

A Thirty Year Public Transport Plan For Sydney



DRAFT DISCUSSION PAPER

SUMMARY REPORT

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Acknowledgement

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The report is part of an evolving series of reports which aim to incorporate ideas from others as far as possible. The August version includes additional material on buses, ferries and taxis as well as cycling.

Background Documents

This summary report draws on and updates a number of earlier reports listed below. For example there have been some slight changes in the details of specific route alignments which were proposed earlier, while there is additional material in this summary report on implementation. The earlier reports are:

Designing a 30 Year Public Transport Plan: Main Report (February 2009)

This report provides greater detail on the analysis behind the plan and on key elements of the plan.

Designing a 30 Year Public Transport Plan: Attachment Report (February 2009)

This includes further details on latest trends in climate change and peak oil; developments in public transport around the world; specifications for metro rail and light rail vehicles; operational plans and notional timetables for maximising existing Cityrail capacity; Heavy Rail, Metro Rail and High Speed Rail; and details of the 26 Strategic Links which were identified.

Designing a 30 Year Public Transport Plan: Strategic Benefits and Staging Plan (March 2009)

This report provides details of the potential staging options for the plan for Stage 1 (2009-2016); Stage 2 (2016 – 2026) and Stage 3 (2026 – 2036). It also provides an analysis of capacity issues in the CBD, and a comparison between the 30 year plan and the current CBD Metro proposal.

The above reports are also available at:

EXECUTIVE SUMMARY

Following growing concerns about peak oil, climate change and links between obesity and health, there is now a global trend back to walking, cycling and public transport, while car usage is tapering off or falling in many places. More than 400 light rail systems are now operating around the world, most of them new, with many more planned and under construction. Many cities are now also investing in metros, heavy rail and busways. Land use patterns are also changing, with transit-oriented developments increasingly commonplace, and cycling is increasing rapidly.

Sydney retains the largest public transport system in Australia, with Cityrail moving almost a million people a day. However patronage on our public transport rose only 5% in the last decade compared with 30-40% in Brisbane, Adelaide and Perth.

Sydney's poor performance in public transport reflects deficiencies in the planning and delivery of public transport infrastructure projects. Many rail projects in particular have been cancelled, while some of the projects which have been completed have suffered from inappropriate pricing decisions (Airport line), non-optimal alignments (Olympic Rail Line, Epping-Chatswood Line), poor service provision (Parramatta Y-Link), or cost over-runs (Clearways).

Building a more sustainable transport system for Sydney is now a priority, and will be essential to minimise the risks from further oil price rises and measures to reduce global warming. But some of the projects required will be expensive, and they need to be well planned to maximise benefits and minimise costs, particularly in light of the global financial crisis.

This requires any projects to be part of a robust, widely supported, long-term plan. Without such a plan there is a risk of "white elephants" – projects which absorb all available funds but which do not deliver widespread benefits or contribute to a cost-effective solution to our transport needs.

This report adopts a structured approach to developing and implementing such a plan. The first step is to develop key objectives, specifically to reduce total oil consumption and greenhouse gas emissions from passenger travel in Sydney by at least 50% over the next three decades, and to reduce the health costs arising from our current over-reliance on automobiles, including obesity, air pollution and accidents.

To achieve this, targets are established to double the use of walking, cycling and public transport, to reduce overall travel per person by 10%, and to improve fuel and greenhouse efficiency.

The second step is to maximise cost-effectiveness by fully utilising existing public transport infrastructure. Contrary to popular perception, there is actually significant spare capacity on the heavy rail network. A redesigned operating plan is proposed which increases peak hour train numbers by 25% to the CBD and 33% across the system. This plan further simplifies operations into three sectors, improving reliability and on-time running. The light rail system is only using 10% of its potential capacity, and accordingly a proposal to extend and expand the network in the inner west is developed to take advantage of this. Measures to expand bus, ferry and taxi utilisation, and to encourage walking and cycling are also proposed.

But building a more sustainable transport system will require significant new infrastructure. The third step is to design the future network for 2036, whilst leaving scope for further expansion beyond that timeframe. Given Sydney's geography, current transport deficiencies and future land use changes, a "double cobweb" design was developed. This includes improved radial networks for both the CBD and Parramatta, together with "ring routes" for circumferential and cross-suburban travel.

The final planning step is to identify the most appropriate mode for each of the 26 corridors identified for upgrades. This involves analysing the characteristics of each corridor; the suitability of the major modes (heavy rail, metros, light rail, buses) for specific applications; and network integration issues. The resulting plan includes:

- Key upgrades to the heavy rail system, including clearways projects, the SW rail link and a Fast North Shore Link from Chatswood to Wynyard;
- A metro network, including lines to the North-West, the West, the South-East, the North-East and Parramatta – Epping, as well as conversion of the existing heavy rail line from Epping to Wynyard for metro operation;
- Light rail networks based on Sydney and Parramatta CBD's;
- Six bus-based ring routes and additional ferry services;
- Development of a seamless multimodal system through use of high quality interchanges and integrated fares, ticketing, information and marketing;
- Extensive provision of secure park and ride and bike and ride facilities;
- Adoption of appropriate rollingstock design standards for future metros and light rail vehicles to suit conditions in Sydney.

Planning is a key task – but meaningless unless the plans are delivered. Three key steps to improve delivery are proposed. The first is the establishment of a sustainable funding regime, including a range of revenue sources, to finance the plan. While it is estimated to cost an additional \$40 billion by 2036 in capital and operating costs, it will save an estimated \$100 billion in car-related costs over that period, with further substantial savings in external costs. The plan thus makes economic as well as environmental and social sense.

The second is to properly stage the plan. The initial stage (2009-2016) includes the first stage of the West Metro (Parramatta to Strathfield); the first stage of the North-West Metro (Epping to Castle Hill); the conversion of the Epping – Chatswood line for metro operation; an initial light rail network in the inner west and CBD; and the first two bus-based ring routes. This provides widespread benefits across Sydney. Other stages cover the 2016-2026 and 2026-2036 periods, with further scope for enhancement beyond 2036.

The final recommendation is for reform of current organisational arrangements for public transport. A Sydney Sustainable Transport Board is proposed, with representation from all political parties as well as key stakeholder groups, to de-politicise the planning process, enable a true multimodal approach, and open the process up to the citizens.

Sydney is Australia's world city. However it is in danger of losing that status unless it moves systematically to establish a world class public transport system. This report aims to contribute to that task.

