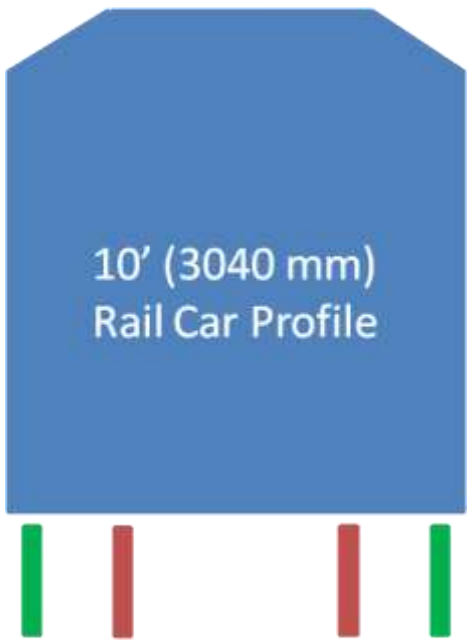
The reason for this common-sense strategy is that with this modern transport technology, all the Passenger Rail Cars **and Freight Rail Cars** would be 10' 0" (3040 mm) in width, and the rails can then be repositioned as wide as practicable, to facilitate maximum safety, a maximally smooth ride, maximum stability and comfort while also providing maximised weight bearing and minimum maintenance.

As the "Standard Rail Car Width" is 3040 mm (10' 0" or 120"); my vision is for a "<u>Standard Australian Wide Rail Gauge</u>" that is 100" (i.e. 8' 4" or <u>2540 mm</u>).

With this Standard Australian Rail Car width of 3040 mm for all rail cars (and engines) and the rails set at a gauge of 2540 mm, this sets the precedent for all the rail wheel assemblies to sit "inside" the 3040 mm Rail Car width profile.

The 3040 mm width Rail Car cross section diagram (on the right) demonstrates the ancient standard wheel / rail alignment (1435 mm) in rusty red and the "New Wide Rail Standard" (2540 mm) in bright green.

This (Wide) rail gauge absolutely maximises the stability of the 3040 mm width Rail Car - and also further maximises the Freight Rail Car stability - because the vast majority of Freight shall be "centred" in 2440 mm width containers!

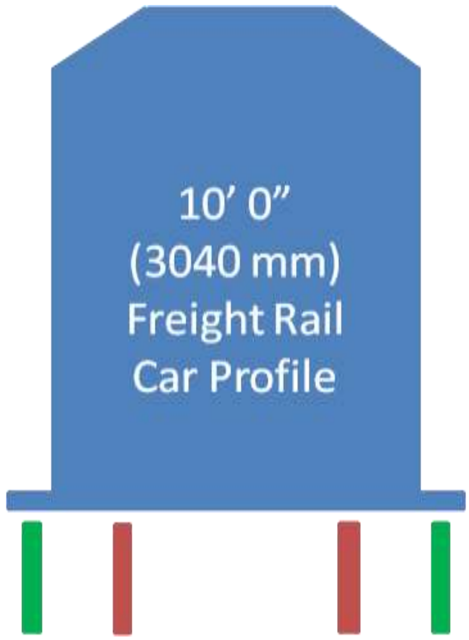


On the right is an example of a container profile on a 3040 mm width Freight Rail tray / car.

Note that the wheel alignments are the same as the above depiction (for a Passenger Rail Car) and that the Freight Car tray extends out by 300 mm on each side to match that of the Passenger Rail Car width.

The floor of these Freight Rail Cars could (and should) be structured to "lock down" the containers at the floor level.

Because the wheels are at the ends of the Rail Cars, there is nothing stopping a "lowered" centre so that tall containers can be quickly transported.



With the Standard Rail Car Width of 3040 mm (10' 0"), Containers (that have a standard width of 8' 0" (2440 mm) and motor vehicles can comfortably sit in a 10' (3040 mm) width rail car and be quickly / properly secured - and be "wind / stone shielded"!

Consequently - this rail gauge of 2540 mm for the new common standard 3040 width "Quick" rail cars will be particularly stable and have far superior load bearing characteristics - making this rail technology very low maintenance while capable of very safely supporting heavy loads at high train speeds.

This "Wide" Rail Gauge to Car width ratio is 2540 mm / 3040 mm = 0.836 which is a very similar ratio to that of the B-Double / B-Triple Heavy Road vehicles; but the rail cars will be on straight and (near) level rails - so not only will the ride be very stable and firm (and glide along), but this train speed can very safely far exceed that of a B-Double / B-Triple Heavy Road Vehicle and be extremely stable! It is this "wide" rail gauge that perfectly matches the now standard 3040 mm width rail cars that will be the catalyst for having very stable, inexpensive, low maintenance, "quick" rail transport throughout Regional Australia. (**Quick Rail National Network**)

For maximum stability, these Engines, Passenger and Freight Rail Cars must have their wheels as wide apart as possible - but not wider than the rail car width. Ideally, the Rail Gauge should be a fraction narrower than the width of the Rail Vehicle (so that the Wheels / Bearings etc. do not protrude beyond this width).

In keeping with this sensible new "Wide" rail standard, the rail gauge needs to be substantially widened to be nominally 250 mm inside the width of the 3040 mm width cars (so the wheels and bearings etc. are (just) inside the width of the cars), leaving the new "Quick Rail Gauge" (width) to be 3040 mm - 250 mm - 250 mm = 2540 mm (100" = 8' 4"). These are "nice round figures" in both metric and imperial!

Now, the "Wide" Rail to Rail Car width ratio is 2540 mm / 3040 mm = 0.836 and this will be very stable (and safe, and very low maintenance)!

The (**Comparative Transport Times**) chart makes it far easier to "visualise" why my "Standard Wide Rail Gauge" (of 2540 mm) is imperative for Australia's near future "Quick (safe) Rail" transport.

Straightening Railway Alignments

The problem is that virtually all of Australia's railways were manually constructed between CE 1850 and CE 1910 - almost entirely without mechanical aides (that emerged in the CE 1950s onwards).

Consequently, with the exception of railroads in Remote Regional areas where the ground is particularly flat are basically straight; almost all Australian (old) railway easements follow the (level) contour lines and wind their way around hills / valleys rivers etc.. It is common for these rail alignments to have radii as tight as 300 metres (and much tighter in some regional urban situations).

The above map is in central NSW where there are "rolling hills" and the course of the existing (single line) railroad is show in "rusty red" as it circumnavigates hill and runs around valleys - where an almost straight through "saddle cut" (as shown as a lime green line) indicates where the rail could (easily and inexpensively) be run.

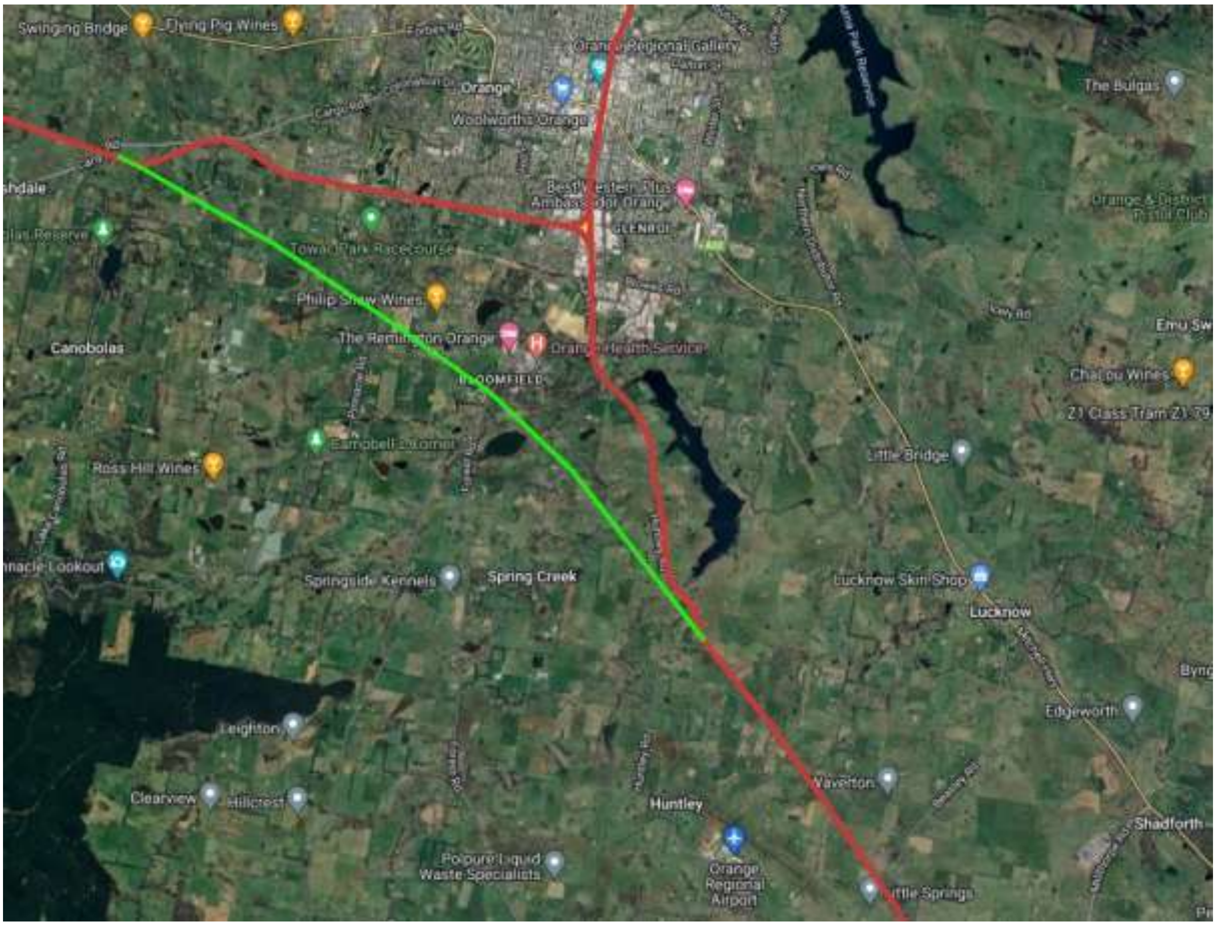
In some cases (e.g. through the Blue Mountains), tunnel boring will be mandatory (e.g. east-west under Blackheath) - but we have this technology for this quick and efficient process - and there is a very high (longer term) return on investment (ROI) for rail tunnels far outside the main metropolitan State cities e.g. to open up Regional NSW.

The associated problem is that many of these winding rail alignments (see above) pass directly through valuable farming / grazing areas - crippling the productivities of these lands - as shown by the rusty red line in the above map. Not only are the new "Quick" rail alignments considerably shorter - but in most cases the released land from the older longer alignments potentially makes the farm land far more productive.

With these tight rail bends (and "ripples") removed from these ancient rail alignments - this action would facilitate a far lower maintenance need (and cost) and considerably lower use of (diesel / electric) fuel in the train's engine(s).

The other all too common problem is that many of these existing rail alignments are single track - used for bi-directional train travel - which is inherently very inefficient use of these (rail) transport alignments / easements. With these rail alignments being straightened - it would make tremendous economic sense to install a second parallel rail track (offset from the new alignment rails by about 4 to 6 metres) for far higher capacity safe and "Quick" rail transport in the opposite direction.

Depending on the terrain, the expected "Quick" rail speed is to be between 250 and 350 km/h and cruise at typically 300 km/h between Regional Intermodal Terminals. This technology is typically three times faster and far safer than the current overuse of Heavy Road Vehicles throughout Regional / Remote Australia.



The above map shows the existing "standard" 1435 mm rail line (in rusty red) passing through Orange in central west NSW. The lower right of this map is near the Orange Airport, and at the top of the map is the rail line heading towards Dubbo, while on the left - the rail line heads towards Broken Hill and Adelaide / Perth.

In the city there is a very tight "T corner" where the existing railway station is just north of there. The southern "T" has a radius of about 290 m and the northern "T" has a radius of about 260 metres. This is a high maintenance and safety nightmare.

The proposed green alignment is about 11 km long. This rail is almost straight and it totally bypasses Orange city. The "Quick" rail intermodal terminal would be a few km north of the Airport, and the branch to Dubbo would be straight through Orange. This urban rail could be used for a shuttle train. Road Freight would be interfaced at the intermodal terminal. The "T" corner in Orange city would be removed and the line going west from that "T" corner would also be removed - opening up the city for natural growth south of the removed railway line.

"Quick" Heavy Rail Freight / Rail Passenger Vehicles have their very economic place to very safely transport Freight and/or Passengers between District / Regional Intermodal Terminals (depending on the terrain) cruising at about 250 km/h to 350 km/h (even 400 km/h) between intermodal terminals. (**Comparative Transport Times**)

All these "Quick" rail cars (Passenger and Freight) shall have a common width of 10' 0.0" (3040 mm) with a height profile not exceeding 13' 9.0" (4200 mm) from the topside of the rails. This is close to the world default rail car profile standard.

For these "Quick" speeds it is imperative that the rails will have a gauge (inner width) of 2540 mm (8' 4.0"), which is comfortably within the width of the 3040 mm (10' 0.0") width rail cars. (**Standard Australian Wide Gauge Rail**)

This "Wide" rail gauge will provide maximum stability and facilitate maximum axle loading with a minimum of long-term damage to the rail tracks and supporting rail foundations. As such - the maintenance requirements should be very low.

These "Quick" Rail trains will interconnect only between intermodal Terminals.

- For Metropolitan Freight, these Intermodal Terminals shall be located in the fringes of the Metropolitan areas - and/or in dedicated Metropolitan Intermodal Terminals.
- For Regional Freight, these Intermodal Terminals will be located away from large (but reasonably near to - within 10 km of) Regional Cities.
- For Metropolitan Passengers, these Intermodal Terminals shall be located at/near Airports and at/near Main urban Train Junctions - providing multi-directional carriage to/from these Terminals.
- For Regional Passengers, these Intermodal Terminals shall be located away from large (but reasonably near to - within 10 km of) Regional Cities.

These Intermodal Terminals shall provide the necessary easy and quick interchange to/from Urban / Short-Haul Freight / Passenger transport.

In hilly areas it is anticipated that a new straightened "Quick" rail route will be used - that will strongly capitalise on the pre-existing rail lines and be "straightened" so that curves will generally have radii exceeding 5,000 metres.

All "Quick" rail lines shall be dual for unidirectional travel in both directions, (nominally spaced apart by 4 metres – or more). The only rail junctions shall be near (nominally within 1 km) of the Intermodal Terminals where the "Quick" trains speeds shall be less than 40 km/h (about 12 m/sec).

It is highly practical and very economic to widely utilise this new "Quick" rail technology. This concept is radically different from ancient (winding) "Standard" rail lines and borrows on the technologies involving linear electric propulsion. Magnetic levitation was seriously considered - but this technology is prohibitively expensive for the massive distances needed to be connected - but the use of linear magnetics for propulsion and braking are very highly favoured.

Considering technology advances it will be far more efficient to have the driver's cabin and main engines more centrally located with front and rear nose / tail providing the visual and air interface.

Further - all "Wide Rail" cars may be self-powered and remote radio / wired controlled so these semi-intelligent cars can very rapidly self-shunt at intermodal terminals to maximise the efficiencies of load transfers to from heavy road freight / sea shipping / other rail and bulk storage facilities.

National Security and Regional Productivity

"Quick Rail" corridors require very reliable telecoms infrastructure. The intent is to include "thick SMOF parallel cabling" in the (straightened) rail easements to provide "Quick Rail" telecoms connectivity, and far more inter-Regional (telecoms Core and Backhaul network) connectivity. These corridors of "thick SMOF parallel cabling" will very significantly restructure Australia's very thin and fragile Regional Backhaul / Core network to be extremely robust. (**Australia's Telecom Infrastructure Debacle**)

Not only is this high-capacity parallel telecom connectivity absolutely essential - but it is imperative to have immediate and highly reliable communications that includes geographically alternate telecoms routes between "Quick Rail" intermodal terminals so that the progress and positions of all rail cars / trains (and the rail infrastructure) is very reliably known.

Low attenuation Single Mode Optical Fibre (SMOF) technology is a "closed" transmission medium (i.e. it is inherently extremely secure and cannot be "listened" into). SMOF also has very low insertion loss and an immense bandwidth and it is extremely inexpensive to manufacture. These inherent physical characteristics make SMOF technology the ideal underground transmission medium to provide universal telecoms connectivity throughout Regional Australia.

From CE 1987 – 1993 most of Australia's coaxial, pair copper and point-to-point radio telecom long haul infrastructure was replaced by underground SMOF cables. Telecom Australia Commission was being split up and privatised and SMOF cables that were manufactured to hold 24 strands – were (Sales / Marketing Executive leadership) "downsized" to just 6 strands. (**Australia's Telecom Infrastructure Debacle**)

Most Australians innocently think that we have a good national security. Most of these same people are totally oblivious that for good national security it is absolutely imperative to have a very robust national telecom infrastructure!

- Outside the metropolitan State Capital cities, Australia's telecom infrastructure is extremely thin and highly (extremely) vulnerable.
- Most District Telecom areas (outside the Metropolitan areas) are operating in "Network Congestion" where there are not enough fibres for the telecom traffic.
- In Regional Australia there are over 13,000 Mobile Phone "Radio Black Spots".
- Most of these "Radio Black Spots" are because there are no available strands in the SMOF cables (and/or no SMOF cables) to back-connect potential Radio Base Stations to the District / Regional Network.
- Most Regional cities areas have only one SMOF cable back-connection (geographic route) with the State Capital Metro city.
- Because most Regional cities do not have a geographically alternate SMOF cables to back-connect into the Telecom Core Network - it is very easy to totally (telecom) isolate large (Regional) areas. This is a major national security risk.
- Because most District Towns / Villages do not have a geographically alternate SMOF cable to back-connect into the Telecom Core Network - it is very easy to totally (telecom) isolate these Towns / Villages.
- There are very few (if any) geographically alternate high capacity Backhaul / Core Network cables between State Capital Cities, making Australia's National Security extremely susceptible.

- By cutting a very few Core Network cables, it is very easy to totally (telecom) isolate every Metropolitan city (and Canberra) throughout Australia.
- Outside Urban Centres, most Internet connectivity is by (slow) point-to-multipoint radio, or by (unreliable) Geostationary Satellite, or by (extremely expensive to Australia) Low Orbit Satellite (“Starlink”).
- Farms and Mining are the prime economy drivers for Australia – yet these productivity centres have by far the worst telecoms connectivity facilities.
- It is the imperative of physical “Quick Rail” transport to have a very robust regional telecoms SMOF infrastructure connected in these “Quick Rail” easements.

With the SMOF cable being ploughed in a "protected" area - near a "Quick Rail" line - the opportunity for these cables to be externally damaged is very small, and consequently ploughing to a depth of about 600 mm about a metre away from the re-enforced concrete rail base would dramatically reduce the SMOF ploughing costs to less than $10,000 per km and provide high-capacity telecoms connectivity.

Ploughing in pairs (or quads) of 96 and/or 144 strand SMOF cables alongside the new "Quick Rail " (Wide Rail) routes will very inexpensively (cost about $20,000 per km including ploughing) provide the imperative high-capacity telecoms infrastructure (well beyond the direct interconnection of State Capital metropolitan cities) for the "Quick" rail network communications.

As the "Quick Rail" network would directly use only a few SMOF “tubes” (of 12 fibres) – this forward strategic planning will leave many SMOF fibre pairs for high-capacity telecoms Backhaul network / Core network connectivity and Non-Urban (Homestead / Mobile Radio Base Station Access along / near all these "Quick Rail" routes!

