

**THE SCOPE FOR ENHANCING  
PUBLIC TRANSPORT IN  
AUSTRALIAN CAPITAL CITIES**

**Dr Garry Glazebrook**

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### **INTRODUCTION**

Public Transport in Australia has been undergoing resurgence for at least the last decade, as a result of population growth, increasing densities and rising road congestion. However, the sharp increases in petrol prices in the last eighteen months has led to very rapid growth in public transport patronage, well in excess of population growth, in all of our major cities. For example:

- In South-East Queensland, there were 150 million journeys on public transport in 2005/6, a 50% increase in the previous 7 years, and 12% in the previous year. Patronage in 2006/7 grew by a further 10%.
- Rail patronage has grown 23% in Melbourne in the last two years
- Rail patronage in Perth grew by 41% in the year to March 2008, following the opening of the new line to Mandurah.

There is also evidence that fuel use has declined in the last year, implying lower car use, although there are no comprehensive statistics available on traffic volumes.

These trends are not unique to Australia. In the United States transit use has outpaced highway vehicle miles since 1995, and in the last year overall transit use grew by 3.3%, with an increase of 10.3% for light rail, 5.7% for commuter rail and 4.4% for heavy rail (APTA, 2008). At the same time, the Federal Highway Administration's "Traffic Volume Trends" report, produced monthly since 1942, shows that estimated vehicle miles travelled on all U.S. public roads for March 2008 fell 4.3 percent as compared with March 2007. This is the first such decline since 1979 and the sharpest yearly drop for any month in FHWA history. Average miles travelled on urban roads in the United States March 2008 showed a 3.8% fall compared with that for the previous two years (US DOT 2008).

This sudden rise in public transport use has temporarily used up the spare capacity on trains, trams and buses in all of our cities. The following analysis therefore examines recent developments in public transport in each of our major capitals, and the scope for enhancing public transport capacity in the future, as a first step in examining what contribution it could reasonably make to reducing oil dependence and GHG emissions, and to improving the sustainability of our cities.

As public transport capacity constraints occur mainly in peak periods on approaches to our central business districts, the analysis focuses mainly on those locations and on the scope for addressing those constraints. In general there is ample capacity available at other locations and other times of the day, and significant scope for enhancing cross-town and local public transport use without major infrastructure upgrades.

Hence the potential increase in total public transport use should significantly exceed the estimates made below for peak period capacity approaching the CBD's of our major cities. The estimates are therefore a conservative measure of the potential scope for public transport use in Australia to expand.

## **BRISBANE**

Brisbane currently has a significant public transport system, including nine rail corridors and three busways. In the last five years most of the expenditure has gone on building a busway network, starting with the South-East and the Inner Northern Busways, with the Northern and Eastern Busways in the capital works program.

However the rail network has also been expanded significantly over the last twenty years, with construction of the Merivale Bridge; construction of the Gold Coast line; construction of the airport line; triplication of part of the Main North line, and duplication of part of the Ferny Grove Line. Currently there are several rail projects under construction or planned including:

- Extension and duplication of the Gold Coast line
- Quadruplication from Corinda to Darra on the Ipswich line
- Upgrades to the Northern Line
- A new line branch off the Ipswich line from Darra to Springfield

This increase in both bus and rail capacity is just keeping up with strong growth in patronage, driven by rising population, strong employment growth, urban consolidation and in the last few years, rising petrol prices and traffic congestion.

Brisbane's CBD is growing rapidly and has significant further scope to expand. However the CBD is geographically isolated by the Brisbane River, necessitating new bridges and most recently a new road tunnel.