A THIRTY YEAR PUBLIC TRANSPORT PLAN FOR SYDNEY

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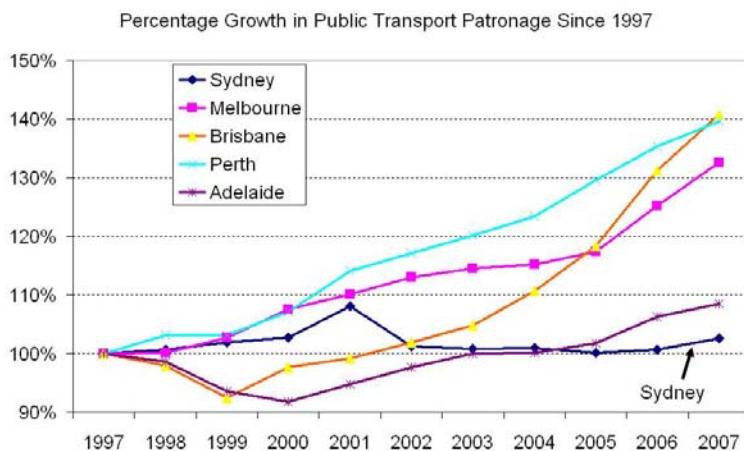
1 INTRODUCTION

Sydney's Public Transport Planning Challenge

In the last decade, Sydney has produced a range of transport plans embracing major upgrades to public transport for the city. However, only a few projects included in these plans have actually been delivered. Many have been cancelled, including the Parramatta – Epping Rail Link, the NW Rail Link, the SW Rail Link, the Harbour Rail Link, the NW Metro, and various high speed rail links.

Other projects which have been completed have not always been optimal. The Airport Line and Cross City Tunnel both suffered from inappropriate pricing. The Olympic Rail Link could have formed the first stage of a fast route between Parramatta and Strathfield, but instead was built as a dead-end loop to save money. The Epping-Chatswood rail line is longer and more expensive than it should have been because it was diverted under the Lane Cove River instead of running over it, as originally planned. The “Y” link at Parramatta has only a couple of trains a day due to budget restrictions. The Integrated Ticketing Project is a decade late because of failure to introduce integrated fares.

The confusion over public transport planning and funding in Sydney and the failure to invest sufficiently has seen Sydney fall behind other Australian and world cities in its public transport performance. In the last decade public transport patronage has grown by 30-40% in Brisbane, Melbourne and Perth, but only 5% in Sydney.



In the last few months there have been new proposals for rail in Sydney, including a CBD Metro from Central to Rozelle, a Western Metro between Sydney and Parramatta, and a plan to introduce metro-style trains onto the existing heavy rail network. At this stage it is not clear how these plans are integrated to form part of a longer term strategy, or if there are more cost-effective options.

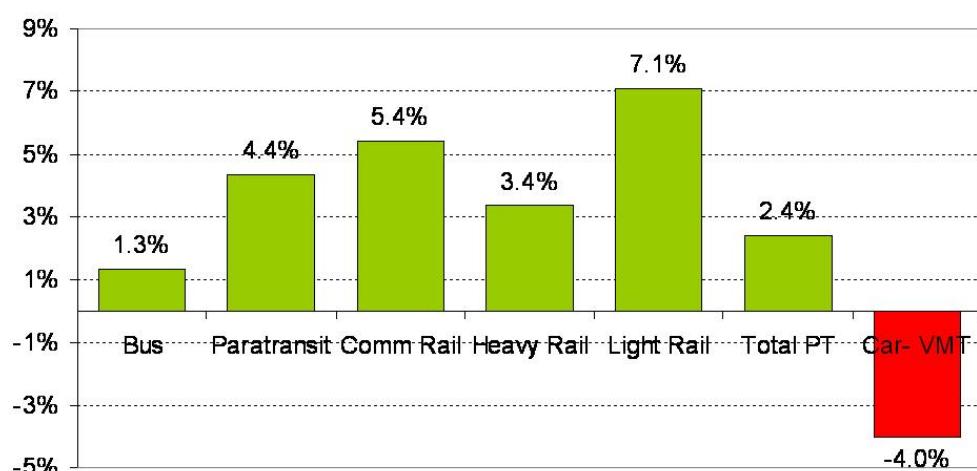
While there is often criticism made of “end-state” and long-term planning, the costs of not having a clear, well-understood and well-supported transport plan for Sydney are now becoming obvious. This report aims to help in the development of such a long term public transport strategy for Sydney.

The Trend back to Sustainable Transport

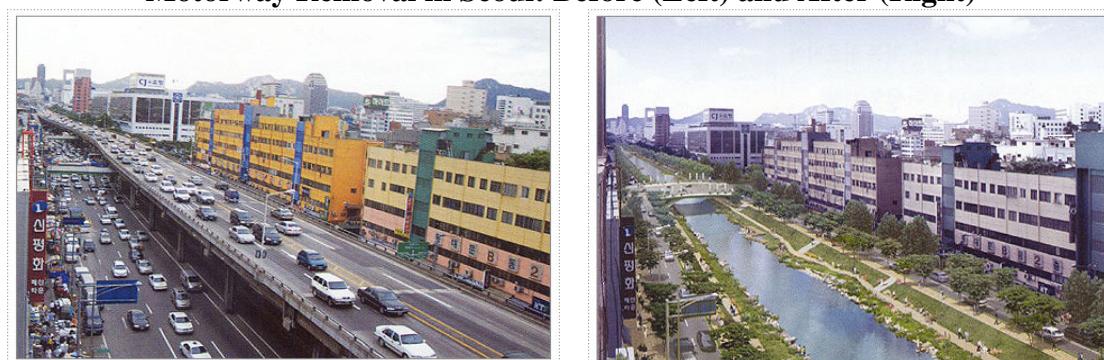
For much of the post-war period, public transport, walking and cycling were in decline as our cities moved to become more car-dependent. However in the last decade this has begun to swing back around the world. For example:

- Public transport patronage in the United States has been growing significantly in recent years, while car usage is falling (see below)
- There are now 400 light rail systems in operation worldwide, many of them new, with another 60 under construction and a further 200 planned
- Many cities are now also investing in metros and busway systems
- Cities like Brisbane have built major bridges purely for public transport, walking and cycling (no cars); cities like Singapore, London and Stockholm have introduced congestion charging; some cities like Seoul have even removed inner city motorways; others like Copenhagen have set ambitious goals such as 50% journeys to work by bicycle (currently 40%).