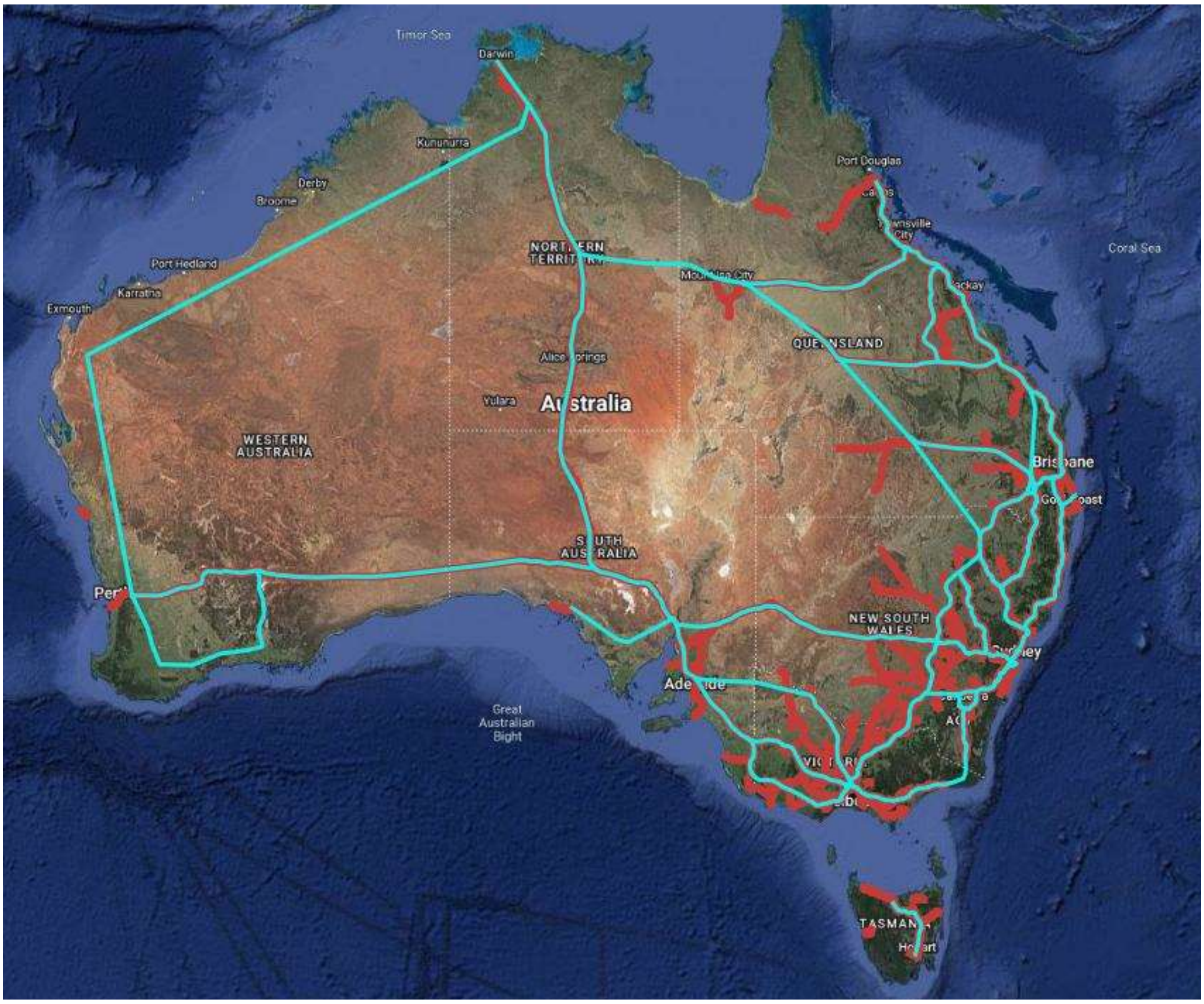
Because almost all this proposed “Quick Rail” network is Regional (not metropolitan) and the “Quick Rail” infrastructure forms a nationally large Regional grid where the Metropolitan cities are not the main nodes; this is the perfect physical structure to very inexpensively set up a massive high speed Internet grid that would be extremely robust and prevent any and every Metro city and every Regional city from being Internet isolated – even if many of these cable were deliberately cut.

This Regional SMOF grid would also lend itself to being the prime Regional Backhaul telecom infrastructure – facilitating people and business to set up and operate mainstream virtually anywhere in Australia – not just in metro cities!

Consider a “corridor” 10 km either side of the “Quick Rail” (straightened) easements to be readily connected by FTTH (Fibre to the Homestead). This inexpensive infrastructure would provide a massive boost to most of Australia’s Regional productivity and release the excessive pressure of extortionate house / home unit etc. prices in Metropolitan areas.

Australia's Quick Rail National Network

The map below is indicative of the proposed National Regional network for "Quick Rail" shown in mid blue with the old rail line easements shown in rusty red.



Note that in general throughout Australia, these "Quick Rail" routes virtually overlay of the main rail routes (and then some) of the pre-existing Regional Rail Network. (**Hidden Economics of Rail V Road Freight Transport**)

In most cases the "Quick Rail" infrastructure shall directly replace the existing railway and/or incorporate the same alignments – but tight bends will be "taken out" and be replaced with sweeping curves with radii (usually) well-exceeding 4 km – and the "Quick Rail" shall be slightly banked to zero balance at about 200 – 250 km/h. (**Rail Gauges and Rail Car Instability**)

This build strategy involves an absolute minimum of land being take for these "Quick Rail" easements – so that minimises the amount of legal wrangling and also minimises the amount of "land grabbing" for short term profiteering from inside information.

The fact is that in the vast majority of locations where the original train easements wander around hills and valleys – the straightened "Quick Rail" alignments will be considerably shorter and the earlier rail alignments will be practically restored to maximise farm / grazing productivity. The new rail alignments will modify some land use – and in most cases this will be advantageous to the farmers and graziers because paddock will usually not be "rail isolated". (**Hidden Economics of Rail V Road Freight Transport**)

Comparative Transport Times

The table below gives an indication of the typical road-based travel times, versus the (old) rail-based travel times, versus my estimated "Quick Rail" travel times (in decimal hours). Note that the Quick Rail is not always based on typical urban main / central railway stations – but will most probably be terminating at Intermodal Terminal that can facilitate rapid transfer with local / district transport facilities.

From	To	Distance (km)	Road (H.hh)	Slow Rail (H.hh)	Quick Rail (H.hh)
Adelaide	Darwin	2802	36.0	46.70	9.50
Brisbane	Gladstone	513	6.70	7.80	1.75
Emerald	Longreach	416	4.80	9.23	1.40
Emerald	Rockhampton	270	3.50	4.55	1.08
Emerald	Toowoomba	753	8.75	12.55	2.51
Geelong	Parkes	771	8.28	15.42	2.66
Geelong	Canberra	723	7.50	18.00	2.72
Geelong	Parramatta	936	9.55	15.60	3.20
Newcastle	Toowoomba	705	8.12	15.70	2.50
Parkes	Broken Hill	820	8.90	11.70	2.75
Parkes	Parramatta	333	4.17	8.33	1.56
Parkes	Toowoomba	830	9.25	16.66	2.77
Port Augusta	Broken Hill	413	4.25	9.90	1.40
Parramatta	Toowoomba	856	9.50	19.00	3.30
Parramatta	Newcastle	151	1.75	3.78	0.60
Parramatta	Canberra	269	3.00	6.00	1.20
Townsville	Cairns	345	4.15	6.20	1.15
Townsville	Rockhampton	724	10.20	9.75	2.90
Longreach	Rockhampton	686	8.33	14.55	2.75
Longreach	Tennant Creek	1309	13.10	21.80	4.36
Tennant Creek	Darwin	988	9.25	15.20	3.30
Tennant Creek	Alice Springs	508	4.55	7.24	2.03
Tarcoola	Port Augusta	417	6.75	5.56	1.40
Tarcoola	Kalgoorlie	1611	21.75	18.80	4.70
Tarcoola	Alice Springs	941	11.75	13.45	3.20
York	Kalgoorlie	528	5.5	6.75	1.80
York	Mont Barker	355	3.8	7.10	1.27
York	Geraldton	510	5.45	8.50	1.70

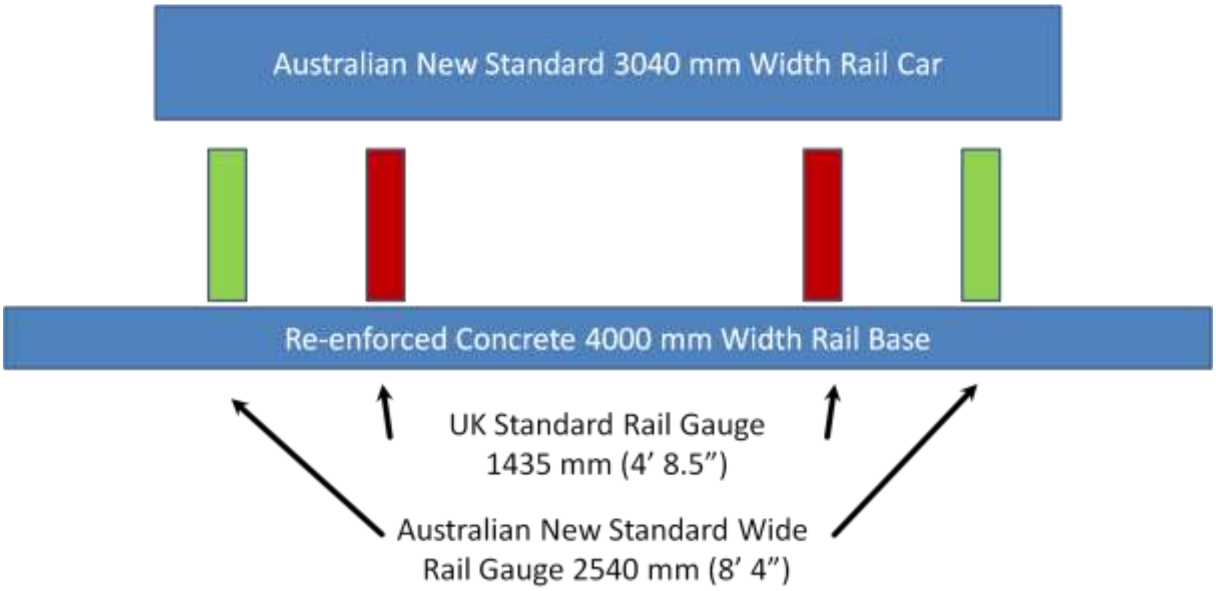
The above table is by no means complete - but - it demonstrates that with this inexpensive and reliable (wholly Australian manufactured and assembled) rail and train infrastructure, that many Regional centres using “Quick Rail” technology shall be connected in a fraction of the current transit time than that of Road or by Rail (or Air).

The physical effect for Australia will be that because this “Quick Rail” transport technology is at least three times faster than by road transport (and less than half as expensive) and about as fast as air transport (and much cheaper, and far more reliable); this will make Australia “appear smaller” and consequently be able to operate more efficiently with geographically distributed businesses.

This “Quick Rail” transport infrastructure has the solid potential to really catapult Australia’s currently “passively floating” economy to quickly become a very powerful primary / secondary / growth / manufacturing / service economy.

Cost-Effective Inter-Region Rail Transport

My concept is to graft the entire Australian inter-Regional rail network to a new "Standard Australian Wide Rail Gauge" of 2540 mm (8' 4") and keep the existing rail different gauge infrastructures in place by utilising a "Standard Australian Wide Rail Gauge" iron re-enforced concrete sleeper / concrete mattress technology that will accept the various rail gauges - and use these rails as strong structural support to very significantly reduce the rolling resistance and significantly reduce the need for ongoing expensive maintenance. (**Standard Australian Wide Rail Gauge**)



The above picture is typical of the lateral cross section of a 3040 mm (10') width Rail Car base with the option of the "UK Standard Rail Gauge" - in rusty red, and the "New Australian Standard Wide Rail Gauge" shown in lime green, with a 4000 mm (13' 7.5") width re-enforced concrete sleepers / rail base. It is clearly obvious that the "Australian Standard Wide Rail Gauge" will provide a far more stable load support than the inappropriate ancient CE 1820 - 1846 UK Standard Rail Gauge.

What is not obvious is that with automated mechanics the 4000 mm width concrete rail base / and/or pre-fabricated sleepers can be (literally) laid at about 1 km (1000 metres) per day and the parallel iron lines fixed firmly in place. With (say) 6 teams working in harmony, that is in the order of 6 km per day, or 30 km per week (5 days per week, 8 hour daylight shifts). In a single year (48 weeks) that is in the order of 30 * 48 = 1440 km of "Quick Rail" in Regional areas.

It is clearly obvious that the "Australian Standard Wide Rail Gauge" will provide a far more stable load support than the "Narrow Gauge".

The considerably increased stability to be provided by this "Standard Australian Wide Rail Gauge" (2540 mm) rail gauge will be the prime catalyst to inexpensive provide "Quick" stable, safe and efficient rail transport at nominally 250 - 350 km/h in Regional Australia. (**Hidden Economics of Rail V Road Freight Transport**)

If a second pair of (pre-existing) rails are also firmly attached to these same sleepers then the rolling resistance again almost halved to about 1.4 metres per 100 metres and the maintenance requirements are also again substantially reduced. This situation infers as very substantial saving in energy required the power the train.

As mentioned, the rail traction is to be primarily through the (rotating) wheels with the rails - but there is a very significant advantage to include linear induction motors under the rail cars (nominally each in pairs about 2000 m long) just clearing both rails to provide considerable extra traction with both acceleration and braking.

This linear motor technology could / should also be used to provide local self-control (automated control) of each (isolated) Rail Car for automated shunting while loading / unloading freight to particular hoists etc.. Consider that each Rail Car has its own very secure Wi-Fi comms with local Shunting / Loading / Unloading control - and a small Battery to (under automated control) propel the Rail Car for upwards of 5 km.

The many initiatives put forward in this document set a clear path for Australia's Future Regional (and National) Economy to really flourish.

The blockers for these initiatives are gross incompetence at the ministerial and senior executive levels - and - of course, endemic corruption by covert international business and political interests. (**Australia's Treasonous Anti-Rail Lobbyists**)

For several decades we have had the rebuilding of the rail line between Melbourne and Sydney to be straightened between Campbelltown and Bowral as this would take an hour off the rail trip and make if far more cost effective. Straightening up some more of that rail line would take another hour off the trip – even with the ancient UK Standard (narrow) rail infrastructure. (**The Melbourne - Sydney Rail Fiasco**)

The inland rail route between Melbourne / Geelong – Parkes - Toowoomba "West Brisbane" / Brisbane has been repetitively stalled (for years) and the specification repetitively "changed" to kill this infrastructure. This project should have been totally completed and be dual lines all the way well before the Western Sydney airport was even started. (**The Inland Melbourne - Brisbane Rail Fiasco**)

Immense funds are being poured into Western Sydney's Airport – that is "advertised" to be a business centre and a main passenger airport – but the plans are showing it will be a prime intermodal port for Freight using avgas guzzling Freight aircraft connecting with Toowoomba (West Brisbane) and Melbourne (Tullamarine's new runway) instead of B-Doubles on the worn-out Hume and Pacific and New England Highways. (**NSW Western Sydney's Airport Fiasco**)

Immense funds are being lined up to be poured into the proposed Sydney – Newcastle "Fast Rail" project that will be almost all in a 100 km tunnel and not use the existing rail line that is almost straight. This project could be inexpensively and far more quickly done with very few (and short) tunnels between Thornleigh and Gosford and a bridge about 30 metres over the Hawkesbury River. (**The Sydney Newcastle Rail Fiasco**)

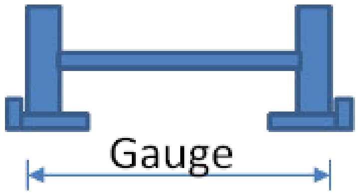
It is not hard to see that (**Australia's Treasonous Anti-Rail Lobbyists**) have been working overtime for decades to stop Australia's economy from flourishing – and maximise the use of imported diesel fuel – as an immense cost to Australia's economy.

Appendix

Background on Early UK Rail Transport

For many centuries Railway technology was implicitly tied with manual mining - where the car / cart body was usually nominally 2' or 3' or 4' wide, and the outsides of the wheels were nominally 3' or 4' or 5' wide. In muddy mining areas, wooden rails were sunk into the ground so that the cart's wheels could run along on top of these rails so that the cart's wheels would not be bogged. As these rails sunk into the mud - it was common practice to position another rail on top of the sunken rail first. These rails under the used rails were called "sleepers"!

It was also common practice to have a pair of "outside offset" wooden rails - to guide the carts wheels from "running off the rails". These pairs of wooden rails formed an "L" shape cross section and the pair of wheels ran on the inside of a pair of these inwards facing "L" shaped rails. The spacing between the two "outside offset" rails was/is termed the "gauge".



Stage Coaches were made for long distance seated travel where the body of the coach was (usually) fully enclosed and the (four) wheels were large diameter (nominally 5’ 0”) to minimise bumps in travel from adversely affecting the passengers. Most Stage coaches also had a leather suspension to further soften the rough ride. The gauge of these wheels was also between 6’ 0” and 7’ 0” to provide maximum Coach stability.

Bullock Drays were nominally 8' wide because with packed wool bales being nominally 48" x 32" x 45"; laying two bales end-on end across a Bullock Dray comes out at 48" + 48" = 96" = 8' 0". The “gauge” of the Bullock Dray wheels were nominally 6’ 0” to 7’ 0” and these were set “inside” the overall cart width.

The horse-drawn (urban) "Trolley Bus" was also nominally 8' 0" wide - with multiple pairs of seats on each side of an isle (just like road busses of today). Because these were “urban” vehicles, the diameter of the wheels were relatively small (less than 3’ 0”) and set into the width of the Trolley Bus (with a gauge of typically 7’ 0”) – with the floor just above axle height.

The problem was that with these Trolley Busses the spacing / gauge of (iron rimmed wooden) wheels were “hard to steer around corners” but with the new (inwards facing “L” shaped iron) rails having a gauge of nominally 5’ 0” (as per most coal carts) and set into the cobble stone streets – these new Trolley Busses could be made longer (and carry more passengers with the same number of horses) and negotiate street corners, and have considerably less rolling friction.

This is where the combination of these two technologies – the Trolley Bus and the Coal Cart were an extremely awkward / fundamentally flawed arrangement as the Coal Cart rail gauge of nominally 4’ 8.0” was far too narrow for the 8’ 0” width Trolley Bus – but…

This very awkward situation was made considerably worse when the Rail Car lengths got longer (to seat more passengers per Rail Car)! At the time this was not a really issue because Trolley Busses didn’t travel faster than a quick walk – and the Trolley Bus ride was far smoother than a Stage Coach.

Circa CE 1800 Richard Trevithick invented the pressure Stream Engine (*in engineering terms this was the "Prototype"*) that was the catalyst for the Industrial Revolution. This

Steam Engine technology was initially utilised in factories providing mechanical power to almost every physical trade.

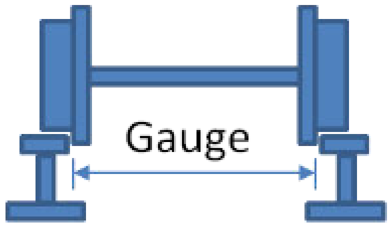
By about CE 1810 this Steam Engine technology was applied by Richard Trevithick to mining to replace men and horses / oxen etc. hauling carts. This was the catalyst for a radical change in mine transport technology that would radically increase mining productivity.

George Stephenson was invited over to an adjacent coal mine to see Richard Trevithick 's then new Steam Engine that was then running inwards facing “L” profile iron rails. Stephenson realised there were fundamental problems in that the shape of these iron rails was not strong enough to support the sheer weight of the engine and worse – these iron wheels had a tendency to “run off the (iron) rails”.

Stephenson also realised the massive productivity that was possible with this Steam engine and iron-railed transport, and he recommended to his coal mine owner / manager to also change to steam-engined iron-rail transport in their coal mine.

Stephenson's manager agreed to the (expensive) trial of several physical changes / improvements to Richard Trevithick's Steam Engine and inwards "L" shaped iron rail technologies - primarily because the engine / cars had a habit of jumping of the rails and also losing traction - and it was near impossible to switch rail lines.

Stephenson changed the rail profile to an "I" beam and his iron wheels included an inside flange to minimise derailment. The rail gauge (spacing) was no longer measured from the outer wheel's distance, but from the outer distance of the inside wheel flanges. With this change – the cars / engines could be "rail switched".



This new wheel / rail technology change resulted in the rail gauge (with 2 inch width iron wheels) converting from 5' 0" (60") to the (inside wheel) 4' 8.0" (56") rail gauge. George Stephenson also introduced there be several close-spaced large wooden "sleeper rails" cross-positioned to very firmly hold the iron rails in place - so derailments were then extremely rare.

Stephenson also conceived the idea of forcing of the exhaust steam over the coal furnace to "superheat" the coal (hence the "choof-choof" sound of steam engines).

Quickly following the resounding success of introducing this then new steam engine / rail technology, other mines in the UK and nearby, followed and converted to the "I" profile rail etc. - but they had a range of rail gauges based on their existing infrastructures. This is basically where the rail gauges of at least: 3' 6", and 4' 8" and 5' 3" and 5' 6" came from.

Coal steam engine powered freight rail transport technology very rapidly mutated to commercial passenger transport between urban centres - all using a variety of rail gauges based on various local mine rail gauges that really never suited these much wider rail cars as these rail gauges were far too narrow for good stability. The rail gauge for steam trains should have been considerably wider than these coal cart rail gauges – but there was a lot of “sunken investments” in the coal mines and this was the ruling engineering fad of the day – so (almost) everybody followed like sheep and asked very few real engineering questions! (**The Five Monkey Experiment**)

Brunel's "Broad" Rail Gauge

By the CE 1820s it didn't take long for the 8' 0" Carriage / Car width to become the industry normal, but there were a few different rail (mainly mine-based) rail gauges.