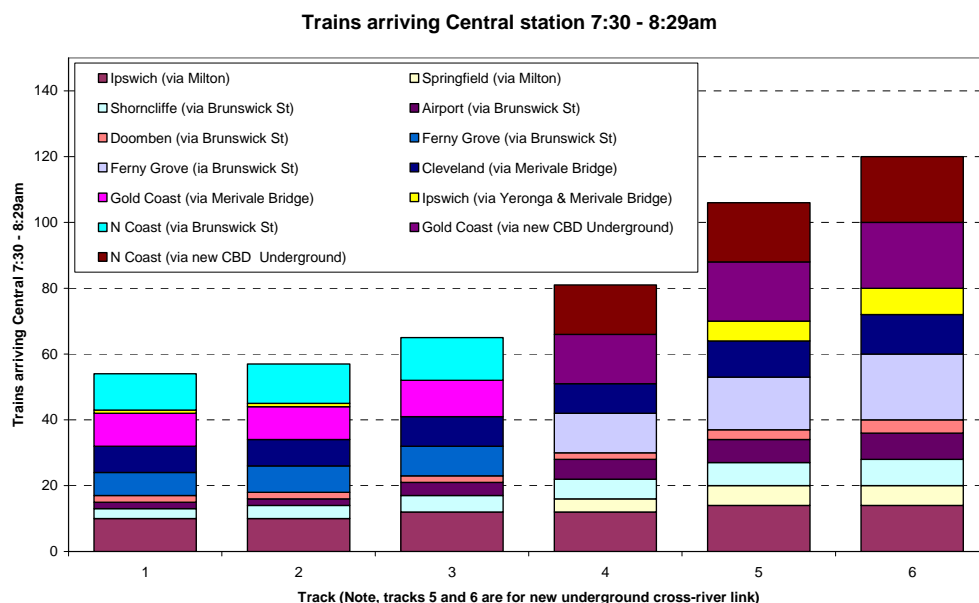
The current rail system is approaching track capacity limits on some routes and will reach capacity by 2020 at the latest (earlier from some directions). For example there are currently 19 services northbound into the CBD in the morning peak hour across the Merivale Bridge, compared with a maximum capacity of 20 – 24. All lines currently lead to Central station, which despite its name is not located in the centre of the CBD.

Consequently for Brisbane to maximise the potential of its rail network, the next major upgrade needs to be an extra river crossing (in tunnel) with new stations underground serving the major commercial and retail heart of the city, as well as Queensland University of Technology, and fed from the Gold Coast line. This would cut at least 10 minutes travel time for many rail commuters destined for the CBD from the southern half of the region. Studies of this have been announced.

Such a link should then travel under Central station (with an interchange to other lines) and serve suburbs such as Spring Hill before rejoining the existing main northern line near Mayne Junction. This upgrade would provide six tracks (rather than four, as at present) feeding the central area, and enable current peak hour services to be doubled by 2021, from 54 trains per hour arriving Central in 2007 to 108 trains per hour. Actual passenger capacity by 2021 could be more than doubled, given that not all trains operating during peak periods at present are six-car trains (See Figure 1).

Ultimate peak capacity of the system would be 120 trains per hour assuming 3 minute headways, and up to 20% above this if average headways of 2.5 minute were achieved. Attachment 1 gives greater details of the potential train volumes in peak hours on different lines, including re-allocation of trains from some lines following completion of the CBD and under-river crossing...

**Figure 1: Potential Peak Train Growth in Brisbane**



Actual rail passenger capacity to and through the CBD in the busiest hour would **increase by an estimated 125%** by 2021 given that not all trains at present are 6 car sets. Furthermore total metropolitan-wide, all-day capacity could increase significantly further given that there is spare capacity outside peak periods and in the counter-peak direction even during the peaks.

The completion of the bus underground in the city centre has relieved pressure on CBD streets from bus movements. Some further increases in bus-based patronage to the CBD are now possible and will occur with completion of the planned busway network, and the introduction of higher capacity buses. However at some point, conversion of the busway network to light rail (as originally allowed for in the planning) could be contemplated. This would free up bus resources to greatly expand cross regional and feeder services. Currently public transport has a very low share of cross-regional travel, and this could be enhanced very substantially with improved services as part of an integrated network plan.

In summary, in the very short term (end 2010) there is scope for at least 25% increase in capacity on Brisbane’s peak public transport capacity, and in the longer term (2021) it should be possible to triple the current amount of all-day travel in the Brisbane metropolitan region by public transport, with realistic enhancements to the rail and bus systems. In particular this involves completion of the planned capital works projects (such as the Springfield line, and Eastern and Northern Busways) and completion of the CBD underground rail link from Mayne Junction to Buranda.