**Public Transit Boardings and Vehicle Miles Travelled in US:
March Quarter 2008 vs March Quarter 2007**



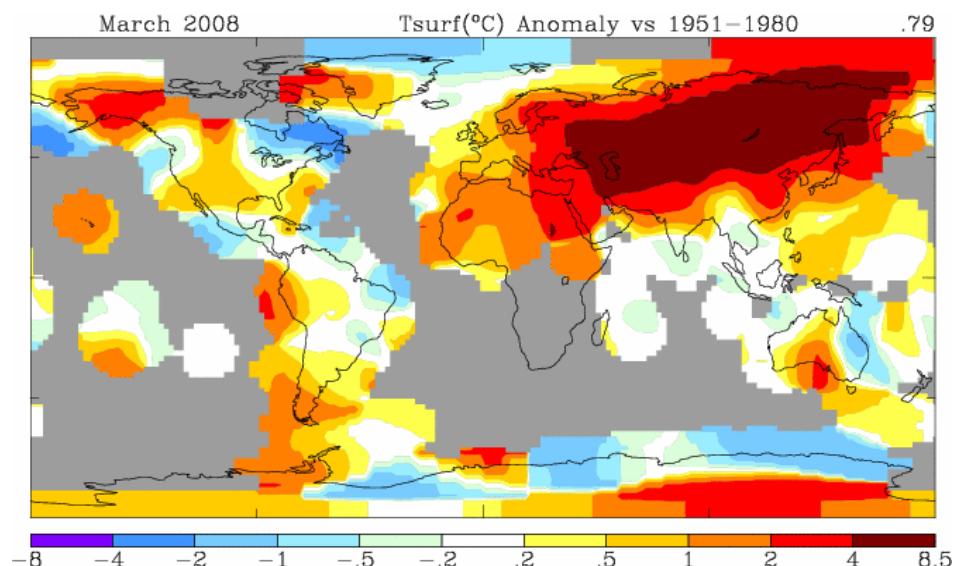
Motorway Removal in Seoul: Before (Left) and After (Right)



These trends reflect growing concern world wide at how to make our cities more sustainable, healthy and liveable. In the last few years this has become increasingly

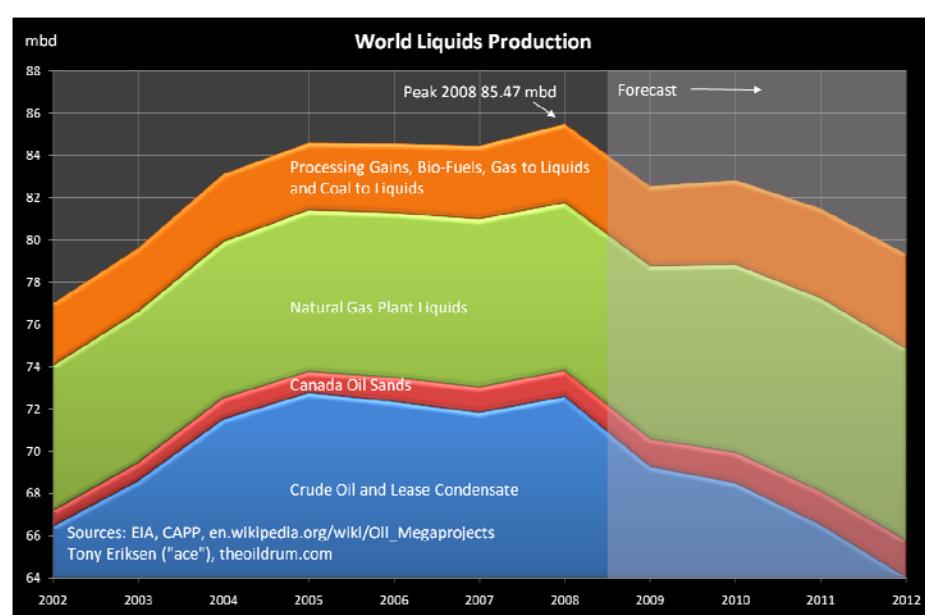
urgent given rising obesity levels and the risks from climate change and peak oil. In particular, the latest data on climate change indicates we may have at most a few decades to significantly reduce greenhouse gas emissions if we wish to avoid major climate change and its consequences, including increased sea levels and ocean acidity, major damage to ecosystems and species extinctions and further adverse changes to rainfall patterns and temperatures.

Temperature Differences: March 2008 compared with Average March for the 1951-1980 period



In addition, our transport systems are heavily oil dependent, and latest data suggests that global oil production flattened out from 2005 and is now likely to go into decline. This could lead to further serious economic consequences (Hamilton, 2009), particularly for those cities which are most reliant on automobiles.

Historical and Forecast World Liquids Production



A Way Forward

It is evident that Sydney is now well behind world-leading cities in its commitment to sustainable transport, with relatively static use of public transport. Sydney also has the lowest levels of cycling of the major capital cities in Australia. This report argues that we need a structured approach to our transport in general, and our public transport in particular, if we are to catch up with other world cities. The approach adopted here has followed the following steps:

Planning

Step 1 Establish objectives, strategies and targets

These need to cover greenhouse gas emissions and oil use, as well as mode shares and total travel demand, taking into account population growth, peak oil, global warming, health trends and other factors.

Step 2 Maximise cost effectiveness

This requires making the most of what we have in terms of transport infrastructure.

Step 3 Design a future public transport network

The network needs to be based on assessment of both current accessibility problems and of future land use changes.

Step 4 Select the most appropriate modes

These need to be determined for each link based on the characteristics of the link, the strengths of different modes, and the need for network integration.

Funding and Implementation

Step 5 Establish a sustainable funding regime

This needs to incorporate a range of funding sources, and be based on the real costs of different modes of travel, including externalities such as congestion, pollution, accidents and subsidised parking.

Step 6 Identify potential staging options

These should take into account the needs of different geographic areas, the availability of finance, and technical requirements such as the necessity for removal of spoil from tunnels or for the stabling of trains.

Step 7 Reform organisational arrangements

This is required to achieve genuinely integrated, multimodal planning, to minimise politicisation and to make the process properly accountable to the public and to key stakeholders.

Chapter 2 develops the 30 year plan, chapter 3 outlines key elements of the plan, and Chapter 4 discusses funding and implementation issues.

2 DEVELOPING THE PLAN

Step 1: Establishing Objectives, Strategies and Targets

Sydney is currently Australia's world city, and is likely to experience further growth in population and jobs in coming decades. Under a "business as usual" scenario, population could be expected to grow by up to 35% over the next thirty years, while energy use, oil use and greenhouse gas emissions would all rise by at least this amount, with adverse impacts on health from obesity, air pollution and accidents.