Most of these rail gauges in the UK were 3' 6", 4' 8.5", 5' 3" (Ireland) and 5' 6" (Scotland). The trouble was that it was not uncommon to have Rails Cars (and Engines) "toppling" over - because of slight level irregularities in the rails and/or the curves were too tight - and consequently the trains / cars were de-railed!

It was not that hard to figure out that a considerably broader the rail gauge the far more stable the ride. But...

Primarily because of considerable "sunken investments" in these railway infrastructures, there was / is very stiff private sector opposition to re-build these (naturally narrow) railway infrastructures with a much wider rail gauge that would match these then industry standard 8' 0" Rail Car width

Circa CE 1830, the renowned British structural Engineer; Isambard Brunel looked at improving the capability and stability of rail transport. He recognised that with the then standard width 8' 0" (2440 mm) rail cars, the wheels and rails were far too narrow and he initiated a radical change in the rails / wheels structure was necessary to deliberately make the Rail cars far more stable than they were.

As the Rail Car width was 8' 0" and the wheels 2" wide, his thinking was to keep the wheel assembly inside the 8' 0" width profile - by giving the wheels about 4" on the outside for axle / bearings / bindings etc., and make the rail gauge 6" in from each side (which was as wide as the wheels could physically be without the wheel assembly exceeding the nominal width of the rail car)!

The diagram on the right shows a typical 8' width rail car cross section profile and the direct comparison of a with the Standard Gauge (4' 8.5") wheels shown in rusty-red and Isambard Brunel's 7' 0" Gauge wheels in mid-blue.

In this diagram the "gauge" is effectively the spacing between the inside faces "block wheels".

It should be very obvious that Isambard Brunel's "Broad" railway gauge would be far more stable than the "Standard" rail gauge for these 8' 0" (2440 mm) width Rail Cars.

Brunel initially trialled this new technology in CE 1831 in (far) western England with a specially constructed about 14 km length rail track. Not only was the improvement in Rail Car stability astounding better, but also the rolling resistance was significantly less than with the commonly used 4' 8.5" (1435 mm) rail gauge.

Apart from Brunel's 7' 0" (2134 mm) Rail Gauge being far more stable than all the other (more narrow) rail gauges, because the sleepers were significantly longer - the weight load bearing was distributed over a considerable larger "floor area" and the rails would have been depressed significantly less than the narrower rail gauges.

Putting numbers to this, the sleeper length for a common UK (1435 mm) rail gauge is about 600 mm over each end or about 600 mm + 1435 mm + 600 mm = 2635 mm. (In practice they are nominally 2600 mm in length!)

With weight loading the rail will sink about 15 mm under the axle (wheel) and considering the wheel diameter is about 36" (920 mm), the "gradient climb" is about 15 mm / 460 mm = 0.0326 or about 3.26 metres per 100 metres.

With the Brunel (2140 mm) rail gauge, the sleeper length would be about 630 mm + 2140 mm + 630 mm = 3400 mm and with this longer / larger floor area the depression will be about 15 mm * 2600 mm / 3400 mm = 11.47 mm. Consequently, the "gradient climb" is about 11.47 mm / 460 mm = 0.0249 or about 2.5 metres per 100 metres.

This is calculation is in effect the static rolling resistance and this simple example shows that the Brunel gauge has a significantly lesser rolling resistance than the common UK 4' 8.5" (1435 mm) gauge. In these calculations, the rolling resistance is reduced from about 32.6 metres/km to about 25 m per km or about by 30%.

In other words - by merely deliberately having a longer sleeper (in this Brunel case about 28% longer), the rolling resistance should be reduced by nominally about 30% - and the weight loading is also considerably increased - so the wear and tear on the rails and sleepers is significantly less - indicating that the expected maintenance overhead requirements (and costs) would substantially reduced.

Isambard Brunel was then commissioned by the UK Parliament / Government to build the "Great Western Rail" between London and Bristol (about 170 km long) - which was based on Brunel's 7' 0" (2134 mm) "Broad" rail gauge.

This railway was fully operational by CE 1835 and this was a resounding success, clearly outperforming all the other (narrower) competing railway services in the UK. Not only was this railroad fairly straight, but the rail cars were particularly stable (the cars did not "rock"), and this very smooth rail technology had far superior load bearing capability to all the other (far too narrow) rail gauges.

Because (like as previously happened with George Stephenson) in some curves the rails "pinched" the wheels - and the wheels jammed in the rails - this rail gauge was slightly increased from 7' 0" (2134 mm) to 7' 0.25" (2140 mm)! This is why this gauge had such an odd Imperial value.

Isambard Brunel's 2140 mm (7' 0.25") rail gauge used for 2440 mm (8' 0") width rail cars and engines was very quickly proven to be the correct / sensible engineering strategy.

The problem was an immense investment in commercial railroad technologies from the early CE 1810s - and consequently because of immense sunken capital (by private railway owners) in existing coal mine originated narrow rail gauges, by CE 1835, there was a frantic pushback to not use Brunel's 7' 0.25" (2140 mm) very sensible well-engineered Rail Gauge technology – for their 8’ 0” (2440 mm) width Rail Cars.

The Five Monkey Experiment

If there is one thing that everybody needs to be acutely aware of (and in proactively practice apply in everything they do) - it is the “Five Monkey Experiment”:

A group of five monkeys were put in a large cage with a bunch of bananas hanging from the ceiling, with a tall ladder under the bananas so that the bananas could be reached (and eaten) if a monkey climbed up the ladder and retrieved the bananas.

When any monkey climbed the ladder to retrieve / eat the bananas; all the monkeys including the monkey on the ladder) were force-sprayed with strong blasts of freezing cold water! (No monkeys got to the bananas!) It didn’t take long for the monkeys to associate that any of them climbing the ladder to get the bananas was met with all the monkeys getting strong blasts of freezing cold / uncomfortable water.

Over time, whenever any monkey attempted to climb the long ladder, all the other monkeys in the cage (in fear of the group blasting of freezing cold water) attacked that monkey in the first instance, to stop that monkey climbing the tall ladder.

The group mental pattern was set, where the tall ladder and bananas were left in place but the blasts of freezing cold-water sprays were turned off.

From then on - no monkey in that cage attempted to climb the ladder for the bananas in real fear that the other monkeys would fiercely attack that monkey!

In the next phase of this experiment – one monkey was removed from the large cage and replaced by another monkey that had no knowledge of the “bananas / ladder / freezing cold water / ferocious attack” situation.

The new monkey saw the bananas near the roof and (naturally) went to climb up the tall ladder to get the bananas - but that monkey was immediately ferociously attacked by the other four monkeys (to not climb the ladder)! “Ouch!”

This new monkey to this group very quickly learned that climbing the ladder to retrieve the bananas would result in the other monkeys fiercely attacking that new monkey!

In the next stages of this experiment, the other original monkeys were sequentially replaced by fresh monkeys with no knowledge about the freezing cold blasts of water!

Eventually, none of the five monkeys / monkeys in the group had ever experienced the blasts of freezing cold water, but they still furiously attacked any of other monkeys / monkeys from climbing the tall ladder. They had all learned and perpetuated a particular reaction the norm without understanding its original rationale!

The telling of this social experiment is often used to highlight how social learning and the transmission of incorrect standards / practices / processes are perpetuated with certain behaviours / religions / beliefs, even if the original reasons for those behaviours or beliefs are no longer relevant or known – but are mindlessly followed.

Whenever you hear / read statements like “That’s the way we have always done it”! “This is World Standard Practice”! etc. Be acutely aware that in most cases that whomever quotes these (or similar) words are totally clueless about what they are specifying and the situation is usually fundamentally flawed / incorrect / baseless.

“**We will use the Standard Rail Gauge**” is a classic example of absolute ignorance.

Why the "Standard" Gauge was/is Law

By CE 1830 in the UK and surrounding countries, the introduction and use of railways was explosive, with new rail network interconnecting many cities and towns.

In (and nearby) the UK - instead of the railways being operated as a Government sub-Department "Commission", theses early railways were privately funded (for profit) - because those that owned the railways knew that there was very little option for this transport mode and these wealthy operators could charge as much as they liked and the general public would have to pay - for what was/is in reality an essential (transport) service that to a large degree took over from Horses, and Stage Coaches.

Most of these rail networks in the UK were based on George Stephenson's 4' 8.5" rail gauge, while most of the Irish network was 5' 3" and the Scottish network was mainly 5' 6" and there were other lines of 3' 6" (particularly in areas where the rails had tight curves) - as literally all of these railroads were manually constructed and cutting tunnels / sides of hills and making large bridges were all very time consuming (and therefore very costly) and it was faster to follow the level contours and have a winding track.

In France, the “rail gauge” was measured from the centre of each rail to the centre of the other rail and this distance was 1600 mm (5’ 3”) – but as “head” of the rails is nominally 60 mm in width, taking 30 mm + 30 mm off the 1600 mm is 1540 mm (50.6” = 5’ 2.6”) which is “very close” to 5’ 3.0” (1600 mm)! Go figure!

In north America there was a frantic competition between the few very wealthy bankers / families to roll out several virtually parallel east-west rail networks - because the return on investment was immense (and the rail workers were virtual slaves). In general, most of these rail gauges in north America “near” but not the same as Stephenson's 4' 8.5" rail gauge – so that if/when there was a takeover then that taking business could not use their rolling stock on competing main east-west rail lines.

Circa CE 1831, the UK Government / Parliament became highly aware of Isambard Brunel's work on an experimental "wide" 7' 0" gauge railway in far western England and they realised the immense potential as this rail infrastructure was properly engineered for 8' 0" (2440 mm) width rail cars and engines. All reports were that Brunel's rail technology far surpassed that of all the other (narrower) rail lines.

Circe CE 1833 the UK Government engaged Isambard Brunel to lead and manage the construction of what would become "The Great Western" railway line using his 7' 0" rail gauge between London and Bristol (about 170 km) - involving a few bridges.

After the "Great Western Railway" was opened in CE 1835 all hell broke loose with the owners in the private railway sector. For the past 10 - 20 years these wealthy rail owners had invested a massive amount of their wealth (resources) into their own railways. Now, there was clearly far superior railway "infrastructure" that was Government owned and operated and it clearly out-performed all their railways!

On the side of all this, Isambard Brunel discovered that on some curves, the trains had "pinching problems" with the rails / wheels. These pinching problems were caused because on some rail curves, because of the (longer) length of the cars, this resulted in the directly fixed axles (to these cars) subtending an angle between the two axles such that effective gauge of the rails was marginally less than 7' 0". He then arranged that the gauge of the rails be slightly increased to 7' 0.25" to minimise this "pinching". This is the reason why Brunel's rail gauge is such an odd width.

Good engineering sense would have stipulated that all rail lines built after circa CE 1835 were be built to Isambard Brunel's 7’ 0.25” Broad Rail specification - and that all earlier rail lines also be later re-constructed to be this Broad Rail Specification.

By circa CE 1840, there was a comprehensive railway network throughout most of the UK. Much of this rail network was 4’ 8.5”, with some 3’ 6”. It was very clear (to at least the private railway operators in the UK) that by then the “Great Western Railway” broad 7’ 0.25” gauge railway clearly out-performed all the other (narrower gauge) railways in the UK (and all other countries too).

These "competing / colluding" private sector railway operators were highly aware and infuriated that Brunel's "Broad" gauge railway infrastructure was extremely stable (far more stable than their mainly 4' 8.5” (1435 mm) rail gauge infrastructures that were being used with the by then virtually standard width of 8' (2440 mm) rolling stock.

The prime problem was that the railways should have been Government infrastructure - and certainly not: owned / managed / operated by the private (greed) sector – who were in a difficult (but very common) private sector predicament.

Because of massive sunken investments by very wealthy competing private railway operators in the UK (most with the 4' 8.5" (1435 mm) railway gauge technology); there was a quiet, deceptive and very underhanded rebellion that was headed by no less than George Stephenson (who was the "father of the 4' 8.5" rail gauge") - to eradicate Brunel’s excellent broad 7’ 0.25” rail gauge engineering technology.

In the UK, many "competing" private sector operators corruptly "colluded" / "conspired" to facilitate a Bill to be passed through the UK Parliament (where it is obvious the Parliament members were heavily "compromised"), resulting the "Standard Railway Gauge Act" (CE 1846) that effectively outlawed all rail gauges in the UK except for their own 4’ 8.5” (1435 mm) rail gauge! (*How amazingly convenient*...)

The prime purpose of this ridiculous “Standard Rail Gauge Act” was for the private sector owners to deceptively outlaw Brunel's far superior “Broad" 7' 0.25" (2140 mm) rail gauge as used on the Great Western Railway - to have this rebuilt to comply with their own far narrower and far less stable 4' 8.5" (1435 mm) rail gauge!

The Act also allowed the Irish 5' 3" (1600 mm) rail gauge to continue as Ireland was largely not part of the UK and the Act also allowed the Scottish 5' 6" (1676 mm) rail gauge to continue (for an unspecified limited time). The 3' 6" (1067 mm) gauge was effectively abolished in a few years in the UK as this was a small component of the overall UK network - and the main body of railway owners deliberately killed of this "competition" for their own benefit!

Because of massive nearly global political power (and engineering leadership) that the British Empire had in that era, most of the developing world countries blindly complied with the UK "Standard Railway Gauge Act" - directing all rail lines (including the "Great Western Rail") to be changed to 4' 8.5" (1435 mm) - even though, the then standard rail car width was 8' 0" (2440 mm)! (**The Five Monkey Experiment**)

This was a classical re-application of “**The Five Monkey Experiment**” where the 4’ 8.5” “Standard” rail gauge was/is far too narrow for the 8’ 0” width cars! The situation is now much worse as the passenger rail cars are now 10’ 0”, (3040 mm) in width!

Australia's Different Rail Gauges

By the CE 1830s with the private sector railway transport industry absolutely booming in the UK – the common expectation was that the same would happen in Australia – but material resources beyond wood were very scarce and expensive.

The first railway line in Australia was in CE 1831 at what is now the CBD of Newcastle (NSW). This was a privately owned and operated inclined plane gravitational cast iron fishbelly rail for the “A Pit” coal mine. Circa CE 1850, both NSW and Victoria started with the Irish 5' 3" (1600 mm) rail gauge.

In Victoria, the first (5' 3") rail line was connecting the sea nearby shipping port in the Docklands area to the Melbourne CBD. In NSW, the first (5' 3") rail line was connecting from near Sydney's Central Station (south of the CBD) to Parramatta, about 23 km.

In NSW with a change in Rail Managers (also circa CE 1850) - because Sydney was a colony of the then very powerful British Empire and the "Standard Rail Gauge Act" (CE 1846) was part of the British Empire's "Law" - the first NSW rail line (Sydney - Parramatta) was immediately narrowed from 5' 3" (1600 mm) to 4' 8.5" (1435 mm) and then all railway tracks laid in NSW blindly followed the idiotic UK “Standard Rail Gauge Act”! (**The Five Monkey Experiment**)

The prime reason why Queensland, South Australia, Western Australia, Tasmania that all use(d) 3' 6" (1067 mm) gauge was one of pure economics and unavailable resources - as the distances to be connected (in UK land terms) were immense (several hundred km between towns); and there was a severe lack of large trees necessary for (long) rail sleepers.

When you consider that a sleeper for 3’ 6” (1067 mm) rail would be about 2200 mm in length and a sleeper for a 4’ 8.5” (1435 mm) would be about 2600 mm, not only is this an extra 400 mm; but if you could get three sleepers 2600 mm in length from the one tree, the chances are you could get four sleepers 2200 mm length from the same tree. That is a 25% increase in the number of available sleepers!

Also consider for “smaller” trees that could not provide a 2600 mm length sleeper – but could provide a 2200 mm length sleeper! This was a “gimme”!

In Tasmania - because of the mountainous terrain the manually constructed rail track winds its way with very tight radii arcs - making it unsuitable for the manual construction of rail lines with the "Standard" gauge 4’ 8.5” (1435 mm) rail infrastructure - so they too stuck with the 3' 6" (1067 mm) rail gauge.

Initially these different rail gauges in the different States were not a major issue until about CE 1880 when interstate train travel became practical – except for the need to change trains at the State borders. This State border rail gauge discontinuity to a large degree stifled / delayed Australia becoming a nation in the CE 1890s, and the Commonwealth (of Infrastructures in) Australia finally happened in CE 1901.

It was not until CE 1962 that the line from Melbourne (in Victoria) to Albury (in NSW) started to be dual-railed with 4’ 8.5” (1435 mm) and 5’ 3” (1600 mm) to facilitate a straight through run between Melbourne and Sydney and this “Standard Rail” line was eventually opened in CE 1966.

In the period from about CE 1850 through to about CE 1915 there were several blast furnaces made in Australia but very few of these actually produced commercial quantities of iron – and almost all the iron for the railways (and Sydney's Harbour Bridge (CE 1925 – 1935) was shipped out by barges from the UK.

At that stage in Australia's history there had been a gold rush in Vic and NSW, and Australia had been exporting immense amounts of wool (and wheat), but Australia had also imported huge amounts of iron and my thinking is that Australia was deliberately positioned to be in immense foreign debit to the UK – which in reality made Australia in effect totally sub-servient to the UK / the British Empire.

The almost Australia-wide Rail Network had overtaken from Horses and Stage Coaches as the prime people and freight transport infrastructure and Telegraphs / Telephones were also being rolled out from the CE 1870s to provide far faster long-distance communications.

In this amazing 100-year span from about CE 1800, Australia had literally grown from a set of penal colonies and isolated settlements into what had become a very wealthy country - and in CE 1901 the various colonies etc. formally combined to form the Common Wealth of Australia.

The map shows that by about CE 1910s Australia had a very substantial regional (mainly "Star" structured) network of Regional rail lines branching out from the State Capital Cities and Sea Shipping Ports to go well inland and provide the essential physical transport for Australia's very rapidly growing produce.

What has to be realised is that Australia did not have any large-scale iron refineries until at least about CE 1885 and even then – when the Sydney Harbour Bridge was constructed CE 1925 – 1935, all the iron for that was barged out from the UK half way around the world – and definitely not locally manufactured!

In other words – although Australia has a massive rail network for its then quite small population – literally all the iron for these rails was barged out from the UK at an enormous cost to the Australian economy.

Background on Australian Freight Transport

Circa CE 1845, not only had gold been ("officially") discovered in Australia back in the CE 1820s but since then coal and iron and copper and silver and lead and a range of other minerals to make Australia self-sustainable had been found and were in the process of being actively mined, some processed; but most were directly exported.

In the northern hemisphere in the CE 1860s, the developing science of lead-acid batteries and electromagnetism heralded the invention of Telegraphs that very rapidly interconnected the developing world. As the Regional Railway networks were every rapidly rolled out in Australia - these railways often included a parallel Telegraphs network.

By CE 1872, Melbourne was telegraph connected via Adelaide (specifically not via Sydney / Brisbane) overland through the middle of Australia to Darwin - and then (with the CE 1868 Siemens and Halske Indo-European Telegraph line) through Indonesia, India, Middle East, Europe to London - and Melbourne quickly became Australia's main commercial city in Australia.

The technology of electromagnetism rapidly developed much further in the CE 1860-80 era with the development of transformers, dynamos, electric motors and alternating current. Practical, commercially available electric road vehicles (EVs) finally appeared during the CE 1880s - but their range was limited to less than 50 km.

Circa CE 1890 in the Internal Combustion Engine (ICE) was being developed - and this was powered by gasoline (diesel or petrol). This ICE vehicle technology showed immense promise because of the much greater distance it could travel and be quickly refilled (same as now)!

Circa CE 1900 the technology of ICE vehicles clearly surpassed that of the early EVs and the worldwide hunt was on to find vast resources of oil to fuel the ICE vehicles - and this was (then) in the USA and in the Middle East (the Ottoman Empire) -Turkey!

By CE 1901 many people in the Australian colonies and settlements had collaborated to form the "Commonwealth of Australia" and they set up a (temporary) capital city Parliament House in Melbourne - based in the "Exhibition Building".

In Australia from CE 1850 through to circa CE 1910 - considering the rather small population and the total lack of mechanical aides, a massive railway regional network was manually constructed, interconnecting all cities and most towns. The Cobb & Co. (Rutherford) Stage Coaches and the Bullock Dray era was effectively usurped by this immense railway network and this rail network facilitated the massive wealth for Australia to become a very productive (and physically powerful) country.

This map shows most of the rail networks throughout Australia circa CE 1910, when Australia's population had gradually grown to about 4.5 M and life expectancy was about 55 to 60 years old. Very few people actually aged to "retire"!