**PERTH**

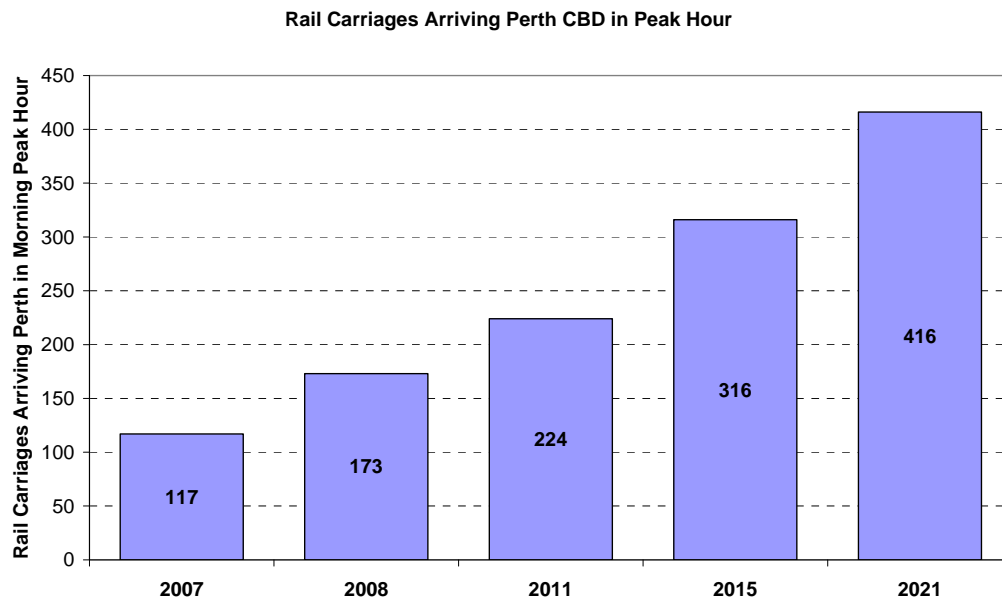
Perth’s rail public transport system has undergone a revolution in the last fifteen years, since it was saved from closure under the then plans to convert it to a busway system. Instead, following a public campaign, the system was electrified and extended, first to the northern suburbs and recently to Mandurah in the south. Perth now has Australia’s most modern and efficient suburban rail system, with very fast and frequent services on five routes and a new underground link providing enhanced access to the city centre.

Bus services also have been continually upgraded, with free CAT (central area transit) services in the CBD and inner suburbs providing local distribution. Bus priority has been provided on key routes, and a circumferential route established.

As a result, public transport patronage has grown very rapidly, though from a low base. Rail patronage in particular jumped by 40% in the year to March 2008 following the opening of the CBD underground and line to Mandurah and the addition of new rollingstock and other extensions to the Midland and Northern suburbs lines. Patronage on the Mandurah line is running at 40,000 – 45,000 a day, well ahead of expectations, and would be even higher were it constrained by lack of rollingstock despite the significant recent enhancement to the fleet.

Perth now has scope for significantly increased patronage on its rail system provided additional rollingstock is purchased, which will allow frequencies and train lengths to be increased. It is estimated that peak capacity could be almost doubled by 2015 with relatively minor upgrades to infrastructure (essentially lengthening platforms on the Midland and Fremantle lines to 4 cars, and on the Armadale line to 6 cars - see Figure 2 and the Attachment.

**Figure 2: Potential Growth of Rail Capacity in Perth**



Perth has also recently explored the potential for light rail, and is expanding cross-regional bus services. As with Brisbane, the scope for major increases in non-CBD bound travel also exists with the right network and full integration.

In summary, Perth has the potential to more than double the total task undertaken on public transport by 2015, in this case with relatively limited enhancements of heavy rail infrastructure (mostly station lengthening), but with the addition of a light rail network and more cross-regional bus services.

Beyond 2015, some further heavy rail enhancements would be required, such as lengthening platforms to six-car length on the Fremantle and Midland lines, and adding a third bi-directional track on the Northern Suburbs line (from Whitfords) and the Mandurah line (Cockburn Central) for additional peak hour services (inbound in the morning, outbound in the evenings). Alternatively line capacity might be able to be increased by 20% by moving to 24 trains per hour on the busiest line (Whitfords – Cockburn Central), if headways can be reduced to 2.5 minutes.