However, as Professor Garnaut has pointed out and as reinforced by the impacts of the current financial crisis, "business as usual" is no longer an option. Given the rising concerns at global warming, peak oil, and sustainability generally, a thirty year target for Sydney was established for passenger transport in Sydney to:

KEY 30 YEAR OBJECTIVES	<ul style="list-style-type: none"> • Reduce Overall Greenhouse Gas emissions by at least 50% • Reduce Overall Oil use by at least 50% • Improve Health by increasing active transport (walking and cycling), reducing air pollution and traffic accidents
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There are four broad strategies for achieving this:

POTENTIAL STRATEGIES	<ul style="list-style-type: none"> • Limit population growth overall • Reduce per capita travel through travel demand measures • Shift to more sustainable modes • Increase energy and greenhouse efficiency
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No single strategy will meet all the key objectives. For example increasing the fuel efficiency of cars will reduce oil use, but will not necessarily contribute to health outcomes and may be counter-productive, by encouraging even more driving.

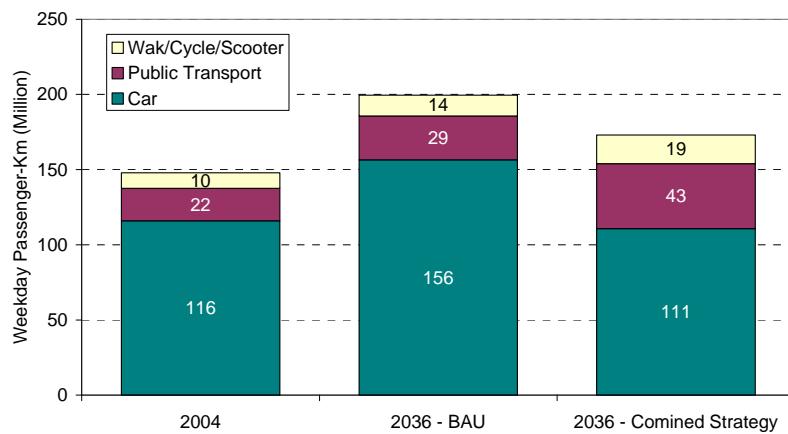
In addition, the strategies take time to implement. Some, such as shifting rail systems to 100% greenpower, could be done in the short term – the estimated cost of switching Cityrail is well under 2% of their total annual budget, and the greenpower required could be met by the planned growth in wind power over the next few years. Other strategies such as replacing the car fleet or making substantial changes to land uses will take decades. For example it took 20 years to phase in lead-free petrol even after it was made mandatory for all new vehicles.

However a combination of the potential strategies, together with specific targets, can meet the key objectives. The specific targets are shown below:

SPECIFIC TARGETS FOR 2036 (compared with 2006)	<ul style="list-style-type: none"> • Reduce population growth to 30% • Reduce the total amount of travel per capita by 10% • Double public transport use (pass-kms) in Sydney • Double walking and cycling • Reduce car share of travel (pass-kms) from 80% to 64% • Reduce fuel consumption and emissions per car-km by 50% • Switch to 100% greenpower for all electric rail transport
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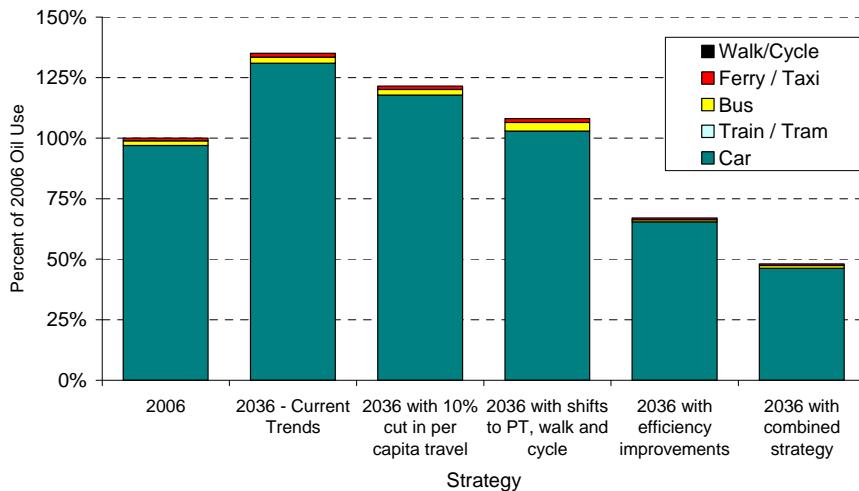
As shown below, the combined strategy significantly reduces total travel in the Sydney region compared with “business as usual”, and in fact leads to a slight reduction in overall car use.

Weekday Passenger-Km by Main Mode

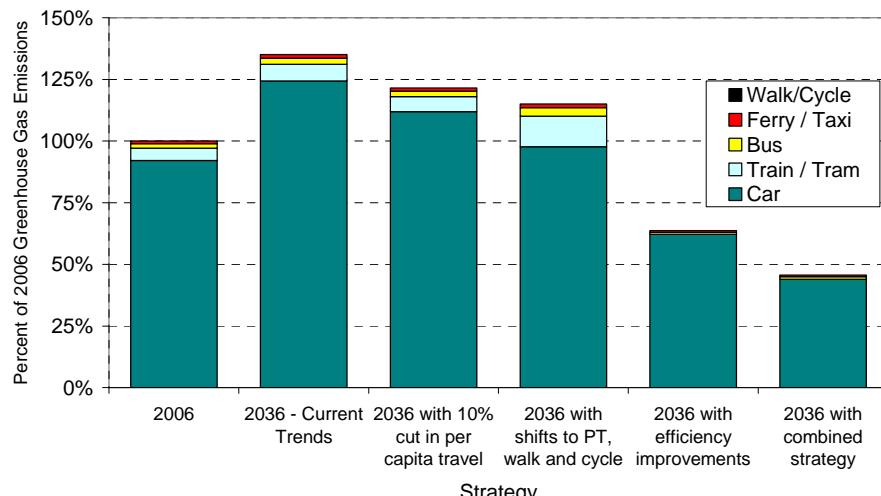


The figures below illustrate the impact of individual strategies as well as the combined strategy on oil use and greenhouse gas emissions.