WW1 (CE 1914 - 1918) was really all about the ultra-wealthies (Rothchild's etc) deliberately breaking up the Ottoman Empire to plunder the world's known oil supplies for themselves, as it was very clear to them that the age of diesel/petrol engines was in the process totally revolutionising all developed countries' economies.

Meanwhile the UK Royals / UK Parliament wasted no time in very heavily involving Australia in this war - to deliberately cripple Australia's rapidly emerging immense commercial / international power from exceeding the UK. WW1 came at a huge cost to most of Australia's very healthy and strong male population; that were (deliberately / deceitfully) slaughtered at Gallipoli and gassed (mass - murdered) in France.

In the CE 1920s and CE 1930s the Australian regional populations slowly re-grew and gradually recovered, and most stump pulling, fencing and land clearing was manually done with a minimum of mechanical aides. Meanwhile Australia's (open wire) Telecom’s network (that now included telephony) was greatly extended to from the State Capital cities to most Regional Cities, Towns and some Villages.

By the late CE 1930s it had become obvious in Germany that the Jews (and Royals) owned almost all the land (and buildings). The German Nazi uprising (against the Royals and Jews) precipitated into WW2 (CE 1939-1945) - where (on the other side of the world) Australia was again forcibly aligned with the UK (Royals).

The Japanese had aligned with Germany and proceeded to invade South Asia, and New Guinea, and Australia was next. Just before the tentative Australian / Japanese agreement for Japan to occupy much of Queensland (north of the Tropic of Capricorn), in the Coral Sea the USA Navy headed off the Japanese from invading Australia.

Somewhat concurrently, circa CE 1944, Australian ingenuity resolved how to refine / separate uranium and the first (USA-made) atom bombs dropped into Japan in CE 1945 abruptly ending WW2. Because the USA military forces had stopped the imminent Japanese invasion, the Australian (Menzies) Government was cornered into signing the (very much USA favoured) ANZUS Treaty in CE 1953, effectively subjecting Australia under the USA military. (Korea, Vietnam, Afghanistan wars.)

A by-product outcome of WW2 was the creation and use of more compact diesel-fuelled engines into vehicles - which found their way into much larger heavy transport vehicles, tractors and other earth moving machinery. These heavy transport vehicles quickly settled on the (freight rail) standard 8' 0" (2440 mm) width rear tray.

This diesel-fuelled heavy earth moving tools were the technology catalyst for the quick and economic rebuilding of roads to be substantially straightened out (into highways) so that (petrol and diesel fuelled) road vehicles could travel considerably faster than Australian rail transport (that was manually built between CE 1850 and CE 1910).

In the CE 1950s, a new era in Australia's transport technologies evolved with Main and Urban roads being graded and tarred with Australian refined bitumen from imported oil and new (straightened) Road Highways were concreted, paving the way for the far more widespread use of Passenger Cars instead of Passenger Trains and Road Freight instead of Rail Freight.

The USA's Oil Industry Lobby (OIL) was very discreetly very well-seated in Australia to compromise all politicians (all sides) - and their advisors etc. for the rapid closing down of metropolitan (electric-powered) Tram networks to be instantly replaced by diesel-fuelled (guzzling) road Busses. Melbourne sidestepped this OIL based deliberate ploy to wipe out Trams ("Light Rail") from being in Australia. (**Australia's Treasonous Anti-Rail Lobbyists**)

Also, in the late CE 1950s the then new technology of diesel-electric traction totally revolutionised rail engine technology. In this case, a battery-powered electric engine was used for traction and the battery was charged by a diesel engine spinning an electric generator. This was a win-win situation because the electric traction engine has massive low revs torque, and the diesel engine can be continuously operated in its most fuel-efficient revs range to keep the battery at near optimum charge.

Whereas a typical steam engine would have to stop and refuel / re-water every 100 - 200 km - the diesel electric could span at least a 1000 km before the diesel fuel tank needed refilling. This relative efficiency scenario basically spelt the end of the Steam Engine by the mid CE 1970s. Although the diesel-electric engine was highly efficient, trains in Australia were/are very much speed limited because the railways were manually constructed almost 100 years before, and these rail tracks wound their way around the hills instead of going straight through as per the then new road highways.

What is generally not common knowledge is that the prime reason why the OIL (Oil Industry Lobby) seated itself so well into Australia's politics and business was that for the equivalent distance and the equivalent load, a B-Double consumes about three times the amount of Diesel fuel than is consumed by a diesel-electric train! This is at a massive expense to Australia's Economy and Balance of Payments (BOP) because Australia (other than Bass Straight and WA) has no readily available oil assets. (**Australia's Treasonous Anti-Rail Lobbyists**)

The prime advantage of these Heavy Road Vehicles was that the rear tray area could be covered in and this provided a (tall) large secure volume for goods to be manually loaded / unloaded (primarily from the rear of these vehicles). It did not take long for factories and storage areas to be fitted with "Loading Docks" where these Heavy Road Vehicles could be backed-up to and have an almost level Freight transfer between the factory floor and the rear of the Road Vehicle.

Meanwhile in the CE 1960s and 1970s, Australia's mining industry rapidly grew with the widespread importing and use of massive diesel-electric earth moving equipment and the development of new railway lines (still all using the ancient 4' 8.5" (1435 mm) narrow "UK Standard" rail gauge) to interconnect the mines with shipping ports and coal-fired electricity power generation stations. (**The Five Monkey Experiment**)

In that same era, the development and very quick uptake of shipping Containers (primarily to minimise "warfies" pilfering the freight) radically changed the "trucking industry" to not have fully contained rear trays - but have flat full-sized trays so that Containers could then be very quickly loaded / unloaded. These Containers very quickly stabilised on the by then very common 8' 0" (2440 mm) width standard - which also (very conveniently) matched that of Rail Freight (and emerging Road Freight)!

Containers standardised the packing/unpacking, loading/unloading, and bulk storing practices - and minimised handling and theft during transport. These far-greater efficiencies flowed through to be the "new standard" for Freight transport. In most instances it is far more practical and far faster to use Road Freight (and not Rail Freight) for quick "Door-to-Door" transport.

With Livestock - the standard practice for centuries was to "drove" flocks of sheep or herds of cattle along known "Stock Routes" and these distances could be up to a thousand km (or more). With suitable ramps at Stockyards, it was highly practical and far faster to load a herd/flock in the tray(s) into Heavy Road Vehicles and rather quickly transfer the stock in a fraction of the time (and with far less stock losses).

With Grain - the standard practice had been to use a tractor and a header (to head the crop of seeds) and transfer the seeds by light road vehicle to the nearest Railhead - and transfer that load into a railroad silo. Some months later, the seed would be transferred by steam / diesel engine rail locomotive train (in bulk) to a mill for processing to flour, or to a sea shipping port for direct export.

With Heavy Road Vehicles, this process was almost totally upended - because a small fleet of road vehicles could transfer from the farm to the (regional) mill - or to a silo far nearer the (regional) mill or direct to shipping port. In other words - the local railroad attached silo was almost totally bypassed!

Compounding on these issues - these Australian regional rail networks were rapidly falling into serious repair needs - and the cost of maintenance of all these branch railway lines became a major "cost centre". Through the CE 1960s and 1970s, virtually all the non-main railway lines (that were by then becoming very high maintenance) were (with the discreet assistance of the OIL) were closed down. By about CE 1980, the age of Australian rail transport (except for main inter-State / inter-Region lines) was discreetly eliminated. (**Australia’s Treasonous Anti-Rail Lobbyists**)

The closing down of these Branch rail lines was a blessing because most of these rail lines literally cut through farms and roads - and there were no (safety) fences / lights / barriers. Farm paddocks were literally "sliced" - with crops on either side. In many cases these rail lines crossed at road intersections - resulting in a high number of fatalities. Even now, it is obvious where the rail lines were with fields still "cut" with the surface stones gathered from the fields to make the rail track's foundation.

Further crippling the use of Regional Rail infrastructure, most shops (in towns and country cities) converted over to using Heavy Road Vehicle “Loading Docks” for the transfer of wholesale goods. The more that the Road Vehicles were used the less the Rail Freight Transport was used and this also compounded on the rather quick closing down of virtually all Branch Rail routes throughout Australia.

With the development of more powerful diesel engines in the CE 1970s / 80s - these Heavy Road Vehicles advanced to having double and triple trailers (B-Doubles and B-Triples) - and even "Road Trains" - that are common in Australia's Remote Outback - where there is very little other road traffic.

Although Heavy Road Freight (B-Double etc.) vehicles are highly manoeuvrable, this is in itself its own nemesis because these vehicles need to be very accurately steered / controlled on public roads for long periods of time. The other major safety concern is that if the majority of the load is behind half way in the trailer(s), these Heavy Road Vehicles are inherently unstable and have a tendency for the trailers to "wander" / "drift" and "swing" - and can "jack-knife" at speed which is inherently extremely dangerous.

It was/is very common practice to "overload" these Heavy Road vehicles (to maximise short term profits - while rapidly wrecking the roads and highways). It is usually not news reported that there is at least one major Heavy Road Vehicle incident / death per day in Australia. These vehicles, etc. are very far from being "safe"!

Hidden Economics of Rail V Road Freight Transport

What is not commonly recognised (nor publicised) is that iron wheels/rails (railways) have a far lower rolling resistance than that of rubber tyre / concrete/bitumen roads and consequently for the same nominal distance and load - the amount of (fully imported and expensive) diesel fuel used by Heavy Rail Freight is about one third that of that used by Heavy Road Freight technology. Consequently, Rail Freight transport is inherently far more energy (diesel fuel) efficient than Road Freight transport!

The third option is Air Freight - which is fast but horrendously expensive and far more weather conscious than Road or Rail, and this also consumes an immense amount of expensive (imported) avgas. Intermodal Air Terminal arrangements are "difficult" and piecemeal - making this mode of physical transport technology highly inefficient. Sydney's second airport has all the signs of rapidly becoming a "white mammoth" for passengers! (**NSW Western Sydney Airport Fiasco**)

A fourth option is Sea Freight - which is (much) slower than Heavy Rail Freight - but the loads can far exceed that of a Rail Freight Train. Sea Freight has its use and exceptional value for transport between sea-isolated continents and islands.

*Inter-Regional / inter-State Heavy **Rail** Transport is very much speed-limited because most rail tracks were manually laid well over 100 years ago when mechanical aides were virtually non-existent. Consequently, most inter-Regional Rail tracks wind their way around the level contour lines instead of cutting straight through hills / valleys etc. like the more recent modern road highways and international rail networks.*

At the Deloitte's "**Meet the Politicians**" conference, I was rather shocked in being openly told (by a senior oil executive) that rail transport uses far less fuel per mass load than the same mass load being transported by road infrastructure. This set me thinking - why is this so and why are we not upgrading rail infrastructure to build Australia and why are we building massive road highways (somewhat) like in the USA?

Consider you have 100 containers to be transported between Sydney, Melbourne or Brisbane - a distance of nominally 900 km by (upgraded highway) road or about 1000 km by (un-upgraded winding) rail. These 100 (full) containers can be transported by 50 B-doubles, or by two 50 carriage freight trains.

Each B-Double carries two containers and uses about 40 litres per 100 km (i.e. 360 litres for the single 900 km trip). As there are 50 B-doubles being used, this is about 50 * 360 = 18,000 litres of diesel fuel. Considering there are 100 containers and 50 B-Doubles, this works out at about 18,000/50/2 = 180 litres per container!

Now consider that per km the diesel-electric engine train uses say 10 times as much fuel as a B-Double. This fuel consumption is about 10 * 40 litres per 100 km = 400 litres per 100 km or 4,000 litres for the 1,000 km trip. As there are two Freight Rail trips of 1000 km long the total fuel consumption is 2 * 4,000 = 8,000 litres for the 100 containers to be transported. This works out at 8,000/100 = 80 litres per container!

The (high-school) maths needed for solving this is rather straightforward and it was an absolute "no-brainer" that inter-urban rail transport is far more (diesel fuel) efficient than inter-urban road transport. But what about the roads / highways?

The prime sticking point with both highway / road and rail infrastructure is that the construction of these "early generations" technologies was highly manual. As a direct consequence the roads and rails paths generally followed the hill contours and seriously avoided any tunnels.

Because road vehicles have inflated rubber tyres, the static friction to concrete / tar is far higher than the steel/steel static friction coefficient of rail vehicles. It is practical to have far steeper gradients with road infrastructures than with rail infrastructures - so roads can literally "go over hills" where rail infrastructure has to "go around hills". Another limitation with rail infrastructure is that curves in the rail track have to be much wider (have a much larger radius) than road infrastructures.

One of the very few positive outcomes of WW2 was the realisation that heavy machinery can very quickly do the equivalent work of hundreds of physical labourers (and use a lot of diesel fuel in the process). Engineers in the USA (in particular) had developed heavy machinery for road building and their mindset of road building was to have a "straight (multi-lane, reinforced concrete) highway".

Realising that (per mass load over the nominal same distance) the Oil Industry Lobby (OIL) was now highly aware that heavy road freight uses far more diesel fuel than rail freight (and steam trains were in the process of being phased out)!

With this in-house knowledge, the OIL wasted no time in perpetually lobbying / compromising politicians (and the news media) of all flavours in and associated with the State and Federal Governments (particularly in NSW) that the Hume Highway (linking Sydney and Melbourne) and the Princes Highway (linking Sydney and Brisbane) needs to be rapidly upgraded "for safety" (and any other reason but that of massively increased use of diesel fuel by road freight vehicles - compared to that used by the advancing diesel/electric rail technology)! (**Australia's Treasonous Anti-Rail Lobbyists**)

The "North of Sydney - to Newcastle" part of the new motorway was initially designed by USA Engineers and this was to be a "straight road" - but the NSW pollies considered that winding highways was "how to drive a car" - so a compromise was struck where this M1 Highway is "almost straight, but gently winds its way through"! (**The Sydney Newcastle Rail Fiasco**)

Recall in those days the amazing Australian invention of "Continuously Variable (ratio) Steering had not been widely included in road vehicles and consequently there was a very high number of road deaths every year (e.g. over 1200 deaths per year in NSW alone) with drivers losing control on what were effectively nearly straight roads!

In a somewhat similar mindset, the Hume Highway was rebuilt between Sydney and Melbourne and in the process deliberately bypassed many Regional Towns and Cities on the way - significantly reducing transport time - but this highway is also now in a state of very high maintenance because of the weight of Road Freight transport! (**The Melbourne – Sydney Rail Fiasco**)

With these new Inter-State concrete highways now in use - primarily for heavy road freight (using as much diesel fuels as possible in the construction and use of these highways), it was not long before (heavy) Road Freight Vehicles were involved in many high speed (fatal) crashes. Apart from most drivers being highly fatigued from endless hours of driving, these heavy freight vehicles were travelling as fast as was physically possible (and the drivers had a "time window" to arrive in - or else)!

Because the number of crashes / fatalities were so high, the (political) decision was to limit the speed to 110 km/h - and that really slowed everything down! but made the highways considerably safer.

The direct consequence from this was the very heavy push to use a three-trailer vehicle (a B-Triple and not just a B-Double) - but this too (sanity reigned) was considered to be far too dangerous on high use roads such as the Hume and Princes highways (even though B-triples are used in the "outback").

No matter which way that inter-State/Regional transport was viewed - Heavy Road transport was "the fastest" and therefore the "most economical"! After all - "Time is Money and Wasted Time is Wasted Money! This was and still is the truckies motto.

CE 1998-1999 Nortel Networks Corp (a then massive multinational telecoms equipment manufacturer) that was involved with the Wollongong University using a highly interactive database / advanced software (of that era) that interconnected with speed cameras placed along the Hume Highway. The number plate reading was then linked to the State databases (and insurance databases etc.).

This software very quickly identified if the vehicle was registered or not and if insured or not and if the associated driver was licensed or not - and if the driver had logged the travel or not! All HELL broke loose!

After being repetitively caught; the speeding politicians / doctors / lawyers demanded to be taken off the checklists and then the Heavy Road Freight operators demanded they too be taken of the lists - leaving just the casual travellers - and this proactive safety infrastructure was much later very quietly taken down!

Tarred roads worked perfectly well for light vehicle traffic i.e. less than a couple of tonnes and "sensible" driving - but with heavier loads the road surface is "compressed" causing minute cracks in the tar that in-turn allow water ingress that in-turn facilitates under-road mud.

From here the road surface rapidly deteriorates as (especially with the torsion from heavy road freight vehicles) the tar now rips apart and the road is then very quickly on its way back to being a dirt track with pot-holes where the tar originally cracked.

But it (very quickly) gets much worse. Because the heavy road freight vehicles' tyres have rapidly sunk into a pot-hole - that hole is made deeper by the impact force and as the tyre (and suspension assembly) leaves the pot-hole, the tyre (and suspension assembly) are momentarily in free air before it lands again (and again) forming a series of (virtually equally spaced) indents in the tarred road that also quickly become a series of new pot-holes!

For this reason alone - heavy freight vehicles (i.e. any vehicle over 2 tonne in total weight) should never travel any faster than 60 km/h on tarred roads and if the tarred road is wet (i.e. it is raining or there is water on the side of the road) - then the maximum speed for these vehicles should never exceed 40 km/h.

With the widespread use of Heavy Road Freight Vehicles on tar-sealed highways in the late CE 1950s it very quickly became a highway disaster with a very high rate of "road incidents" (crashes - most of which were fatal) because the tar-sealed highways being wrecked faster than they could be maintained!

It was obvious that the tyre impact under these heavy road freight vehicles (some as much as 35 tonnes and at least 24 wheels) was far too much for tar-sealed tracks to bear - especially if the road base (under the tar) was not particularly strong.

The "fix" was to use iron re-enforced concrete as the road base and typically have this concrete 300 to 450 mm deep. No matter which was this was looked at - this was an immense amount of concrete per km - let alone per thousands of km.

While this technology "worked" it was astoundingly expensive - but worse still - it was not uncommon to have the bottom of the concrete slab crack at the base (in several locations) resulting in "plate shifts". The "fix" if it could be called that was to cut out large blocks of concrete and pour another slab in these large flat holes. Inevitable the edges never aligned and the "impact bouncing" caused mot cracks on adjoining concrete slabs!

Australia's Main Roads / Highways were really engineered for Vehicles that have a tare (weight) of less than 1000 kg. Consequently, Heavy Road Freight can and does very quickly cause massive damage to roads because of the excessive weights (and speeds) of Heavy Road Vehicles. Road maintenance costs are enormous.

Particularly with rain / water on (in) these roads, is that the tar / bitumen surface is contorted by the excessive weight of these Heavy Road Vehicles resulting in the surfaces being torn open - which then facilitates far more water ingress opening up - resulting in lines of (dangerous) pot-holes; exposing the road-base gravel that quickly becomes pliable resulting in these roads being very dangerous and very expensive to maintenance.

These immense costs severely eat into Australia's economy - crippling Australia's Inter-Regional connectivity and productivity. The recent (Transport for NSW) **"NSW Heavy Vehicle Access Policy: Safe Productive and Sustainable Road Freight"** is a classic example of immense funds being quietly sidelined to repair the massive repetitive damage caused by Road Freight transport.

Heavy Road Freight vehicles have their place for Short Haul (<100 km) to transport Freight to / from District / Regional Intermodal Terminals to / from Factories, Shopping Centres, Farms.

Australia's successful economic future depends on the restructuring of all our Inter-Region / Inter-District **("Long Haul") transport that must be by "Quick Rail"** technology and this physical transport technology needs significant re-engineering.

Most Passenger Rail Cars in Australia are 3040 mm (10' 0") in width - but Rail Freight Cars are only 2440 mm (8' 0") in width. By re-engineering the width of Rail Freight Cars (and Engines) to be 3040 mm (10' 0") in width - this brings all this Rolling Stock to one common "New Wide Standard" of 3040 mm (10' 0"). (**Standard Width Rolling Stock**)

With all this Rolling Stock being 3040 mm in width, this facilitates the rail gauge (for this Rolling Stock) to be substantially widened to the "Standard Australian Wide Rail Gauge" of 2540 mm (100" or 8' 4") for maximised travel stability, minimum rolling resistance, maximum load bearing and minimised future maintenance overhead costs. (**Standard Australian Wide Gauge Rail**)

Passenger Rail Cars Became Wider

In the developed world, by the CE 1920s, (international) travel by luxury Steam Ships had become rather popular - breaking the almost century grip of Steam Trains as the public transport infrastructure. Steam Ships offered luxury living with an abundance of well-padded lounges, buffet meals in these ships' restaurants and plenty of on-board entertainment (to fill in the time) - because (compared to Steam Trains) these ocean trips were slow and took several days - if not weeks in touring.