## **ADELAIDE**

Until recently Adelaide has been the Cinderella of public transport for Australia's capital cities, with no major upgrades since the O-Bahn was built some 20 years ago. However in 2007 the Glenelg tramline was upgraded and extended through the CBD and new light rail vehicles purchased. This proved the popularity of light rail and the State Government announced in the 2008 budget a \$2 billion upgrade to public transport including:

- Extension of the light rail system to Port Adelaide, with further branches to Semaphore and Grange
- Electrification of three of the four heavy rail lines, with one (the Outer harbour line) being fitted for operation by both "tram trains" and by heavy rail vehicles
- Additional buses and upgrades to the O-Bahn
- 19 new trams and 50 new electric trains, and conversion of most of the existing diesel trains to electric power.

This will transform the public transport system, enhancing comfort, capacity and passenger appeal. The target is to double the share of passenger-kilometres on public transport from 5% to 10% by 2018. Clearly there is scope for significant further expansion of this target in the future. A realistic target for 2030 could be a mode share of 20%, which is only slightly higher than the current situation for Sydney.

## **MELBOURNE**

As with other capitals, public transport patronage has been growing strongly in Melbourne, with rail patronage up 23% in the last two years, and free travel introduced for early morning commuters to try to spread the load and reduce overcrowding. Ten new trains have been ordered, and new trams leased as a temporary measure to increase capacity on route 109 (one of the busiest tram lines in the world) until additional permanent rollingstock can be brought on line.

Bus travel is also growing rapidly with additional cross – regional and outer suburban routes and the “Smart Bus” corridor program.

The CBD of Melbourne has an extensive radial heavy and light rail network, but the Eddington report has proposed construction of a new underground rail line to relieve congestion on the City Loop. There has been some debate in Melbourne as to the necessity of this investment until current surplus capacity in the heavy rail network is utilised, with Paul Mees arguing that there is currently significant surplus capacity, if operational and timetable changes were introduced.

Clearly in the short term the constraint for both heavy rail and light rail systems is rollingstock (and associated stabling facilities).

## **SYDNEY**

Sydney has by far the most heavily patronised public transport system in the country. However in recent years it has suffered from unreliability, slow services and overcrowding. These all relate in part to capacity problems coupled with a complex operating plan on the rail system, and rising traffic congestion on the road system.

Some enhancements have been made to the public transport system in the last decade, including:

- The airport rail line
- The “Y” link at Parramatta
- The Liverpool – Parramatta and Parramatta – Rouse Hill bus transitways

Other enhancements are about to open, including some “Clearways” projects, the Epping – Chatswood line, and various bus priority projects and cross-regional bus services.

In addition, the State Government has announced the “Sydlink” program including:

- The North-West Metro, from Rouse Hill to the CBD. This \$12 billion project would be a “European-style” metro using single deck rollingstock, possibly fully automated, and would provide enhanced capacity and fast services from the outer north-western as well as the inner north-western suburbs.
- The south-west rail link from Glenfield to Leppington (by 2012)
- Other upgrades such as duplication of the Richmond and Cronulla lines
- Further potential metros including the South-East metro, the West metro between the CBD and Parramatta, and a metro to the Warringah peninsula.

Incremental enhancements have also been made to the bus system, with new buses on order, some bus priority installed, and introduction of higher capacity buses and off-vehicle ticket purchase to reduce the time taken for boarding buses. However the logical next step of introducing light rail on suitable corridors has so far been resisted by the State Government.

Notwithstanding the well documented problems with Sydney’s public transport, patronage has been growing significantly, with an increase on rail of 4.7% in the last

year. However patronage growth has been heavily constrained by lack of trains and buses, and by lack of parking at stations which makes it difficult for people outside walking catchments of the rail system to use it. Essentially all available parking places near stations are fully utilised.

The proposed metros will add very significantly to Sydney's public transport system. The first metro (Rouse Hill to Epping) is proposed to open by 2015, with the extension to the CBD by 2017. It is however possible to enhance capacity of the existing Cityrail rail network before the major metro lines are built, by adding services, and extending train lengths to the maximum.

With regard to light rail, Sydney currently has a small-scale system from the CBD (Central Station) to Lilyfield in the inner west, with only 7 vehicles. There is some prospect of immediate extensions to Summer Hill, and a CBD link to Barrangaroo is under consideration. The City of Sydney has proposed a series of routes in the inner suburbs including routes to Bondi Beach and to the Green Square / Victoria Park area, as well as a full CBD loop line. These would allow increased capacity compared with current bus services on these routes.