Oil Use in 2036 compared with 2006



GHG emissions in 2036 compared with 2006



Step 2: Maximising Cost-Effectiveness

Heavy Rail

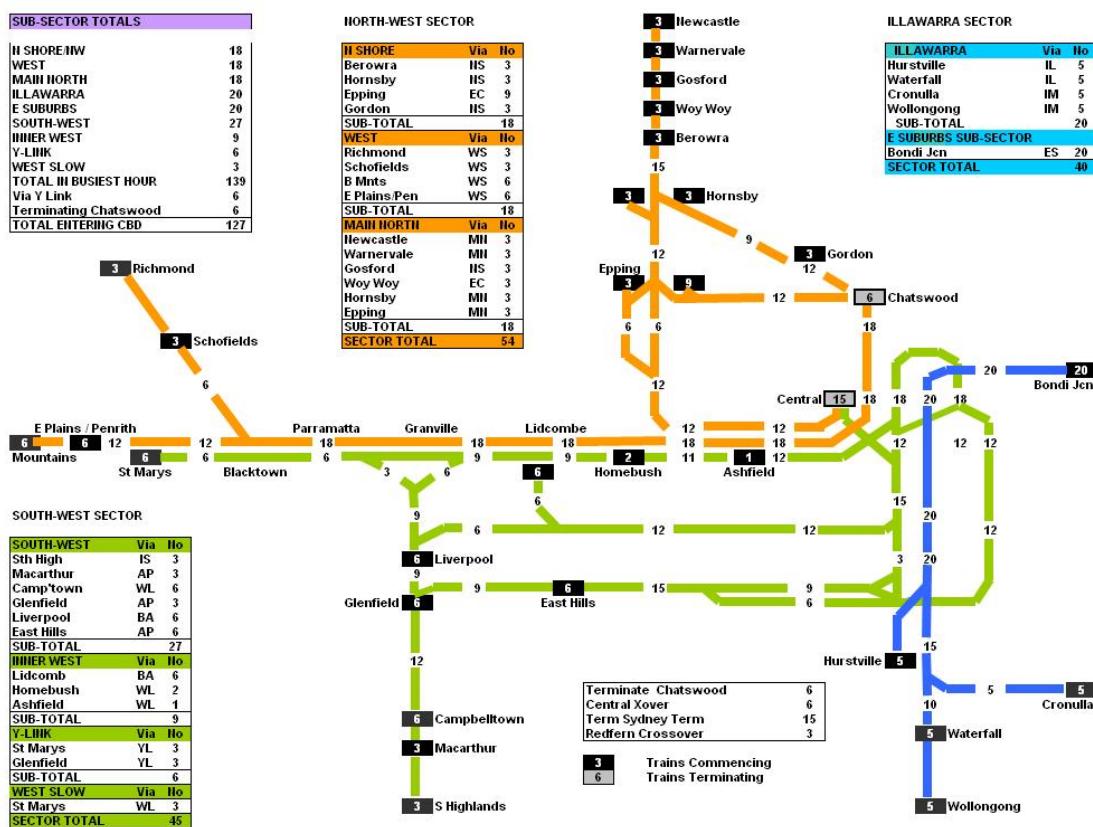
Sydney's rail system carries almost a million people a day, accounts for 10% of weekday travel (passenger-kilometres) in Sydney and is 2.7 times more energy efficient than private cars. So we need to maximise the use of this major asset.

An examination of the current rail system for Sydney found that, contrary to popular belief, there is substantial spare capacity on the track infrastructure. For example there are only 101 trains arriving at central station in the busiest hour (7:30 – 8:29am), compared with a practical capacity of around 130 trains when track constraints and timetabling restrictions are taken into account.

Hence a revised operating plan has been developed to take advantage of this capacity (see below). The plan:

- Increases peak services by 25% to the CBD, and by 33% overall, with minimal extra infrastructure required.
 - Accelerates services and increases frequencies
 - Separates services into just three sectors – the North-West, the South West and the Illawarra, further improving reliability and on-time running.

Proposed Heavy Rail Peak Hour Operating Plan (Short Term)

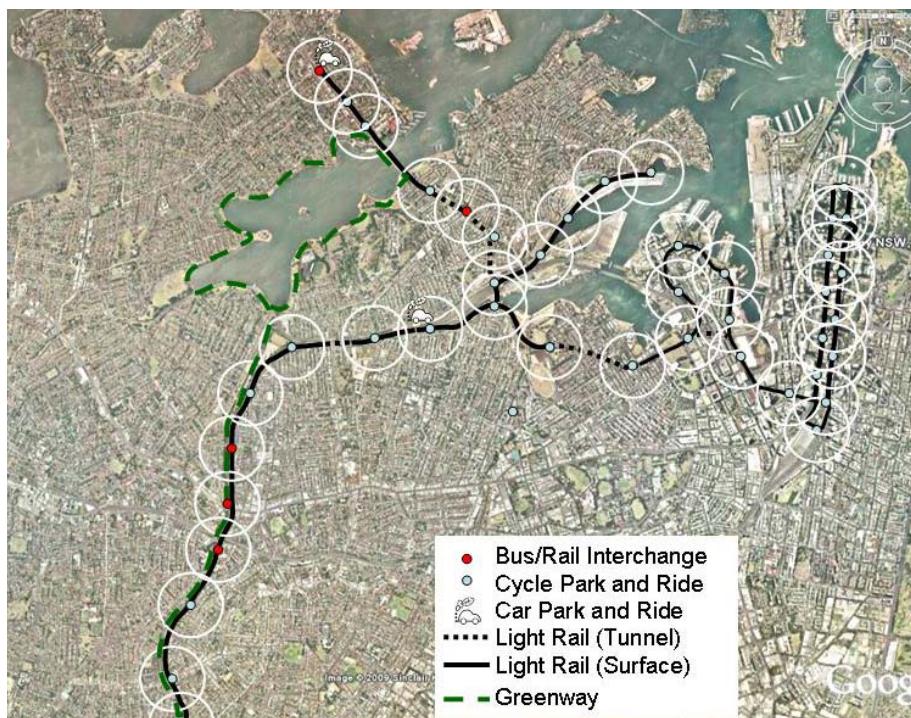


Light Rail

Similarly Sydney's current embryonic light rail system is mostly separated from traffic, but is only utilising around 10% of its potential capacity. It can be readily extended, and form the basis of a light rail network for the city which can help reduce congestion and improve amenity.

The first stage of this expansion would be the extension of the existing LRT line to Dulwich Hill, using the goods line, in conjunction with a greenway between the Cooks River and the Harbour. This would be followed by extension into the CBD proper, the construction of a short cut-off tunnel under Pyrmont, and a series of extensions in the inner western suburbs, including to Drummoyne and White Bay.