Making matters worse for the long-haul train travel industry (that also had very expensive fares), was that passenger aeroplanes burst on the travel scene in the mid CE 1930s, providing far faster travel between (air) ports, and the luxury of on-board meals, while the passengers were seated in semi-lounge chairs.

Competition between these passenger transport technologies was incredibly intense. Rail Cars could not provide any of the comparative luxuries that could be provided by Steam Ships - but Rail Cars came close to the luxury of seating in that of passenger airplanes. The main problem was that Rail Cars were only 8' 0" in width as a direct follow-on from the standard width of Bullock Drays and Trolley Busses - and it was this relatively narrow Rail Cars width that was the major (negative) sticking point.

With the 8’ (2440 mm) width Passenger Rail Cars (and Road Busses), the seating was/is (2 - isle - 2), with each seat being nominally 450 mm wide, leaving about 50 mm for each side wall and an isle about 540 mm wide. This is tight but it worked because few people actually stood in the isles. Not exactly what is called luxury!

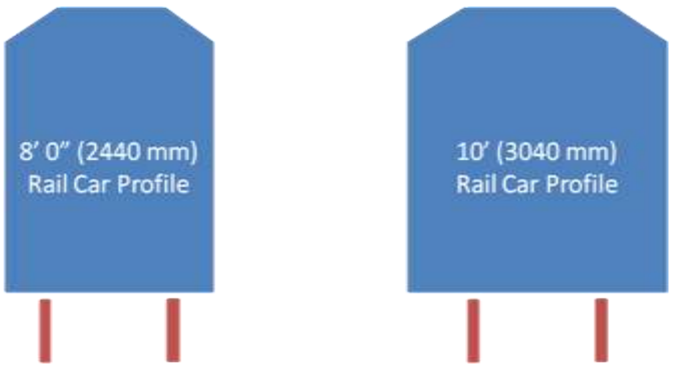
If Steam Train transport was going to provide any of the comparative luxuries to that of a passenger aeroplane - then the width of the Rail Car had to be increased in width - but not too much – because there was a tremendous amount of “sunken costs” in cross member Rail Sleepers and in Rail Car’s Bogies (etc.)!

The first stage was to as one more 12” plank making the rail cars 9’ wide and with this the two pairs of seats per row could be far more comfortable (and they were). These rail cars were (just) too unstable for the 3’ 6” rail tracks but as most rail tracks were close to the UK stipulated “Standard” of 4’ 8.5” and this (just) worked – but….

Adding yet another 12" plank brought the nominal car width up to 10' wide (nominally 3040 mm). This arrangement could seat five people per row and a (slightly offset) isle corridor - or have a side corridor and have "sleeping compartments" / and four (lounge) seating compartments for long distance travel!

In standard Imperial block measurements - the width of Rail Cars was increased 2 foot (600 mm), from 8' 0" (2440 mm) to 10' 0" (3040 mm), and this provided a very substantial "air of space" in Rail Cars that previously was not otherwise achievable.

This simplified view of the cross-sections of two rail cars (with the wheels at the "Standard" 1435 mm rail gauge) shows why the 3040 mm width rail car on the right is far more unstable than the 2440 mm width rail car on the left (which is less unstable)!



With the 10’ (3040 mm) width Passenger Rail Cars, the seating was/is (2 - isle - 3), with each seat being nominally 450 mm wide, leaving about 50 mm for each side wall and an isle about 700 mm wide. Also, with this wider (3040 mm) Passenger Rail Car, the seating could be (2 - isle - 2) and far more luxurious seats could be 550 mm wide and the isle could be about 750 mm wide. Another seating option is (4 - corridor) where the bench seats can be converted to overnight bunks. Alternatively, a food / drink bar could be set up in a "Diners" car and/or tables of 4 (2 facing 2), or tables of 6 (3 facing 3) - with a wide isle, is straightforward.

This 10' 0" (3040 mm) Passenger Rail Car width was an absolute winner - except that there was an immense amount of "sunken costs" invested in the rail infrastructure - which in most cases was 4' 8.5" rail gauge in accordance with the very outdated CE 1846 UK Parliament "Standard Rail Gauge Act" that was nearly 100 years old!

This “fixed mindset” rail gauge situation was a classic case of “We have always used the Standard Gauge – because (without question) it is standard and we have always used it”! (**The Five Monkey Experiment**)

By the CE 1940s virtually all Passenger rail rolling stock that used the "UK Standard" 1435 mm (4' 8.5") rail gauge (and wider rail gauges) rapidly migrated to 3040 (10') width rail cars - to successfully revitalise their sagging travel / transport businesses. Meanwhile, all the Freight Rail cars stayed at 2440 mm (8' 0").

The table below shows that for four fairly common Rail Gauges, the Rail Car width to Rail Gauge width forms a simple ratio that is effectively the "Instability Ratio"! The wider the rail gauge, the more stable the cars, and the faster the cars can safely travel!

Rail Gauge	Rail Gauge	2440 mm Container	3040 mm Passenger
3' 6.00"	1067 mm	0.438	0.351
4' 8.50"	1435 mm	0.588	0.472
5' 3.00"	1600 mm	0.656	0.526
5' 6.00"	1676 mm	0.687	0.551
7’ 0.25”	*2140 mm*	*0.877*	*0.704*
8’ 4.00”	*2540 mm*	*1.041*	*0.836*

It should be quite obvious why the 3’ 6” (1067 mm) rail gauge is a very poor choice (even for 8’ width rail cars) as the “instability figure” is only 0.438 as this is well below a nominal minimum of 0.50.

In Queensland, South Australia, Western Australia and Tasmania, it was not safe to increase the Passenger car widths to 10’ 0” (3040 mm) because the rail gauge in these States was still only 3' 6" (1067 mm).

Likewise, the “instability figure” of 0.588 is (just) “OK” for 8’ 0” (2440 mm) width rail cars using the (Five Monkey Experiment) “Standard UK” 4’ 8.5” (1435 mm) rail gauge – but when the car width is 10’ 0” (3040 mm) the rail gauge really should be greater than 5’ 0”, as the 5’ 3” rail gauge is in Victoria.

The second last row relates to Isambard Brunel’s deliberately outlawed “Broad” gauge (which was optimally engineered to be stable for 2440 mm width rail cars.

The last row is my wide “Quick Rail” gauge of 2540 mm (100”) that is optimised for maximum stability and safety for 10’ (3040 mm) width (Passenger) rail cars.

Rail Gauges and Rail Car Instability

The inherent problem is that because the width of the Passenger and Freight Rail Cars commonly well exceeded the Rail Gauge (and the Rail Cars are "tall"), the Rail Cars are inherently not all that stable! But we (and the Chinese with the fast trains) always use the “Standard” gauge – because it is “Standard”!! (**The Five Monkey Experiment**)

One simple way to get an understanding of instability is to compare the rail gauge (width) to the width of the rail car and have this as a decimal fraction.

Another more complex way is to identify the centre of gravity (COG) of the rail car (in relation to the width of the rail car, and the height above the rails) and from that, calculate the angle where the (rail) car will tip off the rails.

Looking at this (in)stability issue from another perspective, when you are flying or riding a bike – as you are moving, you turn in a curve of a particular radius, you lean inwards at an angle to balance the centrifugal force and the gravitational force.

90 degrees to this leaning in angle is the “banking angle” and if the curved road surface is banked (wider side is higher) to that angle, then when you ride the bike around that bend at the same velocity and the bike is vertical to that banked road surface – like in a bicycle velodrome.

Similarly, if you are in a road car, much the same happens when you turn a bend in the road at a particular velocity, there is an outwards (centrifugal) force that makes the car tilt outwards. As the road car’s Centre of Gravity is above the wheels there is an angle that the car can be tilted such that the car sideways over-balances (tips over). This is the Tipping angle. If the road is (positively) “banked” then the road car can travel through that same bend at a faster velocity and not tip over!

A typical road car the wheel gauge is about 1600 mm m and the centre of gravity (COG) is about 1000 mm, so the “tipping angle” ATan(Gauge/2/COG) = ATan(1600/2/1000) = 38.7 deg. With an SUV, these are “higher up” (about 1200 mm) so the tipping angle is about ATan(1600/2/1200) = 33.7 deg. With a B-Double the Gauge is about 2050 and the COG is about 2000 mm, so that angle is about ATan(2050/2/2000) = 27.1 deg.

To get a feeling for rail car instability, this table below shows the Rail Car width of 8' 0" (2440 mm) versus various Rail Gauges as Ratios and Banking / Tipping angles.

Origin	Imperial Gauge	Metric Gauge	Rail Gauge / 2440 mm Car Width	Tipping / Banking Angle (deg.)
Mining	3' 6.0"	1067 mm	0.437	14.9
Stephenson / UK	4' 8.5"	1435 mm	0.588	19.7
Irish	5' 3.0"	1600 mm	0.656	21.8
Scottish	5' 6.0"	1676 mm	0.687	22.7
B-Double / Triple	6' 8.7"	2050 mm	0.840	27.1
Brunel	7' 0.25"	2140 mm	0.877	32.4

With these Car Width v Rail Gauge ratios, anything under 0.5 is effectively "unstable" and anything greater than 0.5 and less than about 0.7 is "quasi" (just) stable. Anything greater than 0.7 can be considered as "quite stable" but even, then we all know that because of the extra height "B-Doubles" are far more unstable than a sedan motor car - as the sedan car has a much lower height profile!

With rail cars, the nominal Centre of Gravity (COG) is about 45 to say 60 degrees up from the outer edges of the 2440 mm floor width rail car, and the floor of the rail car is about 1000 mm above the rails. At 45 degrees the COG is about 1000 mm + 2440 mm / 2 = 3440 / 2 mm = 1720 mm above the centre of the rail track and at 60 deg the COG is about 1000 mm + 1.732 * 2440 mm / 2 = 3113 mm above the centre of the rail track. Figures in the “Tipping/Banking” column have been calculated from the higher COG in relation to the rail gauge.

The inclusion of a Heavy Road Freight Vehicle (B-Double / B-Triple) is deliberately included to give a familiar comparison. With Heavy Road Freight, the (rear) Tyre gauge is about 2050 mm, the Tyre to Container width ratio is about 2050 mm / 2440 mm = 0.840 - but be aware that the rubber tyres also "compress" on the road - so this "stability figure" is a little optimistic for Heavy Road Freight (B-Doubles etc.).

Isambard Brunel realised this inherent instability design flaw of the rails being far too narrow for the 8' 0" (2440 mm) width Rail Cars and circa CE 1831 he made a rail gauge of 7' 0" (2134 mm) that proved to be exceptionally stable.

Several years before, George Stephenson had his rail gauge increased from 4’ 8.0” to 4’ 8.5” to minimise the flanged wheels from occasionally jamming in the rails

This rail/wheel technology emerged before the introduction of (swivel) bogies and this is why gauge was too precise and on some rail curves it occasionally jammed the wheel flanges on the "Great Western Railway" (CE 1835-37). Consequently, Brunel also had that rail gauge slightly widened to from 7’ 0” to 7' 0.25" (2140 mm) to also minimise the wheels jamming on rail curves! In this case, the car width to rail gauge ratio is 0.877, closely approaching 1.00 than any other rail (and road) gauge.

This table also clearly shows that Isambard Brunel's "Broad" gauge of 2140 mm was far more stable than all the other Rail Gauges - and the prime reason why in the CE 1840s, the competing private sector UK rail businesses (who were really there for the money and not provide maximised services) really wanted Brunel's far superior "Broad" railway scrapped ASAP and by any means honest or dishonest!

If we were to construct a railway and use 8’0” (2440 mm) width cars – then we need to have an understanding of how fast we can travel (on level lines) – without tipping over around particular bends of known radii. The table below shows the various gauges and radii and the numbers in <u>the main fields are the maximum speeds in km/h</u>.

Origin	Gauge (mm)	500 m	1000 m	2000 m	3000 m	4000 m
Mining	1067 mm	131	184	260	318	368
UK Std	1435 mm	151	213	302	370	426
Irish	1600 mm	159	226	319	391	451
Scottish	1676 mm	163	231	326	399	461
B-Double	2050 mm	180	255	360	441	510
Brunel	2140 mm	201	284	401	492	568

Considering trains running at 350 km/h max, the minimum radius for the UK Standard gauge is 3000 m radius, where the Brunel gauge would allow the same train to safely travel at almost 500 km/h on that same 3000 m radius.

This situation set a very unseen precedent where railways in Queensland, South Australia, Western Australia, Tasmania that all use 3' 6" gauge cannot use the 10' 0" (3040 mm) width rail car technology on their rail network systems - because these 10' width cars would topple over in normal use! Irrespective of that narrow gauge situation it was not uncommon to have rail cars (and engines) topple over (narrow in particular) rail lines because of wind and because the rails were not level and or "tight rail curves".

The UK / Stephenson rail gauge of 4' 8.5" (1435 mm) while using 10' 0" (3040 mm) width Passenger Rail Cars is in real jeopardy as the horizontal stability ratio = 0.472 which is effectively "quasi-stable" and this is why these cars "rock" from side to side.

Similarly, the 3040 mm width (Passenger) rail cars on the Irish (1600 mm) gauge (ratio = 0.526) are considerably more stable than these same cars on the UK (1435 mm) rail gauge (ratio = 0.472). Also, the Scottish 5' 6" (1656 mm) gauge is significantly more stable than the UK "Standard" and Irish rail gauges.

It is "interesting" that when India gained independence from the UK in CE 1947, one of the first changes they made was to broaden all their (immense) rail infrastructure from the UK "Standard" of 4' 8.5" (1435 mm) to the Scottish 5' 6" (1676 mm) rail gauge - to have a far smoother ride, and have far less maintenance overheads.

This was a brilliant engineering strategy because the wooden sleepers were still solid – but because of decades of torsional forces, the “pins” hammered into the sleepers to firmly hold the rails in place were loose. Instead of replacing about 36,000 km of wooden sleepers (and there was already a real scarcity of hardwood) the decision to move the rails outwards by about 5” each side – drill new holes for the “pins” and hammer the “pins” in; giving the sleepers another 50 years of low maintenance life.

Considering the modern rail car that is 10’ 0” (3040 mm) wide, these figures are even more restrictive! The figures for Rail Gauge / Car Width and Rail / Car Tipping angles are as follows:

Origin	Imperial Gauge	Metric Gauge	Rail Gauge / 3040 mm Car Width	Tipping / Banking Angle (deg.)
Mining	3' 6.0"	1067 mm	0.351	11.9
Stephenson / UK	4' 8.5"	1435 mm	0.472	15.9
Irish	5' 3.0"	1600 mm	0.526	17.6
Scottish	5' 6.0"	1676 mm	0.550	18.4
Brunel	7’ 0.25”	2140 mm	0.704	23.0
Aust Wide Standard	8' 4.0"	2540 mm	0.877	26.7

The above table shows the situation for rail cars being 10’ 0” (3040 mm) in width (and includes the Brunel rail gauge for good measure). It is a real surprise that the Stephenson/UK gauge / Car width is less than 0.5 – and should never have been used with 10’ 0” (3040 mm) rail cars!

The Banking / Tipping angle is very interesting as this clearly shows why the 3’ 6” (1067 mm) gauge is too narrow for 3040 mm width rail cars – unless extraordinary measures are taken to tilt the cars by a few degrees – and even then, this is “not a safe practice”!

As mentioned before, the “Tipping” angle is synonymous with the “Banking” angle where the force in going through the rail curve’s radii at a particular velocity matches the combination of Gravitational force and the Centrifugal force – such that the resultant force is perpendicular to the floor – so you are not leaning!

This is where the column of “Tipping / Banking” angles is far more telling. As the rail gauge is made wider the angle needed for the rail car to tip over (outwards) is considerably greater. This “tipping angle” has a direct relation to the maximum safe velocity of the vehicle and the radius of the rail curve.

Consider a set of rail curves with defined radii (top row) and various rail gauges (second column) – looking for the maximum velocity that the rail cars might travel - without tipping over!

Origin	Gauge (mm)	500 m	1000 m	2000 m	3000 m	4000 m
Mining	1067 mm	115	163	231	283	327
UK Std	1435 mm	134	190	269	330	380
Irish	1600 mm	142	201	284	348	402
Scottish	1676 mm	145	206	291	356	411
Brunel	2140 mm	164	231	326	402	464
Aust Std	2540 mm	179	252	357	438	505

This table is “interesting” as even with so called UK Standard gauge rails – these 3040 mm width rail cars will be really struggling to stay on the tracks at 350 km/h! The Aust Std rail gauge clearly outperforms all the others and unsurprisingly – the Brunel gauge comes a close second. Clearly there should be no rail curve with a radius of less than 1000 m and the minimum radius should exceed 2000 m.

A further consideration is to include rail “banking / inwards tilting” so that all curves include an added tilt of (in this case) 10 degrees (inwards) from level when passing through a rail radius.

Origin	Gauge (mm)	500 m	1000 m	2000 m	3000 m	4000 m
Mining	1067 mm	159	226	319	391	452
UK Std	1435 mm	175	248	351	430	496
Irish	1600 mm	182	257	364	446	515
Scottish	1676 mm	186	262	371	455	526
Brunel	2140 mm	203	287	406	497	571
Aust Std	2540 mm	217	306	435	533	615

This rail banking is not enough to cause a rail engine / car to tip over when not moving – but this shows that the engine / car velocity (speed) can be considerably increased to be in the range of 250 – 350 km/h with a combination of rail gauges and rail radii.

With the ancient UK Standard rail gauge, the radii of 2000 m clearly shows that this is on the verge of tipping at only 250 km/h and by increasing the banking from 0 degrees to 10 degrees the maximum car / engine speed barely scrapes in at 350 km/h.

Meanwhile with my proposed Aust. Standard rail gauge of 2540 mm, these figures clearly show that with a 2000 m radius, the level maximum speed would be about 357 km/h and with 10 degrees banking on this 2000 m radius rail curve, the maximum speeds would be about 435 km/h. Even with a rail radius of 1500 m and 10 degrees banking the tippling velocity is 377 km/h – which is 27 km/h greater than the nominal 350 km/h expected maximum speed.

Thinking laterally, the width of a Container is 2440 mm and this proposed Australian "Standard Australian Wide Rail Gauge" of 2540 mm (8' 4") is marginally wider, so in a practical sense the horizontal instability factor is 2540 mm / 2440 mm = 1.04. This clearly shows that this "Standard Australian Wide Rail Gauge" of 2540 mm is exceptionally stable. This stability factor (of 1.04) is far greater than all the other rail gauges (other than Brunel's 7' 0.25" (2140 mm) rail gauge, engineered for 8' 0" (2440 mm) rolling stock).

This "Standard Australian Wide Rail Gauge" of 2540 mm has a far superior weight carrying capability than all the other historically narrow rail gauges that were never really engineered for quick, stable, safe, rail transport.

Most of inland Australia is "flat" and this facilitates straight railroads - but - the Great Dividing Range inland from Australia's east coastal areas and extending inland about 150 km as rolling hills resulted in the early rail lines winding their way between Metropolitan and Regional centres.

Compared to road highways for Heavy Road Freight transport it is relatively inexpensive and far faster to straighten existing rail alignments to facilitate safe Quick Rail corridors - and compared to road maintenance, the ongoing maintenance costs for these straightened Quick Rail easements / corridors are miniscule.

The recent (Transport for NSW) **"NSW Heavy Vehicle Access Policy: Safe Productive and Sustainable Road Freight"** (CE 2024) is a classic example of immense funds being sidelined to repair the massive damage caused by Road Freight.

Heavy Road Freight vehicles have their place for Short Haul (<100 km) to transport Freight to / from District / Regional Intermodal Terminals to / from Factories, Shopping Centres, Farms.

The success of Australia's economic future depends on the restructuring of all our Inter-Region / Inter-District **("Long Haul") transport that must be by "Quick Rail"** technology and this physical transport technology needs significant re-engineering. There are a lot of heavily vested interests that are against any form of (highly efficient and clean) rail transport!

As it is now common practice to have rails without expansion joints and the use of iron re-enforced concrete sleepers, it is also very common to deliberately bank rail roads through curves so that the rail cars travel through at their nominal speed – say 80 km/h, and the resultant of the gravitational and centrifugal forces is perpendicular to the rails / car floor.

Velocity (km/h)	500 m	1000 m	2000 m	3000 m	4000 m	5000 m
100	8.9	5.5	2.2	1.5	1.1	0.9
150	19.5	10.0	5.1	3.4	2.5	2.0
200		17.5	8.9	6.0	4.5	3.6
250			13.8	9.3	7.0	5.6
300			19.5	13.2	10.0	8.1
350				17.8	13.5	10.9
400					17.4	14.1

A little bit of straightening the winding rail lines and a little bit of “banking” (which is standard practice with concrete sleepers) and the Aust Standard Rail Gauge (2540 mm) will have absolutely no problem in travelling at 400 km/h (and faster) where the (ancient) UK “Standard” gauge will be really struggling to not tip over!