## OTHER CITIES

The above analysis focuses on our five biggest cities, which between them had 61% of our population in 2004 and are expected to grow by 45% by mid-century, with an even higher share (63%) of national population by that point (see table 1). This highlights the significance of urban public transport to the national agenda.

**Table 1: Australian Population Projections**

City	Population ('000)			Growth % 2004-2021	Growth % 2004 - 2051
	2004	2021	2051		
Sydney	4225	4871	5608	15%	33%
Melbourne	3593	4252	5041	18%	40%
Brisbane	1778	2404	3355	35%	89%
Perth	1455	1875	2454	29%	69%
Adelaide	1123	1201	1203	7%	7%
<b>Sub-Total</b>	<b>12174</b>	<b>14603</b>	<b>17661</b>	<b>20%</b>	<b>45%</b>
Rest of Aust	7917	9268	10509	17%	33%
<b>Australia</b>	<b>20091</b>	<b>23871</b>	<b>28170</b>	<b>19%</b>	<b>40%</b>
% in 5 largest cities	61%	61%	63%		

Source: ABS 32220.0: Population Projections 2004 - 2101

However public transport is likely to play an increasing role in our next biggest cities as well in the future. For example the Gold Coast, our sixth largest city, and fastest growing, is currently contemplating the installation of a mass transit system along the high density coastal strip, with light rail or busway being the preferred modes.

Light rail systems are also under consideration in Canberra and Darwin, while cities like Newcastle are experiencing urban consolidation and regeneration of their historic city centres. This will provide a base for expansion of mass transit systems in the future.



## CONCLUSION

Major upgrades to public transport are now underway across our capital cities, with significant expenditure planned by State Governments, and many more projects in the potential pipeline. This will lift capacity and quality significantly. For example all new rail and bus rollingstock is air conditioned, while recently built infrastructure such as Parramatta interchange, the Brisbane busway stations, the new rail stations in Perth or Melbourne's "Super" tram stops are of much higher quality than in the past. Some cities (Perth, Brisbane, Melbourne) are moving to fully integrated smart card ticketing.

In addition, major urban development is now increasingly focused around public transport nodes – examples of such "Transit Oriented Developments" (TOD's) include:

- Kelvin Grove on the Inner Northern Busway in Brisbane
- Major development in the Macquarie Park area around the three new stations on the Epping – Chatswood line in Sydney
- Redevelopment around Subiaco in Perth and now occurring at many similar stations.

In addition, the CBD's of Australian cities continue to grow strongly in floorspace, but with increasing residential and retail as well as commercial activity. For example the Docklands precinct in Melbourne, which is immediately adjacent to the refurbished Southern Cross Railway station, has been a major mixed use development which has transformed the city centre, greatly expanded floorspace and employment and created new residential and entertainment areas.

All of these trends have been apparent for some years but are being accelerated by rising oil and petrol prices. In future, major employers will be required to report on greenhouse gas emissions, and will be seeking locations which minimise car – based access and maximise use of sustainable modes (walking, cycling and public transport). Locations in TODs and near public transport hubs will become paramount.

These trends will further accelerate growth in public transport use. However the issue will be whether sufficient trains, trams and buses can be deployed to cope with demand without sacrificing comfort, and whether the necessary infrastructure can be built fast enough to cope.

The table below provides estimates of the potential enhancements in rail public transport capacity approaching the CBD in the morning peak hour in the very short, short and medium term, for each major city, and the key infrastructure upgrades assumed to be completed to enable that to occur. This represents the most critical part of the rail systems.

The potential increase in all-day patronage could be significantly higher than this given that there is substantial spare capacity generally in the off-peak periods and in the counter-peak directions during peak periods.