First Stage Light Rail Extensions, 2009 – 2016



LRT and Greenway (Left) and Windpower (Right) for carbon-neutral travel



Later extensions could be made to Abbotsford and Burwood, while a network of light rail would be added also to the inner eastern, south eastern and southern suburbs. A separate light rail network would be based on Parramatta (see later discussion).

Buses, Ferries and Taxis

There have been some enhancements to the efficiency of bus based systems for Sydney, including two busways in western Sydney; provision of bus lanes and bus priority measures; use of articulated buses; and introduction of pre-paid only buses and Metrobuses. These initiatives need to continue.

Sydney harbour with its many headlands and increased development along the Parramatta River in recent years provides an ideal opportunity for ferries. However Circular Quay is now relatively congested, and there is limited scope for further development near many of the jetties on the harbour, while the historically high cost of ferry services has limited the willingness of the government to expand services. Options for enhancing ferry services include:

- Expanding the King Street wharf into a second major city ferry terminal, supporting additional ferry services. The wharf would also need to be connected back to the CBD with light rail and potentially metro.
- Increasing secure bike storage facilities at ferry terminals. Bicycles (including electrically assisted bicycles) take only one tenth of the storage space of cars, but can greatly expand the catchment areas of ferry services. This can be further expanded by additional connecting bus services, particularly small buses.
- Improving the cost efficiency of ferries by new management and crewing arrangements, and the introduction of faster methods for passenger loading / unloading at wharves.

Sydney also has a very extensive taxi system, with well over 4,000 taxis. However it suffers from uneven demand, with many periods with much of the fleet being idle, while at other times it can be extremely difficult to book or hail a cab. Similarly there are specific locations such as the airport where large numbers of taxis spend long periods in queues waiting for jobs, and where it can take up to half an hour at busy times to clear the queues of passengers.

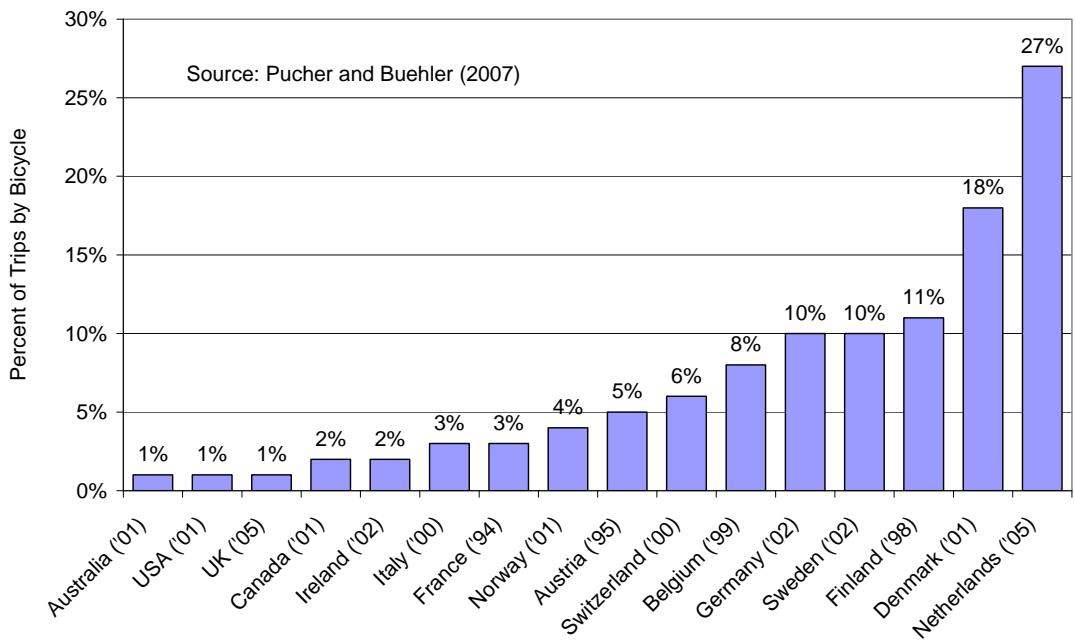
One promising solution which can utilise the fleet more efficiently is to introduce multihiring, especially at busy times and to or from specific locations such as the airport. Modern computer based despatching systems can effectively link passengers travelling on similar routes so as to minimise deviations, thereby evening out the load on the system.

Walking, Cycling and Small Electric Vehicles

While improving public transport is crucial for improving sustainable travel for medium and longer-distance trips, we also need to encourage walking, cycling and the use of small electric vehicles for shorter (and in some cases, medium length) trips.

Australia is currently well behind the rest of the world in the use of cycling, with under 1% of trips by bicycle compared with 28% in the Netherlands and 10% in countries like Germany.

Cycling in Different Countries



Sydney is the least developed major city in Australia for cycling. For example Brisbane has built the Goodwill Bridge (purely for walking and cycling), the Green Bridge (purely for buses, walking and cycling) and is building a second walking / cycling bridge across the River.

However there are ambitious plans in Sydney for an extensive network of cycleways. For example the City of Sydney has just completed the first cycle lane project in the CBD, which is aimed to be the beginning of a 200km network of regional, local and recreational cycle routes, with connections to networks in neighbouring council areas.

Clearly we need to move to establish such networks and to take other actions (such as provision of safe lock up facilities and showers) for cyclists. We also need to consider opening up such networks for the growing number of small electrically powered or assisted vehicles, including electrically assisted bicycles and mobility scooters, which also need safe, slow speed networks to operate on.