Australia's National Quick Rail Network

With railway lines straightened out and levelled out to go over valleys and through hills - as they do in Europe / Germany (instead of winding around everywhere as they still do in Australia); it is easy to have an electric engine train travel at 100 to 200 km/h on "Standard" (1435 mm) gauge rail. (**Why the "Standard" Gauge is/was Law**)

If this same train was run on the Brunel (2140 mm) gauge - which is considerably wider and makes the train cars far more stable; it should be easy to travel at 200 to 350 km/h - but at these speeds the train engine and cars need careful aerodynamic shaping to minimise wind drag and "seat" the engine and cars on the rails. (**Brunel's "Broad" Rail Gauge**)

With the line straightened and using my "Standard Australian Wide Rail Gauge" of 2540 mm (8' 4.0") these trains should have little problem at safely travelling at about 300 – 400 km/h. (**Comparative Transport Times**)

The biggest transport route in Australia is between Melbourne and Brisbane (about 1,900 km) – with Sydney roughly in the middle. Most freight was conveyed by steam ships (sea) or by steam trains (rail) as the roads were more like tracks and tarred roads in Australia really didn't happen until the CE 1930s.

Since the late CE 1850s there was an interconnecting rail line between Melbourne (Victoria) and Sydney (NSW), but Victoria had wisely chosen 1600 mm rail gauge whereas NSW was (instantly) pushed back from 1600 mm to the "UK Standard Rail Gauge" of 1435 mm. The (Intermodal) rail gauge changeover terminal was at Albury (about 305 km from Melbourne), and changeover of rail bogies took several hours, making this trip very slow and very frustrating. (**The Melbourne – Sydney Rail Fiasco**)

Starting in CE 1928, the Hume Highway (joining Melbourne to Sydney) was "reconstructed" from the existing dirt "main" roads, and even with WW2 (CE 1939 – 1945) in the middle of this construction, this main road was completed by CE 1940. The Hume Highway was a major boost to Australia's economy as Melbourne and Sydney could work much closer – to operate with an increased "economy of scale"!

Since CE 1945 the Hume Highway between Melbourne and Sydney has had a very substantial upgrade to being the Hume Highway that has a (minimum) 2 lanes each way and the nominal speed limit is 110 km/h. My educated guess is that in the early CE 1960s the OIL had a lot to do with "facilitating" many pollies over several years to make this happen. Since then, there have been many sections that have been totally rebuilt primarily because of the massive damage done to the Hume Highway by overweight and speeding diesel fuelled Heavy Road Vehicles. (**Australia's Treasonous Anti-Rail Lobbyists**)

Circa CE 2010 there was a quiet but very heavy push for B-Triples to use this Hume Highway as a main transport medium - but this was deemed to be far too unsafe. (**Australia's Treasonous Anti-Rail Lobbyists**)

The (900 km+) road joining Sydney and Brisbane was initially at best a dirt track and because of the mountainous terrain along the east coast – the more common road route was to travel from Sydney to Newcastle and then go inland via Tamworth and Armidale to Casino and come into Brisbane from there.

Because the terrain along the east coast between Sydney and Brisbane is particularly mountainous / hilly, the Pacific Highway (joining Sydney to Brisbane) was “started” in CE 1958 and it took at least to about CE 1989 for this main road to be “complete”!

This road highway was a really major boost to Heavy Road Freight because the railway between Sydney and Brisbane (via the Cowan embankment just north of the Sydney basin) is the prime rail transport sticking point. Although there is a considerable amount of freight transferred by rail between Sydney and Brisbane – the bulk is transported by Road Freight using the then recently rebuilt (again and again) Pacific Highway and New England Highway. (**The Sydney – Newcastle Rail Fiasco**)

It is now standard practice that thousands of drivers of B-Double Heavy Road Freight vehicles daily traverse the 900+ km hops between Melbourne and Sydney, and Sydney and Brisbane on daily trips. These vehicles are driven at nominally 100 km/h all the way, and assuming a minimum of a 30 minute break every two hours (which I seriously doubt happens) to rest and recover, that trip would include 4 to 5 rest and recovery breaks – bring the total travelling time over 11 hours per day (every day)!

As the industry catch cry is “Time is Money” and they have a 2-hour window to be at a particular Melbourne or Sydney metropolitan location; I am very unsurprised there is (apparently) barely one major “incident” collision / driver death / serious injury per day that is publicly reported! (**The Inland Melbourne – Brisbane Rail Fiasco**)

The current pressing problem with (Freight) rail transport in eastern Australia is that the design and build of the rail network was done between CE 1850 and CE 1910 when there were very few mechanical aids. Consequently, the rail tracks are not straight – so rail transport speeds are very limited.

These days, the building a major infrastructure such as roads, railroad, tunnels, bridges etc. consumes an immense amount of diesel fuel – because all the (large) mechanical aides use very large diesel fuelled engines for physical energy. The massive advantage of using (large) mechanical aides for example Earth Moving Equipment, Cranes, B-Doubles etc, is that these Heavy Machinery tools can do the work of thousands of people in a small fraction of the time – so this is very efficient.

The road highways are being continually damaged by the onslaught of Heavy Road Freight Vehicles (mainly B-Doubles) - especially during and after rainy seasons where the road foundations are severely weakened by water ingress through the bitumen.

Very high on the list of multiple Government priorities are to again (and again) rebuild these highways – using massive amounts of diesel fuel – and the members of the Oil Industry Lobby (OIL) could not be any happier!

Australia's Treasonous Anti-Rail Lobbyists

Australia has at least three large and extremely powerful anti-rail lobby entities that systematically lobby / compromise / bribe / etc. (become “plumb pudding friends”) not just the pollies at all levels but also their families and their work associates.

The first is the Oil Industry Lobby (OIL) who import and distribute diesel fuel etc. throughout Australia. These people / businesses are fully aware that Rail Freight / Rail Passenger technology uses far less fuel per mass load over the equivalent distance that Road Freight / Road Busses / Cars / SUVs etc.; and the sales / maintenance of these road vehicles is also highly lucrative.

The topic of comparative road / rail costs for freight in particular are discreetly not included in road-based / touring advertorials on TV nor in movies! All Australia's pollies (and their associates / families etc.) are very well/over-compromised by these lobby groups or otherwise totally ignorant of the situation that Australia imports a massive amount of diesel fuel and apart from crippling Australia’s economy this also costs Australia an immense amount in negative Balance of Payments (BOP).

By the mid-CE 1930s GM Corp in the USA had been put on notice by the USA Federal Government that buying out Bus and Tram networks (in the USA) and later closing these down to force people to purchase (GM etc.) cars was not to continue - but WW2 intervened. After WW2 ended GM (USA) bought the Holden Saddle factory in Adelaide (Australia) and converted this into a motor car production line.

Since the mid CE 1950s onwards (behind the scenes), the Oil industry Lobby (OIL) has been very active in Australia with politicians of all breeds to have had thousands of km of railways and tram networks closed for the thinnest of reasons.

It did not take long for GM Holden (Australia) – as road vehicle manufacturers – being the second intensive anti rail lobby group - to side with the local oil industry lobbyists (OIL) to continue their devious processes and arranged to compromise / buy out Ministers etc in various State / Federal / Local Governments and rid the cities of trams (as trams used virtually no oil / petrol / diesel) - and replace the trams with busses that use lots of diesel fuel, and (GM) cars that used lots of petrol!

Once the State / Local Governments are totally compromised / bought out (except Victoria); it was a relatively simple matter for OIL to close a tram route in the afternoon and in the evening tar the roads (especially the rails), and the following day take down the overhead electricity network.

The very rapid demolition of the then very extensive Sydney tram network was a classic example of the OIL "working with the (highly compromised) NSW Government" to demolish every aspect of what was a very efficient metropolitan tram network infrastructure. This destruction was very fast, very brutal and extremely effective in wiping out tram / rail infrastructure - particularly in Sydney. In Victoria, OIL bitterly failed in demolish their very extensive Melbourne tram network.

Way back in the early CE 1960s as diesel-electric locomotives started to be rolled out to replace coal guzzling steam engine train technology, the "Oil Industry Lobby" (OIL) in Australia very quietly pounced on this in every delicate and political way possible!

The problem was that the diesel-electric technology is particularly efficient because the diesel engine is operated at near its maximum fuel efficiency – while providing near its maximum torque at a well-chosen revs that is directly connected with an (on-board) electric generator and associated storage battery. The energy from the "floating" battery is directly wired to the rail traction electric motors. The electric motors are controlled by the train driver to suit the freight load and changing gradient of the rail tracks. Apart from the diesel engine running at near its maximum revs/torque the fuel efficiency of this arrangement is quite high (far higher efficiency than a direct diesel engine to wheels) – and because the train is on rails the rolling friction is a small fraction compared to that of a road vehicle!

The oil industry realised that they could sell far more diesel fuel if they (quietly) found reasons to close railway lines in regional areas and move as much transport as possible to roads - including their own fuel distribution practices - to further hide everything from the public, and concurrently compromise (inept) politicians and their associates (decade after decade - all sides of all political parties)!

The OIL also knew that if they had the Governments continually upgrade the roads they were continually wrecking with heavy freight vehicles, the OIL (and its associates) would continue to make a "financial killing' for many decades!

Circa CE 2020 I was in a Deloitte's "Meet the (NSW) Politicians" gathering in the Grosvenor Building in Sydney where there were about 250 - 300 business people - including a considerable number of (NSW) Politicians (who openly met with business people to discuss - "business")!

While there I had a chat with several people including a senior executive who had been in the "Oil Industry" for about 50 years. As this was a "safe environment" he openly spoke about the high number of branch and main rail lines that he had "arranged" to have closed in and beyond NSW - for the most-flimsy reasons over his employment tenure! As I intently listened, I was externally very polite - but inside I was absolutely fuming with rage as I was realising the treason that he was so proud to have claimed and been well over-renumerated for!

The next very intensive lobby group are the Road Freight transport businesses. With the development of large diesel engines through WW2 it was also only a matter of time in the late 1950s before large road transport vehicles started to become commonplace - and these vehicles use a lot of diesel fuel (and the OIL was right there too)!

The trucking motto is "Time is Money" and there is no mention of safety and it is all about rapidly transferring freight between destinations! In that "discussion" I was reliably informed that the drivers are operating on the verge of disaster with typically 8 to 12 hour daily virtually continuous driving shifts. In Australia there are several Road Freight incidents per day and that is usually one Road Freight death per day - but these news items usually never reach the commercial Radio / TV news as it is bad for the trucking businesses (and bad for the OIL)!

This trucking (Road Freight) lobby group also works closely with the OIL and covertly with Ministers of all shades and sides, for the upgrading existing road highways and specifically not upgrading railway routes to be far straighter as per the newer highway routes! This was a very astute move because the building of these highways uses a heck of a lot of diesel fuel and once the road highway is in place this road infrastructure seriously disadvantages the somewhat parallel rail infrastructure.

In hindsight it is rather surprising (disappointing) that there have been literally no railway upgrades since about CE 1920 outside the metropolitan areas and that most railways were built with an absolute minimum of machinery - from about CE 1840 to about CE 1920 and this absence of rebuilding / re-routing shouts volumes that there have been very active forces in the background to ensure that Australia's Regional Rural / Remote economy was and is continually stifled!

Together these lobby forces are also behind the introduction and very wide use of B-Doubles and B-Triples (large road freight vehicles) and increasing the road speeds to over 110 km/h wherever possible - but this was mostly knocked back on the grounds of driver and public safety!

These heavy vehicles have speed monitors on them that limit their maximum speed to 100 km/h or 110 km/h and it is common to be overtaken in back highways where these vehicles are obviously well exceeding the regional speed limit. It usually takes these vehicles between 9 and 12 hours to travel the hops between Adelaide - Melbourne - Sydney - Brisbane - Townsville - (excluding mind refresher breaks for the drivers).

What is also "interesting" is that the tarred roads throughout most of the regional areas are built from imported tar (that comes via the Oil Industry Lobby (OIL) businesses) - and the heavy B-Doubles etc road trains that use these roads absolutely hammer / smash these road surfaces to bits - making this another win-win for the OIL to sell far more (expensive) tar.

The recent rather wet years (2021-3) has with excess use of B-Doubles on these roads facilitated water ingress through these tarred surfaces, resulting in hundreds of thousands of large / long / deep potholes making these previously safe roads very dangerous to negotiate.

Had these too-heavy and too-fast B-Doubles etc. Road Freight vehicles been restricted to local traffic (to and from intermodal Rail Terminals) then the damage to these roads would have been miniscule and maintenance of these potholes would have been manageable (and far less expensive to maintain). Most of these Regional roads will require complete rebuilding - before they are again smashed with overweight (for these roads) long trip B-Doubles.

It should be absolutely zero surprise that the inland Freight Rail route (between Melbourne and Brisbane) is taking forever to happen and that the route is not using a straightened rail alignment (that would facilitate quick rail transport) - but wherever possible it is using the twisting old (circa CE 1870) alignment to quietly ensure that the speeds of these trains will never exceed 80 km/h (and be no competition to the many Road Freight businesses and Oil Industry Lobby). (**The Inland Melbourne – Brisbane Rail Fiasco**)

Circa mid-year CE 2022 on the ABC TV there was a Regional Queensland story lamenting the problems of rail/road level crossings and the apparently high number of deaths caused by having these level crossings and how dangerous these rail vehicles and level crossings are! (No mention of drunk / tired truckies.)

The risk of level crossing collisions is very low - and it became obvious to me that the ABC story was a set-up (with the ABC producers either being paid off or otherwise compromised - or just plain ignorant) to have the railroad closed ASAP with this story as "evidence" as it will/may have a devastating effect on inland trucking profitability and really cut down on diesel fuel sales for road transport in that regional area!

As it turned out a week or so later I happened to be on a coach tour: Sydney - Lithgow - Dubbo - Nyngan - Bourke - Cunnamulla - Charleville - Augathella - Tambo - Blackall

- Ilfracombe - Longreach - (Wilton). Yes, there are several level crossings in the Queensland outback (and it is very flat) and yes the gauge in Queensland is 3' 6" (1067 mm) and most importantly the rail between Tambo and Longreach - Winton is being re-established. Yes that rail line was de-commissioned a few decades ago!

The fourth lobby group are the airline businesses as they know that Rail Freight / Passengers is not nearly as expensive as Air Freight / Passengers - but Air Transport can be far faster. While the advertising of Air Transport has considerably increased in the past 50 years, there has also been a definite and very discreet political push from the airline industries for rail infrastructure to not proceed with Quick Rail transport - particularly between Sydney - Melbourne and Canberra; as these routes are the big three national routes for Qantas and other intra-Australia airlines.

There are other lobby groups - including the (holiday) travel industry that discreetly guide people away from trains and instead promote flying into holiday resorts, and politically; the road highways have been deliberately re-routed to bypass regional cities and towns - primarily to speed up road freight transport.

If the rail transport was re-routed to be far straighter - and bypass major regional towns, then the rail transport would be capable of being nearly as quick as air transport and not have the long taxi / terminal delays that are inherent in air transport. This situation would be a really major threat to the airline industry, and the oil import /selling industry, and the road transport industry, and the sale of longer distance consumer vehicles.

The outshot of all these high efficiencies of rail transport using diesel-electric train engines was the realisation that heavy road transport uses at least twice if not three times more diesel fuel to transport a mass load between any two centres.

If anything, this massive diesel fuel efficiency realisation (in comparison to heavy road transport) should have been far more than headline news to insist that all (heavy) freight must be transported by rail and not by road!

More recently the reality of massive “Tunnel Boring Machines “(TBMs) have emerged as another technology that uses an immense amount of diesel fuel to produce electricity to power these mechanical monsters.

It may well be that an electric train may use virtually no diesel fuel – but when you consider that cutting a massive tunnel through several kilometres of stone will use an absolutely immense amount of diesel fuel 24/7 for many years – the whole diesel fuel import and sales game changes to promoting the building of massively long under city road highways and under city railroads – and very long inter-regional tunnels (where the rail infrastructure could easily be re-engineered to be totally above ground – and travel much faster).

The Melbourne – Sydney Rail Fiasco

In Australia, Melbourne and Sydney are the two biggest State Cities (each with populations verging on 5 M people) and they are separated by about 950 km. Passenger and Freight (and Telecom) transport between these two big cities forms the big part of the "Golden Boomerang" linking Brisbane – Sydney – Melbourne – Adelaide.

The Hume Highway (Sydney – Campbelltown – Moss Vale – Goulburn – Wagga Wagga - Albury – Wangaratta – Seymour – Melbourne) is the main road highway that provides a direct multi-lane Road connection and the Rail line follows much the same path. By air, the (direct) connection is via Kingsford Smith (Sydney) and Tullamarine (Melbourne) – with Canberra as an important "optional" midway Airport.

The railway line between Melbourne and Sydney is nothing short of a disaster with a considerable portion of the Victorian track subsiding in mud (for many decades) and a considerable portion of the NSW track being a tangled mess between Campbelltown and Goulburn - and winding its way to Albury. My educated guess is that OIL (and Qantas) also had a heck of a lot had a lot to do with "facilitating" many pollies over several years to prevent any improvements to this rail infrastructure.

In reality with the modern powerful heavy engineering equipment readily available these days - it would be rather simple to "straighten out" the rail line between Campbelltown and Moss Vale which currently is about 80 km.

In the CE 1960s the road along the Blue Mountains between Campbelltown and Goulburn was completely rebuilt (using lots of heavy earthmoving machinery that chewed an immense amount of diesel fuel). This rebuild sheared about an hour off the trip allowing the road vehicles to travel considerably faster – because some large bridges and hill cuttings made the road into far more straightened dual lanes each way.

The rail line was manually built in the CE 1850s – but because of the very steep terrain near Picton (south west of Campbelltown) and the ensuing escarpments all the way to at least Moss Vale / Bowral – this rail line had a massive cut through the range at Hill Top and even then, the gradients were very steep. Consequently, this rail line has very substantially been restructured but still has many tight arc curves south of Picton to Moss Vale get through the Great Dividing Range towards Goulburn.

Going by the main highway this road is about 73 km long and takes about 40 minutes (average speed about 109 km/h) but by rail this is at least 80 km and takes more than 80 minutes (average speed about 60 km/h). Straightened out this would be about 70 km and have a gradient of about 1:90, so trains using the ancient 1435 mm rail gauge could travel at up to 100 km/h and take about 42 minutes. From Moss Vale to Goulburn is about 71 km by road and this takes about 40 minutes (about 106 km/h); but by rail this trip takes about 60 minutes (about 80 km) averaging about 80 km/h.

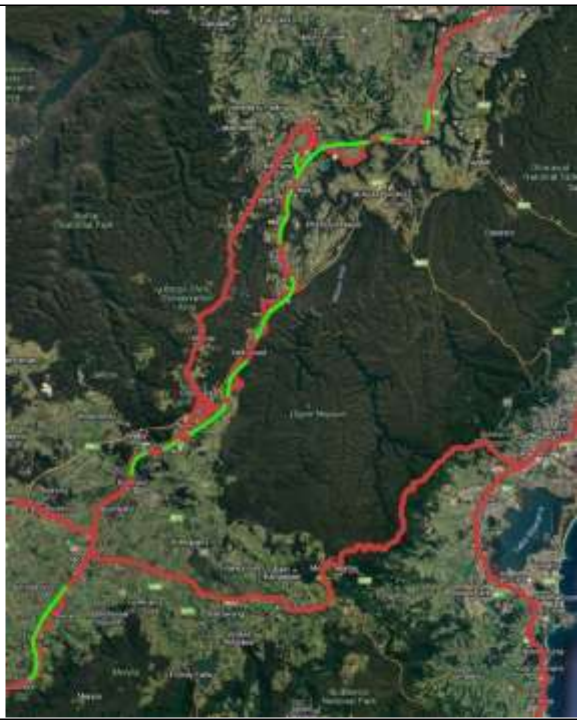
Similarly, from Goulburn to Albury (via Wagga Wagga) is about is about 266 km by road and this takes about 2 hours 43 minutes (averages about 98 km/h); but by rail this trip takes about 5 hours and 50 minutes (averages about 24.5 km/h).

The Highway from Sydney to Brisbane is now (CE 2024) virtually completed (again) - after about 15 years - and because of heavy road transport vehicles - this highway has literally shattered (because of heavy road freight vehicles) and much of this highway now needs total (extremely expensive) replacement!

The adjacent map shows the early and existing rail lines in rusty red, (the original rail line was the more western (left had side) alignment – but this was very steep in several places and replaced by the more easterly alignment in the CE 1920s.