**Table 2: Potential Increase in Peak Hour Rail Capacity to CBD areas**

City	Very Short Term (end 2010)	Short Term (end 2015)	Medium Term (end 2021)
Sydney	20%	35%	60%
Melbourne	20%	40%	80%
Brisbane	25%	70%	125%
Perth	25%	83%	162%
Adelaide	20%	80%	120%

*Note: Increases measured compared with capacity operated in mid 2008. Estimates allow for lengthening of trains as well as increased train numbers. Major infrastructure works assumed are detailed below:*

City	Very Short Term (end 2010)	Short Term (end 2015)	Medium Term (end 2020)
Sydney	<b>Epping-Chatswood Line; Cronulla Line Duplication;</b> Inner West Light Rail Extension	<b>South-West Rail Link; Riverstone Line duplication;</b> CBD Light Rail Line; Bondi Beach Light Rail	<b>North West Metro;</b> Southern Light Rail Line
Melbourne	<b>Selected duplication / triplication works</b>	<b>Various tram and rail extensions</b>	New CBD Underground Link
Brisbane	<b>Gold Coast Duplication and extension; Ferny Grove duplication project</b>	<b>Springfield Line; Corinda – Darra Quadruplication</b>	Cross River and CBD Line; Northern Line duplication
Perth		Station Lengthening on Midland, Fremantle and Armadale Lines; Light Rail network (Stage 1)	Triplication Whitfords – Perth; Light Rail network (Stage 2)
Adelaide	<b>Glenelg line extension</b>	<b>Electrification of some lines</b>	<b>Completion of electrification program and light rail extensions</b>

*Note: Items in Bold are already committed.*

Accordingly it is considered feasible by 2021 to double the total public transport travel task (passenger-kilometres) in our two largest cities, Sydney and Melbourne, and to approximately treble it in our smaller capitals (Brisbane, Perth, Adelaide), with significant increases also in smaller cities like the Gold Coast, Canberra and Newcastle which currently have a small mode share for public transport.

Beyond 2021 there are further substantial increases possible, with suitable land use, transport investment, pricing and other policies. For example there is active consideration in Sydney of a network of metro lines to supplement the existing heavy rail system.

While it is clear that mass transit will not perform the dominant role in Australian cities that it does in much denser cities like Hong Kong, Tokyo, Singapore or Paris, it is becoming clear that it will play a much more significant role in the future than it has in the recent past.

The extent to which this occurs will depend on a range of factors, including:

- future oil and petrol prices and carbon trading
- trends in urban consolidation and land use policies
- housing preferences, demographic changes and urban consolidation
- economic trends including locational preferences by firms
- government pricing policies (eg parking policies, congestion pricing etc)
- transport infrastructure investment and priorities

The emerging evidence from both Australia and overseas is that the paradigm of car-oriented, low density cities, which has dominated urban development in Australia and the United States in particular since World War 2, is changing (see for example <http://www.msnbc.msn.com/id/25010939/> on trends towards mass transit, and <http://www.cnn.com/2008/TECH/06/16/suburb.city/index.html> on emerging trends in suburbia in the United States).

Many factors, including different housing preferences by members of generations X and Y compared with earlier generations, rising oil prices, and a growing concern for sustainability are driving these changes. Companies will soon have to report their carbon emissions, and will increasingly seek locations which are accessible by public transport. Already the impact of rising petrol prices is being felt in the outer suburban areas of Australian cities which are the most car-dependent.

It is becoming increasingly apparent that those cities and countries, which fail to adapt to the new paradigm of a more sustainable urban form, with a much greater share of travel by walking, cycling and mass transit, may face substantial economic and social difficulties in the future. The speed of the change in sentiment is most apparent in the United States, where until very recently car-based suburban development has dominated. However in the last decade there has been a substantial move back to the inner city areas, a significant reinvestment in mass transit systems and a move towards “smart growth”. Cities like Dallas, Texas, which is currently doubling its light rail network and planning 250 miles (400 km) of light rail and commuter rail systems, illustrate this well.

Australian cities are in reality much better placed than most US cities in that they have a residual rail-based infrastructure to build on and build around. Despite rapid growth on our public transport systems in recent times, there is spare infrastructure capacity available in all of our cities. Patronage, even in peak hours, could be significantly increased over the next few years with the provision of additional rollingstock. Beyond that, there is very substantial capacity for growth implied by the projects already commenced or in planning stages. The challenge for our cities is to make the most of this heritage and to start investing appropriately for the future.