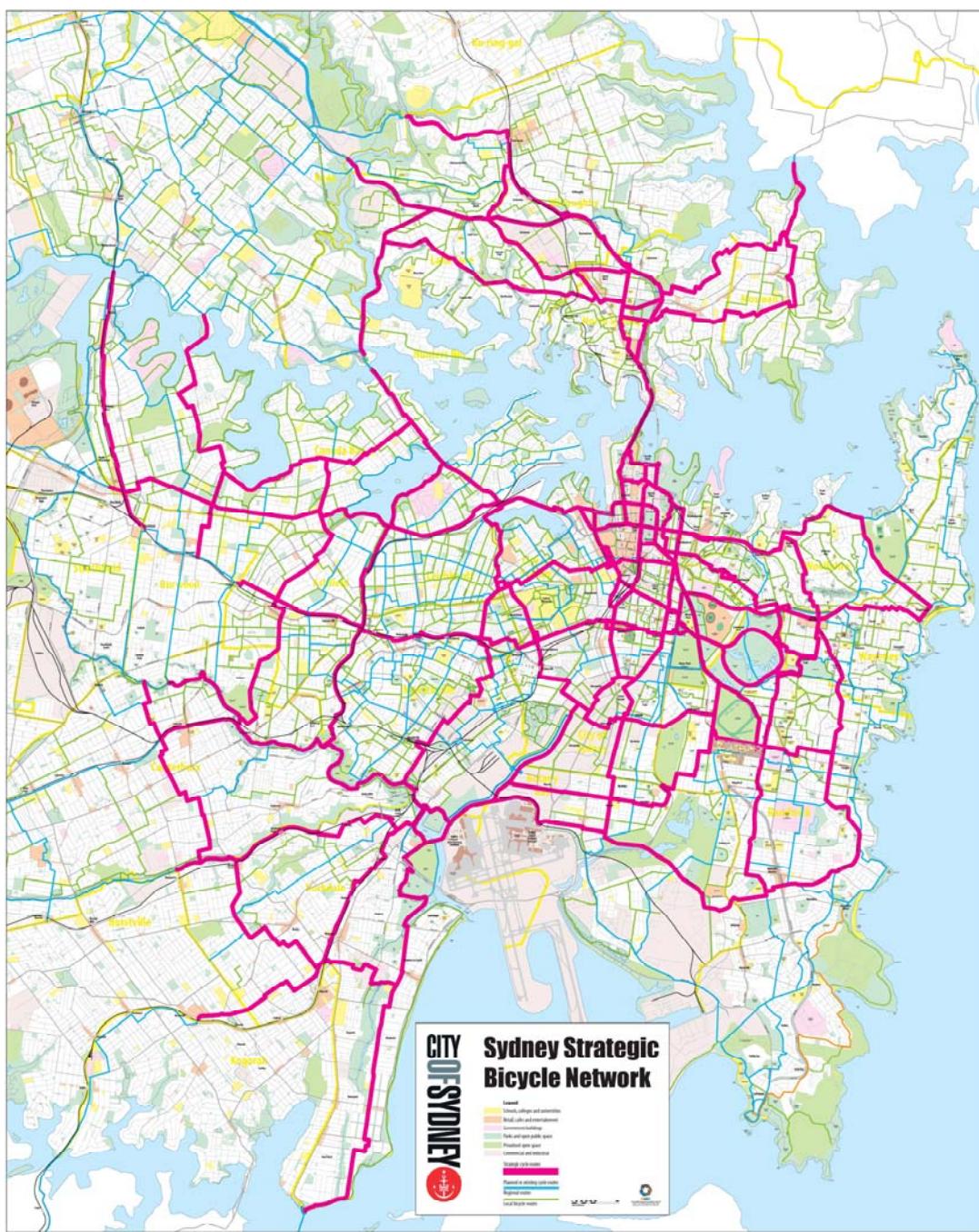
Cars

We also need to maximise the effectiveness of motor vehicles. This includes:

- measures to encourage car sharing, such as the moves by some councils to provide dedicated parking for car-share firms;
- car pooling; this tends to work best when based on people working at the same location;
- road congestion charging to encourage more efficient use of vehicles and a switch to motor bikes, cycling, walking and public transport, as has happened in cities such as London, Stockholm and Milan;

- increasing the provision of park and ride facilities to encourage people not to bring their cars into congested town centres.

Proposed Cycle Network for Inner Sydney



Source: City of Sydney, 2007.

Step 3: Designing the Future Network

Whilst making the most of our existing infrastructure will help, an analysis of the task ahead indicates that **substantial enhancement** of our public transport systems will be required if we are to achieve a more sustainable transport future for this city. First and foremost, the transport system must be designed to address both:

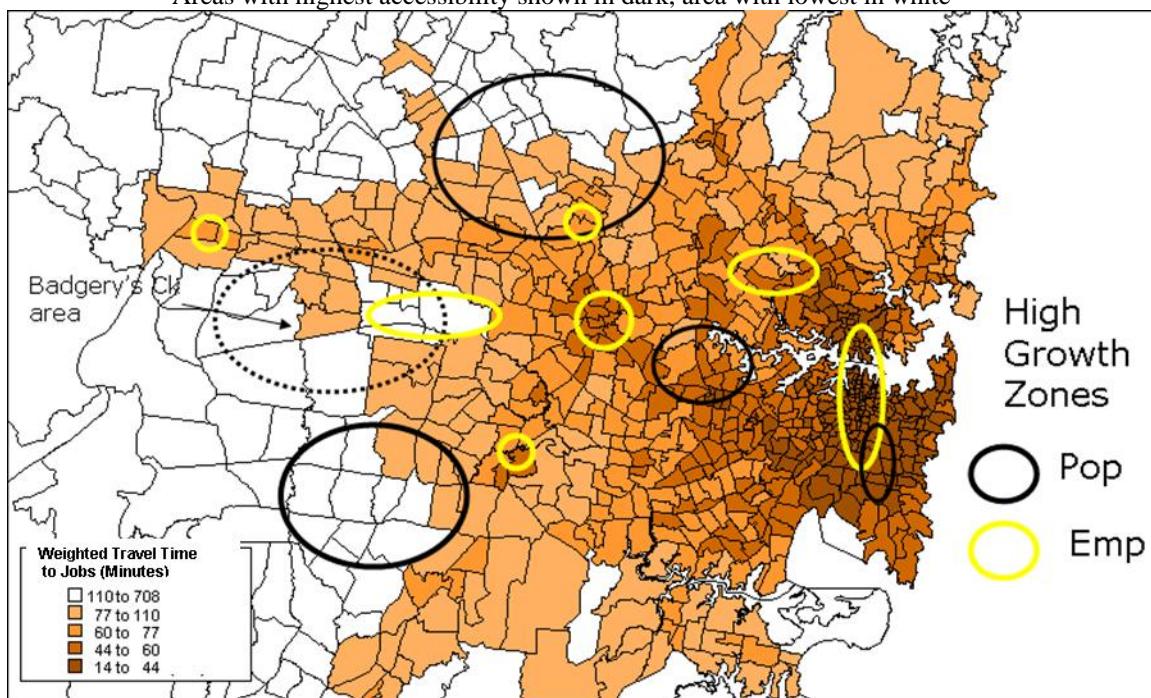
- **existing public transport accessibility problems; and**
- **future land use patterns.**

As shown below, the areas with the worst current public transport access are the NW and SW suburbs. Analysis of the likely growth patterns for Sydney suggests that the original “global arc” hypothesis of strong employment growth from the Airport to the Macquarie area remains valid. Strong job growth is also expected in other key centres including Parramatta, Norwest, Liverpool, Penrith and the Western Sydney employment lands.