The lines in lime green are my approximation of where this rail can be re-aligned to - using heavy earth moving equipment – and all the tight curves are totally removed.

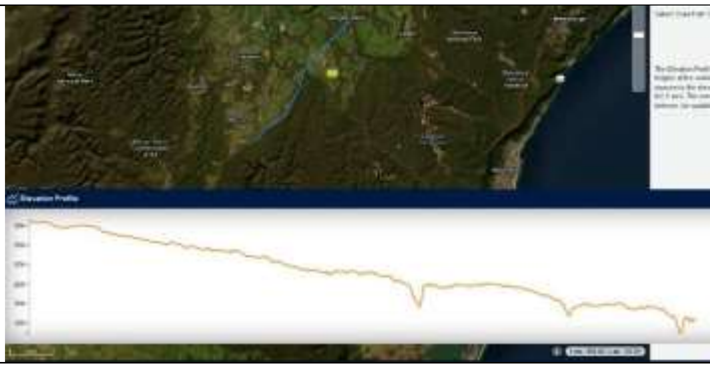
At the northern end (north of Tahmoor) this 8 km rail line would require significant bridging to provide a sweeping almost straight extension to get onto the sandstone "shelf".



By using Heavy Earth Moving machinery, most of these tight arc rail lines can be substantially straightened to have radii exceeding 4 km. At the southern end of the map the line south of Moss Vale – near Exeter can also be substantially straightened.

The beauty about these slightly changed rail alignments are that in most cases these changes have very little effect on the surrounding land and even then – because these rail alignments are substantially shorter than before the, external effect should be substantially less – in fact – be positive!

An alternate strategy is to run the rail alignment alongside the existing motorway. This section is about 19 km and the difference in elevation is about 250 m for an overall gradient of about 19,000 / 250 = 1.3 metres per 100 metres or about 1 in 77 metres.

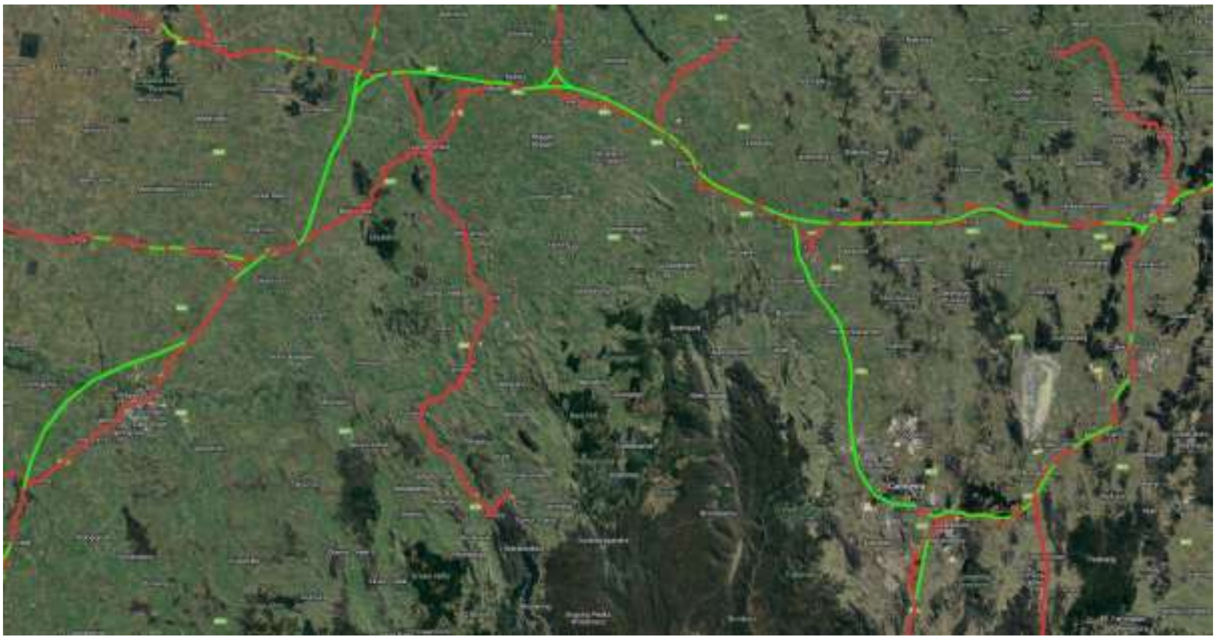


In a similar mindset – this almost straight alignment can be run east of Bowral and have a gentle gradient all the way through to Goulburn!

The rail alignment strategy that I have outlined here would involve an absolute minimum of tunnels (if any at all) and other very expensive costs and delays to connect Sydney and Goulburn.

The below map is particularly interesting because most of the existing rail track's easements are used – and straightened!

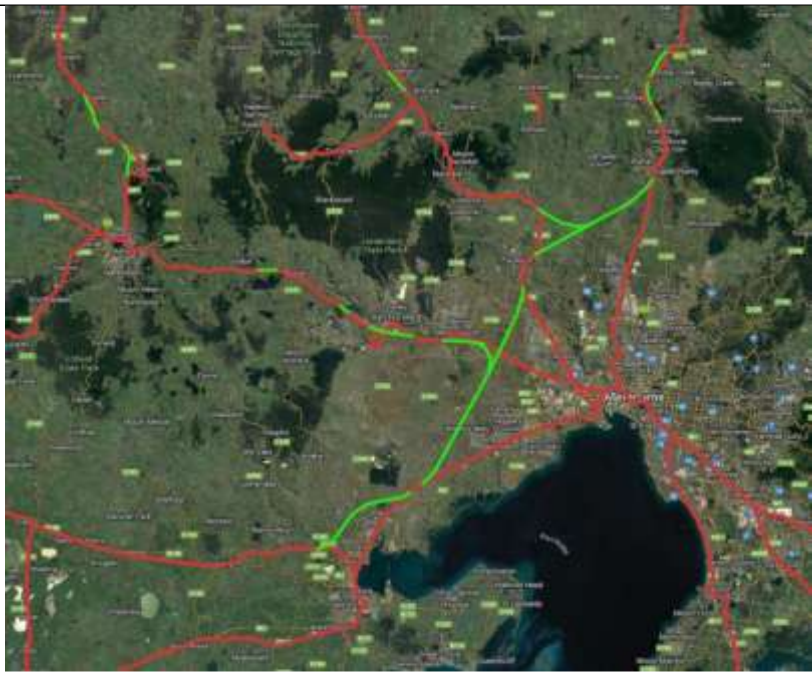
The run from Goulburn to Canberra is slightly straightened – particularly near Queanbeyan and the run from Goulburn to Bowning is "straightened" where it meets the new line from the western side of Canberra. This puts Canberra "in the loop" and the rail line continues west and bypasses Cootamundra (and the very winding tracks around there) where the new line continues west and links with the proposed but forever delayed Melbourne – Brisbane inland rail line!



Instead of going through Wagga Wagga my concept is to skirt around Wagga Wagga (and have an intermodal terminal in this bypass (and not in the city). Same scenario with bypassing Albury (and Melbourne too) to connect at Geelong!

My thinking here is that the rail line straight into Melbourne is already narrow and congested; and coming out west via Sunbury then to Geelong is a clear and near straight path for Quick Rail transport.

An intermodal terminal east of Melton would provide a rapid connection with Central Melbourne- and the Western link towards Adelaide.



There have been several private sector attempts to run a Sydney – Melbourne or Sydney – Canberra fast rail – but none have actually considered to simply straighten up the existing line alignment - and put in a “Standard Australian Wide Rail Gauge” 2540 mm gauge rail (as a dual rail set over the pre-existing 1435 mm “standard” rail set) on this run for maximised stability and maximised load bearing!

The Inland Melbourne - Brisbane Rail Fiasco

For many decades there has been a push to reduce the amount of Heavy Road Freight vehicles off the main Highways and instead use Rail Freight. Unsurprisingly, the pushback from lobby groups has been cunning and very intense.

For more than 40 years (i.e., before CE 1980) there has been a long-term initiative to build an inland rail link between Melbourne and Brisbane, and this has taken a very long time (more than a few decades) to get off the ground and actually start!

It is "interesting" that the funding always falls short or is non-existent and /or the project stops etc. before it starts – and/or the specifications are abruptly changed etc. All this is really saying is that there are a lot of private greed / business (transport related) interests that certainly do not what this rail to proceed. And this means that this railroad initiative is extremely good – else these greedy forces would not be so negative!

The run by road from Melbourne to Brisbane (via Sydney, Newcastle, New England Highway) is about 1900 km and at 100 km/h all the way that is about 19 hours. Too much for one day – but with two drivers on a hot-bed "shift"! This fits inside a 24-hour (one complete day) travel! Do not mention safety!

By Rail Freight this is about 60 km/h all the way or about 32 hours (say 1.5 days). That is not problem for the Oil Industry Lobby (OIL) – but – for the same mass load the trains use about 30% diesel fuel compared to that used by Heavy Road Freight – that is a real problem for the Oil industry Lobby and as far as they are concerned – even the concept of this inland rail has to be stopped from being brought into reality!

Several sections of the proposed railroad will be using pre-existing rail roads (based on George Stephenson's 1435 mm (4' 8.5") ancient rail gauge) – and most of these rail sections are in NSW. There are joining sections of the railroad being (very slowly) constructed – and these are single lane (not dual lane) and heavy duty – to carry double height containers – as per in the USA!

With road highway initiatives, it is standard practice for the rebuilt road highways to bypass the large country towns / cities - so the road freight vehicles have a minimum delay in transport between source and destination ports. This is not happening!

In other words, there will be (multiple) level crossings in built-up areas and these rail alignments will not bypass the towns / cities – and the rail will have tight arc curves in these built-up areas - so the wheels/rail will be squealing – causing a high maintenance issue and also causing complaints for those people living in these urban centres!

It is painfully obvious that this project has been deliberately stifled because with this inland rail project the old rail (winding) routes are being used wherever possible - and also wherever possible these rail routes pass through regional towns and cities - and have considerable bends / curves in the tracks - so there is no way the rail freight transport can travel at over 80 km/h and the time of these rail trips will be maximised!

One of the "more recent" specification changes was to remove the double height stacked containers – (as in the USA) – because the road bridges would be far too expensive and the train speed would be very limited! Really? Which idiots approved double level containers in Australia – especially on this route? Who were the organisations behind putting somebody up to approve this stupid scenario?

It is even so painfully obvious to "Blind Freddy" that this (not) new rail infrastructure is being deliberately set up to fail (and the volume of Road Freight transport will continue as if nothing happened)! The following map is "interesting"!

Yellow is new track (bends and all) and the green is pre-existing (discarded) track (which is not straight). Purple is pre-existing used track - also not straightened out!

It is painfully obvious that this rail passes through many towns - so the train speed cannot be fast!

It would make very much sense to inexpensively bypass these Regional cities (and towns) with a few km straightened rail and have an intermodal terminals near – not in some of these major Regional Cities.

The above map was copied out of the Australian Rail Transport Corporation (ARTC) website (a "corporation" but not a "commission") - interesting - as the business model for a corporation is to make as much profit as possible where a commission is to provide as much infrastructure as possible). These two business initiatives are directly opposite - and the wrong business model is operating this build - which goes a very long way to explain why this project is repetitively stalled!

It is also "interesting" that this ARTC website (in this area) is very much like a "honeypot" where an inordinately large amount of time can be spent on the site to get very little useful information.

After about 5 minutes I gave up as I could not find a project timeline anywhere - as this should be one of the prime features! There was certainly nothing obvious about the expected train speeds over various sections of the railroad and/or the expected travel time and other rather obvious selling features.

Overbuilding this rail section spent all the funding – and then there is the problem of rail bridges – made for single level containers on rail cars! Ongoing funding is a mere trickle and neither end has been sorted out as to where the trains will actually terminate! My educated guess that the rail alignments will never be straightened out – to make sure that the maximum train speed cannot (ever) exceed 80 km/h!

There is almost a continual stream of B-Double heavy road freight vehicles each way on the Hume Highway and consider that one B-Double Heavy Road Vehicle per two minutes adds up to about 700 vehicles per 24 hours or about 1,000 containers by Road transport per 24 hours!

Consider that about 50% of these containers (i.e. 500 containers) are driven/transported North of Sydney and/or Brisbane (and beyond)!

NSW Western Sydney's Airport Fiasco

The emerging reality of the conceptual an inland railway (where the land is generally flat) connecting between Melbourne and Brisbane had the Oil industry Lobby (OIL) in a blind panic – because the push for that infrastructure was eventually getting positive traction from many more areas than it was decades before!

Not only would this inland railroad require far less ongoing maintenance (involving a lot less imported diesel fuel) than the (somewhat parallel) road highways but these trains would use a third the amount of diesel fuel that is used by a fleet of B-Doubles – and these Freight Trains could travel straight through without stopping at all – anywhere!

(Remember the truckies catchcry: "Time is money"!)

A typical Freight Train has 50 cars conservatively carrying 50 containers - so 500 containers per day adds up to nominally 10 Freight Trains per day. If these 10 Freight Trains were evenly timed, then there would be one Freight train every 2.4 hours (2 hours 24 minutes) between each other. This is barely a congested route!

Consider if there was one 50 car Freight train per hour (every hour of the day and night) - that adds up to 24 * 50 = 1200 containers per direction per 24-hour day, or put another way, that is one container (in one direction) every 1.2 minutes. Consider a return Freight train on the same route (parallel line) – we are now talking about 2400 containers being transferred between Melbourne and Sydney every 24 hours – that is about one container every 40 seconds! The Hume and Pacific and New England Highways would be void of diesel fuel guzzling B-Doubles and their heavy cargo. (**Australia's Treasonous Anti-Rail Lobbyists**)

Now the shocking reality! Consider of the rail link between Geelong (a little south-west of Melbourne) and "West" Brisbane (i.e. Toowoomba) was "straightened out and this rail was made to be the "New Australian Wide Rail Standard" of 2540 mm (8' 4.0"). These diesel/electric-fuelled Freight trains could then safely travel at 300 km/h on this "Quick Rail " technology all the way.

Consider the much-abbreviated transport duration table:

From	To	Distance (km)	Road (H.hh)	Slow Rail (H.hh)	Quick Rail (H.hh)
Geelong	Parkes	771	8.28	15.42	2.66
Parkes	Toowoomba	830	9.25	16.66	2.77
Geelong	**Toowoomba**	**1601**	**17.53**	**32.08**	**4.44**

The bottom line says it all that with "Quick Rail" this trip would take about four and a half hours – and that is nominally say 12 freight rail cars and/or 12 passenger cars!

The slowly emerging Sydney's second main airport is an "interesting ploy" and it fits in the puzzle like Cinderella's Ugly Sisters forcing to fit Cinderella's Crystal Slipper! There is absolutely nothing about this airport that makes any infrastructure sense!

Shipping freight by air is extremely expensive in terms of very expensive aircraft that have a relatively short life combined with massive maintenance and operational overheads and immense (Avgas) fuel usage.

Working the analysis backwards, the expected fuel requirement is in the order of 18 B-Doubles every 24 hours – and not put in an extension pipeline from St Marys to Badgerys Creek (about 16 km due north) – and there is a fuel pipeline from Kurnell to St Marys! Go figure! Why would they not want this pipeline put in?

With Sydney's Kingsford Smith Airport (located at Mascot / Kurnell / Rockdale) the standard landing path is straight in line with the runways and most planes line up at about Turramurra (about 25 km NNW) for a straight run into the landing strip.

With Sydney's Western Sydney Airport (located at Luddenham / Badgerys Creek) the standard landing path is straight in line with the runways and most planes will be lining up at about Hornsby then to Toongabbie (about 25 km NE) for a straight run. The western side of the Sydney basin is fogged in far more than the coast (i.e. at Kingsford Smith Airport) – so this airport will be not functional for about 50 days per year.

The only rail line (which was a real afterthought) is a "metro" (1435 mm rail gauge running 25 kV AC) so that shows some "late forethought" – but this line is a spur running about 14 km south from St Marys. At the airport – the rail line is parallel (not at right angles) to the landing strip and this rail alignment is facing the wrong way to loop back towards Parramatta, or to Glenfield! This rail line should have looped to Glenfield to provide cross connectivity to Kingsford Smith Airport / Parramatta etc. but no! This rail link is going to be a totally dysfunctional (useless) distraction!

My thoughts are that the purpose of this Western Sydney Airport was not to provide passenger services, but this rail branch was used as the prime "cover" to hide the real purpose of providing a very (fuel) expensive alternate Heavy Freight link to both West Brisbane airport (Toowoomba) and Melbourne (Essendon / Avalon) - using huge amounts of imported expensive Avgas and at all costs – do everything to stop the Melbourne – Brisbane inland rail from happening! (**Australia's Treasonous Anti-Rail Lobbyists**)

Essendon is far too small for a Freight airport - so be very unsurprised if (and when) Melbourne's Tullamarine Airport is "suddenly financed" to be considerably enlarged to look like extended international passenger transport – but the real reason will be intra-avgas-guzzling State Freight transport (at an enormous further cost to Australia's international balance of payments), plus the cost of the very expensive aeroplanes too!

Consider that at the West Sydney Airport a major road link is quietly being provisioned across the northern end to of the runway to interconnect with the north – south M7 (central west Sydney) at Elizabeth Drive!

This is a "no-brainer" that the vast majority of Road Freight vehicles that would be travelling to-from Sydney – to connect with Brisbane or Melbourne, would then be re-directed and intercepted at Western Sydney Airport and the freight transferred at this intermodal terminal and then flown to/from Melbourne or Brisbane.

It is now rather obvious that the "interested Oil Industry Lobby groups" have worked over all sides of the State and Federal politicians (and their staff etc.) so much that these heavily compromised people are like worn out doormats!

Australia will be in immense international Balance of Payment (BOP) debit (wrecking the international value of the Australian $$) because we will be then importing far more Avgas than ever before – and wasting this on very expensive and unnecessary inter-State air freight.

The Sydney – Newcastle Rail Fiasco

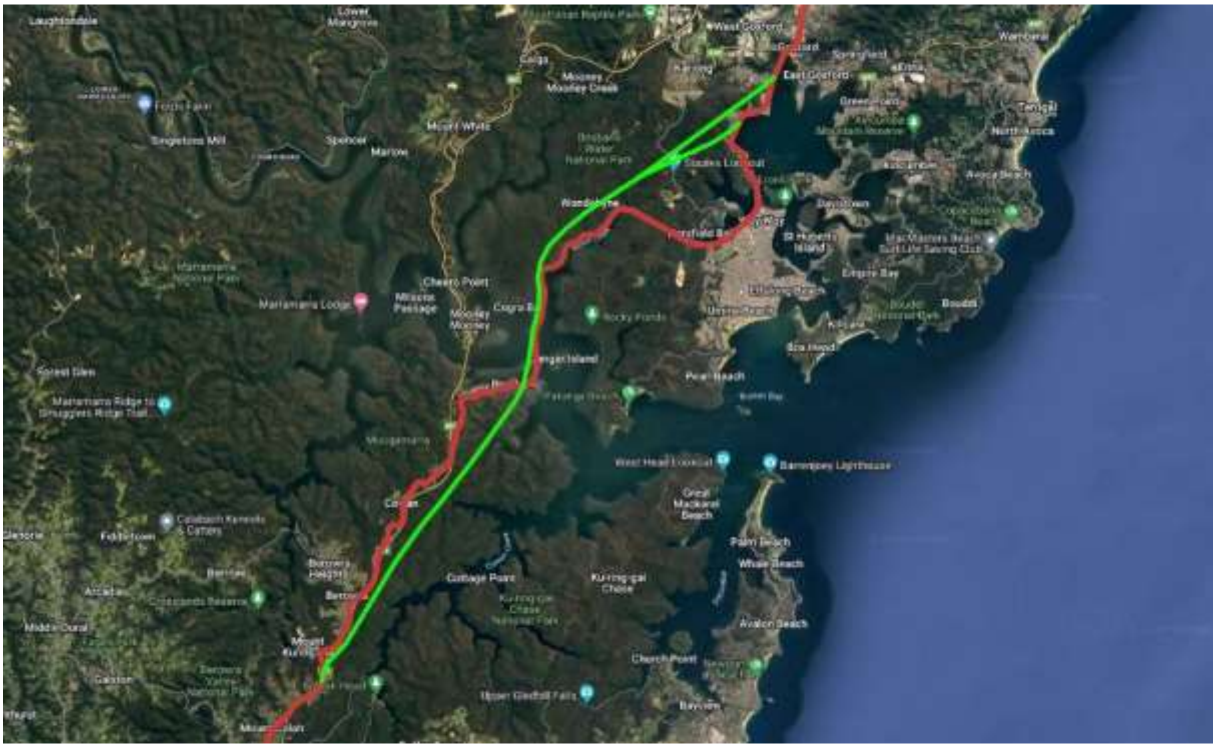
About 40 km north of Sydney is the Hawkesbury River (which is wide) and the surrounding this is a broken plateau about 200 m above sea level. It is this geographic / geological area that is particularly difficult to have a road or rail connection. There was rather winding main road using the Hawkesbury River Bridge that provided a transport path and this road then worked its way to Newcastle.