## ATTACHMENT 1: ANALYSIS OF RAIL CAPACITY POTENTIAL PERTH: POTENTIAL SCENARIO

**2007**\* Arr CBD 7:30 -  
8:29am

Line	From	Peak Hr Trains*	Consists	Cars	Average
Fremantle	Fremantle	7	2-car	14	2.0
Midland	Midland	9	2-car	18	2.0
Armadale	Armadale	7	2, 4 car	21	3.0
Thornlie	Thornlie	4	2, 4 car	12	3.0
N Suburbs	Clarkson	11	3, 6 car	44	4.0
	Whitfords	4	2 car	8	2.0
S Suburbs	S Suburbs	0		0	0.0
<b>Total</b>		<b>42</b>		<b>117</b>	

**2008**

Line	From	Peak Hr Trains*	Consists	Cars	Average
Fremantle	Fremantle	7	2-car	14	2.0
Midland	Midland	9	2-car	18	2.0
Armadale	Armadale	7	2, 4 car	21	3.0
Thornlie	Thornlie	4	2, 4 car	12	3.0
N Suburbs	Clarkson	6	6 car	36	6.0
	Whitfords	6	3 car	18	3.0
S Suburbs	Mandurah	6	6 car	36	6.0
	Inner Station	6	3 car	18	3.0
<b>Total</b>		<b>51</b>		<b>173</b>	

**2011**

Line	From	Peak Hr Trains*	Consists	Cars	Average
Fremantle	Fremantle	8	2 car	16	2
Midland	Midland	8	2 car	16	2
Armadale	Armadale	6	4 car	24	4
Thornlie	Thornlie	6	4 car	24	4
N Suburbs	Clarkson	6	6 car	36	6
	Whitfords	6	6 car	36	6
S Suburbs	Mandurah	6	6 car	36	6
	Inner Station	6	6 car	36	6
<b>Total</b>		<b>52</b>		<b>224</b>	

**2015**

Line	From	Peak Hr Trains*	Consists	Cars	Average
Fremantle	Fremantle	8	4 car	32	4
Midland	Midland	8	4 car	32	4
Armadale	Armadale	6	6 car	36	6
Thornlie	Thornlie	6	6 car	24	4
N Suburbs	Clarkson	8	6 car	48	6
	Whitfords	8	6 car	48	6
S Suburbs	Mandurah	8	6 car	48	6
	Inner Station	8	6 car	48	6
<b>Total</b>		<b>60</b>		<b>316</b>	

**2021**

Line	From	Peak Hr Trains*	Consists	Cars	Average
Fremantle	Fremantle	10	4 car	40	4
Midland	Midland	10	4 car	40	4
Armadale	Armadale	8	6 car	48	6
Thornlie	Thornlie	8	6 car	48	6
N Suburbs	Clarkson	10	6 car	60	6
	Whitfords	10	6 car	60	6
S Suburbs	Mandurah	10	6 car	60	6
	Inner Station	10	6 car	60	6
<b>Total</b>		<b>76</b>		<b>416</b>	

**BRISBANE: ANALYSIS OF POTENTIAL TRAIN MOVEMENTS**

**Trains Arriving Central Station 7:30 – 8:29am: Potential Scenario**

Track	Line	2007	2008	2011	2015	2021	2030	Ultimate
1	Ipswich (via Milton)	10	10	12	12	14	14	14
1	Springfield (via Milton)	0	0	0	4	6	6	6
2	Shorncliffe (via Brunswick St)	3	3	4	4	5	7	8
2	Airport (via Brunswick St)	2	2	4	4	5	7	8
2	Doomben (via Brunswick St)	2	2	2	2	3	4	4
2	Ferny Grove (via Brunswick St)	7	8	9				
4	Ferny Grove (via Brunswick St)				12	16	20	20
3	Cleveland (via Merivale Bridge)	8	8	9	9	10	12	12
3	Gold Coast (via Merivale Bridge)	10	10	11	11			
3	Ipswich (via Yeronga & Merivale Bridge)	1	1	0	0	2	8	8
4	N Coast (via Brunswick St)	11	12	13				
5	Gold Coast (via new CBD Underground)				14	16	18	20
6	N Coast (via new CBD Underground)	0	0	0	0	14	18	20
	<b>TOTAL</b>	<b>54</b>	<b>56</b>	<b>64</b>	<b>70</b>	<b>85</b>	<b>110</b>	<b>120</b>