Circa CE 1855, the chosen rail route was the Cowan gorge that has a gradient of about 1:40 which is critically (too) steep for rail transport – and a really major impediment for "Quick Rail" transport. This rail section needs two locomotives for every (freight) train to ensure rail traction and the speed limit is typically a maximum of only 40 km/h.

The railway from Sydney to Newcastle was completed in CE 1857 and the line through to Casino via the New England (inland route) was completed in CE 1883. At Casino there was an intermodal (rail/rail) Transport Terminal where from here the much narrower 1067 mm gauge line (as used throughout Queensland) through to Brisbane!

Before the M1 road freeway between Hornsby and Newcastle was put in place by USA contractors using (diesel fuel guzzling) heavy earth moving equipment circa CE 1960, there has been continual pressure to significantly improve the rail network interconnecting Newcastle Sydney (about 165 km north of Sydney Central Station near the CBD of Sydney). There has been ever-so-silent (and extremely well-funded) relentless and enormous pushback to not upgrade the rail line between Hornsby and Newcastle. (**Australia's Treasonous Anti-Rail Lobbyists**)

Considering the wealth of heavy earth moving equipment available these days - it is a virtual "no-brainer" for the rail line to totally bypass the Cowan Bank/Gorge and branch out just south of the Mt Kur-ring-gai Railway station, cross over the M1 freeway to the east and follow an almost straight line and come in over/ in the existing Brooklyn Rail line – as shown below in a lime green line in the lower half of the map.

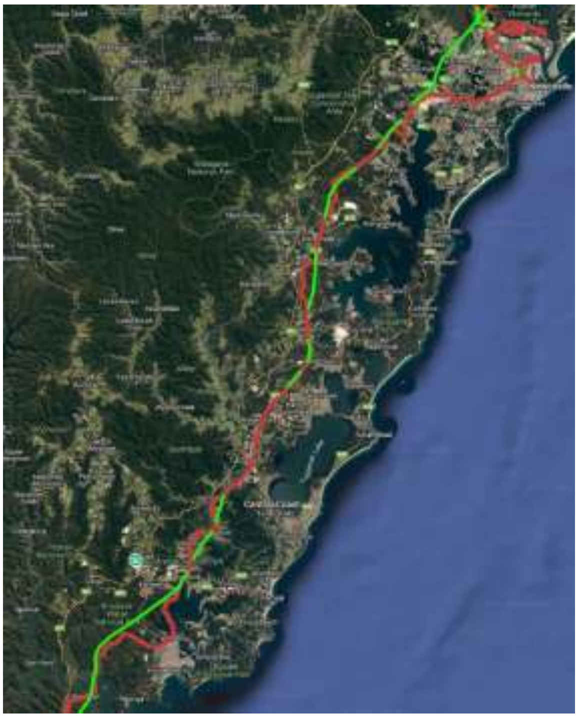


This distance from Mt Kur-ring-gai to Brooklyn is about 20 km and the elevation of Mt Kur-ring-gai railway station is about 215 metres. Considering the new railway bridge at the Hawkesbury River would be about 25 metres in elevation, this elevation differential would be about 190 metres. With an even gradient over this distance; this is about 1 metre per 105 metres or 0.95 metres per 100 metres.

This section and therefore the whole route between Hornsby and Gosford would not require a second locomotive and trains could (easily) go through this section at 100 km/h (or much faster) – in both directions!

The second part of this inexpensive rebuild is to run along the western escarpment of the spur along Mullet Creek and use a very few tunnels and fills to come in at Point Clare, then across to Gosford. Apart from this rail line being considerably shorter, the overall distance from Hornsby to Gosford would be about 40 km and at a nominal 100 km/h this is about 0.4 hours or 24 minutes instead of one hour, or 60 minutes.

There are several “wriggle parts” on the line through to Newcastle and this map shows from Brooklyn up to Hexham (NW Newcastle). In most places the change in line orientation is straightforward with heavy earth moving equipment – and very little tunnelling except south west of Gosford (under much of the Brisbane Water National Park), and under Link Road, Wallsend (west of Newcastle).



Most of the rest of this rail line re-alignment to be far straighter requires fill – which would be very readily available!

The overall length from Hornsby to Hexham would be about 115 km and the maximum length of tunnels through this rugged terrain would be about 15 km.

My reason for not running this rail line into and out of Newcastle near shoreline CBD is that Newcastle has a “V” shaped (suburban) rail line (where the centre of the “V” is the Newcastle CBD area) that essentially services the suburbs with the CBD. By placing an intermodal station at Hexham and another at Glendale – the local trains (and trams, busses, taxis, cars, bikes, containers etc.) can change at Hexham and Glendale and this really cuts the transport time (and bypasses Newcastle CBD)!

Consider that using my straightened rail alignment (about 115 km instead of about 140 km), a 3040 mm car width train using the ancient “Standard” 1435 mm gauge rail could (easily) travel at 120 km/h from Hornsby to Hexham with stops at Gosford and Tuggerah and Glendale (3 minutes each), the total time would be about 68 minutes instead of 116 minutes – almost halving the transit time!

Now consider that a standard 3040 mm width train using my new “Australian Standard” 2540 mm rail gauge could (because this gauge is far more stable than the ancient “UK Standard” 1435 mm rail gauge) travel at 300 km/h from Hornsby to Hexham (115 km) with stops at Gosford and Tuggerah and Glendale (3 minutes each), the total time would be about 23 + 9 = 38 minutes instead of 116 minutes. This is considerably quicker than getting a train from Hornsby to Sydney Central (49 minutes)!

The “Real Reason” for deliberately not upgrading the rail line between Hornsby and Newcastle has very little to do with passenger transport and absolutely everything to do with the transport of Freight north of Sydney! (**Australia’s Treasonous Anti-Rail Lobbyists**)

The prime reason the M1 was built was to facilitate the use of Heavy Road Freight (B-Doubles, and if allowable but they were not; B-Triples) to be the prime diesel fuelled transport “tools” instead of diesel-electric trains on railways!

Because Diesel fuelled B-Double Heavy Road Freight on roads (highways) use about three times the amount of diesel fuel that the same mass load would use over the same distance as that by rail infrastructure – the wealthy oil executives that operate Australia’s oil import / distributing / selling industry; have done everything possible to stop / delay / side-track / compromise successive Local / State / Federal Governments and Oppositions (and their advisory staff) etc. from looking at / funding any improvement to the existing Hornsby – Newcastle rail infrastructure.

In CE 2023/4 there was a very sudden about-face by these OIL executives to now push for a high-speed train (300 km/h) between Sydney and Newcastle – using (of course) “The 5 Monkey Syndrome” the UK ancient “Standard” gauge rail of 1435 mm for 3040 mm width rail cars and about 100 km of tunnels for the nominally 130 km track!

My estimates were that all that is needed is about 15 km of tunnels and even that is “excessive” as many of these “tunnels” could (and would) be deep cuts about 20 to 30 metres instead of tunnels. This would bring the “tunnels” back to about 5 to 10 km!

Well, this High-Speed Railway (HSR) project will require at least 10 to 20 diesel fuel guzzling Tunnel Boring Machines (TBMs) to be operating 24/7 for the next decade at least – running 24/7 and consuming immense amounts of imported diesel fuel – and while that is going on there will be an immense team of diesel fuel guzzling Heavy Earth Moving Machines transferred from the West Sydney Airport (that is getting close to being finished) to the new project of the Sydney - Newcastle High Speed Rail!

It is now obvious what has gone on – in that the Federal and State Transport Ministers and their support staff (of course) have all been “won over” (incredibly compromised) to transfer the funding tails of the West Sydney Airport (fiasco) to the Sydney – Newcastle High-Speed Rail project! (Another fiasco!)

Let the imported very expensive diesel fuel guzzling continue without a break!
(**Australia’s Treasonous Anti-Rail Lobbyists**)

Australia's Telecom Infrastructure Debacle

The massively economic introduction of plastic insulation and underground cables to replace open overhead wires had barely been realised by the late CE 1950s because of other massive overhead operational costs but - by the mid CE 1960s linear semiconductor technologies (diodes / transistors) were rapidly emerging and showing to have far lower maintenance overheads than thermionic valves that had been used since the early CE 1910s.

In a similar mindset, the use of Crossbar switch technology (introduced in CE 1960) involved far lesser mechanical stresses (and far less maintenance) than the traditional "Step-by-Step" automatic switches; and far less maintenance and employer overheads than the manual "Sylvester" switchboards.

In that era, the Post Master General's (PMG's) - Australia's Telecom Research Lab (TRL) and the Australian Broadcasting Commission (ABC) were world-recognised in developing specifications and practical (Quality) manufacturing practices that were literally given to Australian telecoms etc. equipment manufacturers – really bolstering their manufacturing standards and productivities. (**Building Australian Productivity**)

These newer technologies showed that the future overhead costs of telecoms could be substantially less, and the greedy private sector entrepreneurs wasted no time in "getting in on the action" (for themselves – of course)!

Circa CE 1969, Chile was in a very awkward economic situation where a large proportion of their long-haul telecom infrastructure was privately owned by the USA Bell Corp. and these long-haul telecom user costs were extortionate – which was crippling the Chilean economy. After ongoing failed negotiations with Bell Corp., the then President of Chile nationalised Bell Corp's. long-haul telecom infrastructure that was in Chile, collapsing long-haul telecom costs in Chile. . .

Bell Corp Executives went straight to USA President Nixon who wasted no time involving the USA's World Trade Organisation (WTO) and the USA's Central Intelligence Authority (CIA) who in turn undermined the Chilean economy. Chile could not import nor expert anything as their currency was declared void (WTO) on the world market. In no time the Chilean economy collapsed and the had a CIA arranged "staged revolt", where President Pinochet was parachuted in as the CIA puppet.

The WTO wasted no time informing the entire Western economy countries that if they did not privatise their (Government owned) telecoms infrastructures (i.e. into the USA's ultra-wealthies hands) then those countries would have the same fate as Chile! In the early CE 1970s the rush /panic was on for (particularly European) countries to privatise their telecoms infrastructure ASAP!

In Australia, the Vernon Inquiry / Review (CE 1971- 1974) was held resulting in the (Federal) Post Master General's Department (PMG) being immediately split up into sub-Department Commissions (Telecoms, Posts, Broadcasting, Civil Aviation etc.) with maximised Economies of scale ("natural monopolies") that no longer needed to have Acts of Parliament to oversee / approve executive decisions.

By the late CE 1970s, Telecom Australia Commission (not Corporation) was world recognised as having "one of the best" constructed and operating telecom network infrastructures in the developed world - which was a severe embarrassment to the USA hard right economic mindset (privatise "liberate" every infrastructure to give all these to the (USA) ultra-wealthies).

The Overseas Telecom Corporation (OTC) was a separate (Australian Government owned) parallel telecom infrastructure body that facilitated international connectivity for Australia – and did this extremely well (running at a substantial profit while undercutting several other “competing” northern hemisphere international telecom corporations).

As a direct consequence of these rapid technology advances (particularly in the late CE 1970s with the emerging (solid state) digital telecom technologies), there was very intense pressure (primarily from the ultra-wealthy USA private sector investors under the deceptive shields of the ANZUS Treaty and the WTO) for Australia’s telecoms infrastructure to be privatised (into their very greedy foreign hands / pockets) – at an immense economic cost to Australia’s economic productivity.

In CE 1980-82 The Davidson Inquiry came out with a "blueprint" Report that forced Telecom Australia to be broken up and privatised. This action totally wrecked that highly efficient Economy of Scale and totally changed the business focus from providing equitable telecoms connectivity throughout Australia - to grossly over-providing maximised telecom connectivity in the major metropolitan cities and leaving the regional areas with a threadbare minimum of telecoms connectivity.

Because Australia did not have a national Stock Exchange until about CE 1988, it took only until about CE 1990 for privatisation and “restructuring” of Telecom and the main funding to be very efficiently diverted from long term Telstra's infrastructure investment into maximising senior executive / board renumerations while minimising all telecoms infrastructure builds outside the State Capital cities.

In mid-April CE 1986, the Australian (TLS – Telecom Research Lab) had an amazing breakthrough invention of very low attenuation Single Mode Optical Fibre (SMOF) technology. The later development of far better / more suitable SMOF cable construction technologies made SMOF the transmission bearer of choice.

Through CE 1987 - 1994, Telecom Australia / Telstra re-constructed its long-haul transmission network into SMOF cables, and this was a national disaster!

Historically, it was common (European) practice to "deep bury" these cables below the topsoil (that in the UK / Europe is typically 1200 - 1500 mm under the ground level). Without question, telecom Engineers in Australia had for many decades blindly followed of the British Post Office (BPO) engineering instructions - even though the geology of most of Rural / Regional Australia has topsoil that is barely 100 mm deep! It would have been far less expensive (and more reliable) to plough these SMOF cables to a depth of only 500 mm. (**The Five Monkey Experiment**)

Before SMOF technology, the costs of telecoms underground cables were very expensive because the copper was/is very expensive. The typical cost of a 40 pair copper cable was in the order of $20,000 per km and the cost of deep-ploughing that cable was in the order of $25,000 per km - so the overall cost was typically about $45,000 per km. Coaxial cable cost at least $80,000 per km just for the cable – and with deep ploughing this was about $105,000 per km!

Because the strands of SMOF are exceptionally inexpensive this made the cost of SMOF cables very inexpensive – and the main cost is the plastid sheath! A 12 strand SMOF cable typically costs about $1,100 per km, and a 96 strand SMOF cable costs about $4,000 per km.

Consider that deep ploughing in an SMOF cable to about 1200 to 1500 mm deep costs about $25,000 per km. Ploughing in a 24 strand SMOF cable (costing about ($1,250 per km) totals at about $26,250 per km. Ploughing in a 96 strand SMOF (costing about $4,000 per km) totals about $29,000 per km. Common engineering sense – to include the 72 extra fibres for future network growth was a “no-brainer”!

Primarily because Telecom Australia / Telstra was privatised, the Senior Executive / Board direction was to minimise costs (for maximum short term Shareholder value, and maximised long term Board / Senior Executive renumeration).

Instead of using 24 fibres or even 12 fibres (costing about $1,100 per km) - potentially costing about $26,100 per km when ploughed in; the idiotic (private sector Sales / Marketing / Advertising controlled) Telstra Board / Senior Executive decision was to cut this back to 6 fibre SMOF cable (also costing about $1,100 per km) and when ploughed in, costed about $26,100 per km.

These Sales / Marketing Executives had no clue that 6 fibre SMOF cable cost the same as 12 fibre SMOF cable – and they were thinking very short term – about 6 months and maximised personal renumeration for reducing the “spend” budget). Engineers think short term is about 5 years and maximum service with low overheads!

Over 40,000 km of 6 strand SMOF cable was ploughed into the regional areas – where this cable really should have been 96 fibres. If 96 strand SMOF was ploughed in, then the whole programme cost would have been about 11% more, and the return on national investment (through increased connectivity – producing increased revenue) would have been immense, and paid for itself several times over every decade!

Privatisation of telecom infrastructure was the prime reason why in the regional areas of Australia have a very thin Backhaul / Core network structure. There are well over 13,000 (Mobile Phone) Radio Black Spots, and most towns / villages and country cities have very limited Broadband connectivity there are virtually none of the 80,000 plus Farms have Fibre the Homestead (FTTH) – though these are all businesses and most mining sites have to rely in geostationary satellites and low orbit satellite that cost Australia an absolute fortune (and provide very limited connectivity).

This very short-term thinking directive resulted in a far inferior regional network that really exposed Australia's National security. The Regional Telecom SMOF network is "tissue paper thin" and incapable of providing geographic alternate routes between State Capital Cities, (or Regional Centres) – so that large parts of Australia and entire metropolitan cities can be very quickly totally telecoms isolated - which is a massive hole in Australia’s national security. (**National Security and Regional Productivity**)

Building Australian Productivity

What was never widely known (even inside the PMG / Telecom Australia) was that (CE circa CE 1900 – 1995) the Telecom Research Lab (TRL) in Melbourne was the crucible of telecoms research and development that really fostered local Australian telecom equipment manufacturing. TRL “worked with” many Australian telecom equipment manufacturing businesses (e.g. wire / cables, insulators, switchboards, telephones, carrier transmission equipment etc.) for the PMG / Telecom / Post Office etc.

Because production research (i.e. “development”) was/is time consuming and expensive (and shows no short-term profits) – the TRL was involved to assist these Australian manufacturing businesses in producing high quality equipment that in turn required far less maintenance overheads for the PMG / Telecom / Telstra.

Unlike those in the USA who couldn’t wait to brag about what they had achieved (or stolen), the TRL / ABC Research Labs kept a rather quiet profile and wherever possible fostered / supported local Australian electronics / telecoms manufacturing.

In the CE 1920s, TRL were instrumental in significantly improving the Quality of drawn copper wire to have highly consistent diameters – depending on the cables being manufactured. Not only were the Australian cable manufacturers able to make cables that favourably compared to the best in the developed world. When it came to fault location – because the wire diameters were highly consistent - the resistance per unit length was also consistent. It was then fairly straightforward for technical staff to electronically “locate” a cable fault – and go straight to the physical location!

Circa CE 1959, PMG Engineers working with TRL were able to re-engineer the Swedish LM Ericsson “Crossbar” automatic switching equipment to match with the Australian “Transit” (2-wire bidirectional Voiceband transmission) network. This equipment was then mass manufactured in Melbourne until about CE 1982.

TRL were also leaders in digital telecoms standards and technologies. It was TRL that in the early CE 1970s came up with a very sensible Plesiochronous Digital Hierarchy (PDH) that was adopted worldwide (except of course in the USA) and it was TRL (with the ABC Lab in Sydney) that in the mid CE 1970s developed and structured the A-Law Pulse Code Modulation (A-Law) that is used world-wide in Voice / Digital interfacing (the USA uses the rather awkward u-Law)! It was also TRL that in mid-April CE 1986 came up with Single Mode Optical Fibre (SMOF) having an insertion loss of barely 0.4 dB/km where elsewhere / before it was at least 3.4 dB/km. The ABC Research Lab were the ones that set up the world standards for digital video / TV.

In the early CE 1950s, Australia was preparing to have television technology introduced. It was expected that the Australian TV transmission system would follow the European (PAL) transmission standards that far-exceeded the USA’s NTSC technology that continually suffered from ever changing colours on the screen.

The problem with NSTC was because of phase variations in the “radio” transmission – hence why Europe opted for Phase Alternation Line (PAL) to cancel these time variable changing phases. NSTC transmission was so poor that apart from it being nicknamed “*Never Twice the Same Colour*” and in the USA, Cable TV was being rush introduced to sidestep the pitiful broadcast quality of NSTC.

The entertainment and electronics industries saw massive potential income from TV and the private sector fight was on to bribe / “steer” (Australian) politicians. Another problem was that PAL has an 8 MHz bandwidth and NSTC has a 6 MHz bandwidth and there were a who lot of “sub-specifications” that fall in under there! The more-narrow bandwidth NSTC would facilitate about 15% more TV channels than PAL!

Australia was about to follow the European PAL standard of 8 MHz and the Federal Telecom Minister was very heavily compromised by the USA sales / Government people (and Australia was about to be forced into signing the ANZUS Treaty). As the Minister walked in to read the TV Law – he crossed out the 8 MHz and instead put in 7 MHz (not 6 MHz) and opted for the PAL transmission!

The result was that the brilliant ABC Engineers (in Sydney) totally re-engineered the TV design (including the TV Transmitters) to include “pre-equalisation” in the Transmitters making the manufacturing of Australian TVs substantially easier (far less costly and far more reliable) while have a better (PAL) picture quality than in Europe!

The flow-on effect of that ABC Research Lab went far further in the following decades – including being world leaders in Hi-Fi speakers and enclosures, room / studio acoustics and digital encoding for telecoms and also world leaders in digital video / TV specifications. Australia had the opportunity to be the world manufactures of Hi-Fi equipment – but primarily because of slow transport and high overheads – this manufacturing productivity never happened in Australia.

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When it comes to developing the research on manufacturing “Quick Rail” technology – there needs to be several (Government-owned) Railway workshops around Australia all working as a close-knit team to maximise their knowledge and experience to expedite the development of “Quick Rail” technology to in turn maximise the production of “Quick Rail” manufacturing productivity!