In recent years housing supply in Sydney has slowed, particularly in new release areas. However reductions in developer charges and practical limits on urban consolidation is likely to see housing supply in the longer term to continue broadly in line with the metropolitan strategy’s assumptions of 30-40% in fringe areas and 60-70% in established areas, particularly in areas with good public transport accessibility.

Key Land Use Patterns and Transport Accessibility in Sydney

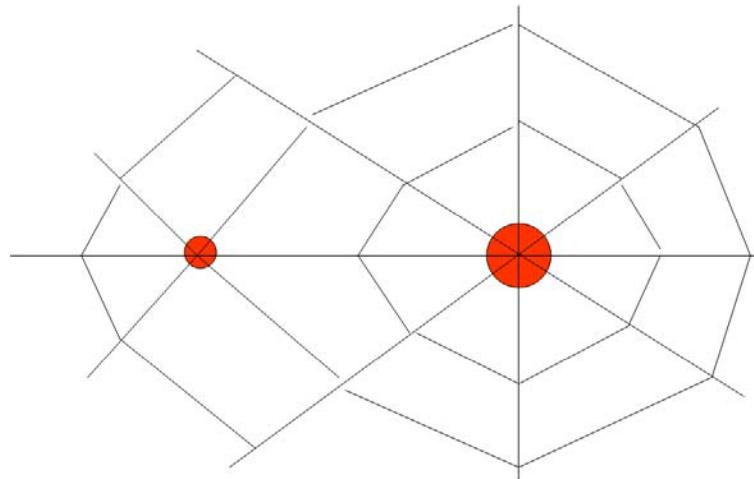
Areas with highest accessibility shown in dark, area with lowest in white



Sydney's historic CBD is increasingly off-centre as Sydney has spread to the west, and a second CBD is emerging at Parramatta. Accordingly Sydney needs a “double

“cobweb” public transport system, with radial networks based on Sydney CBD and Parramatta, supported by circumferential or “ring” routes for cross-regional travel.

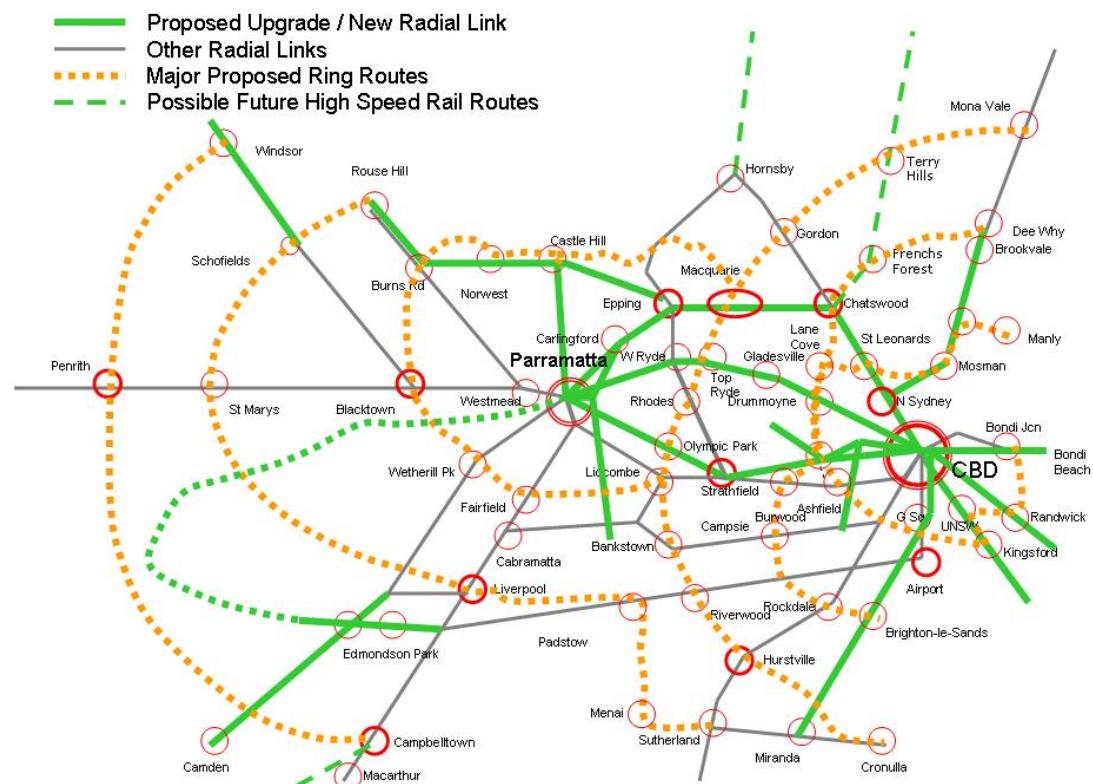
Double “Cob-Web” Design for Sydney’s Strategic Transport Network



CBD is off-centre. Secondary network needed for Parramatta.
Road system and topography make grid system impractical,
but more cross regional links needed.

An analysis of Sydney’s current public transport systems in relation to key centres and the above network geometry identified 26 strategic links in need of enhancement. These include both radial and circumferential links and are shown below:

Key Strategic Links for Sydney



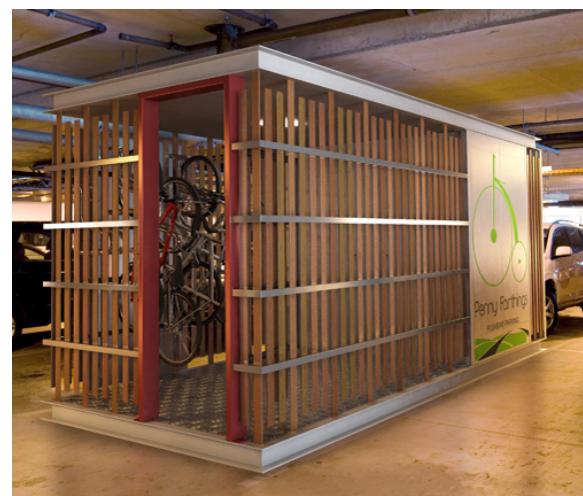
In addition to these strategic links, **improved local public transport access**, as well as **secure and safe parking** at stations and stops for cars, bicycles and scooters is required.

Similarly public transport needs to be converted into a **single seamless system** through integrated fares and fare collection, integrated passenger information and marketing and well designed interchanges.

Indicative Zoning Map for Sydney (left) and “Green Pod” Secure Bike Storage and Shower Facilities (right)



Source: Caldwell (2008)



Source: www.pushbikeparking.com/green-pod

Parramatta Interchange, integrated with retail, commercial and residential areas



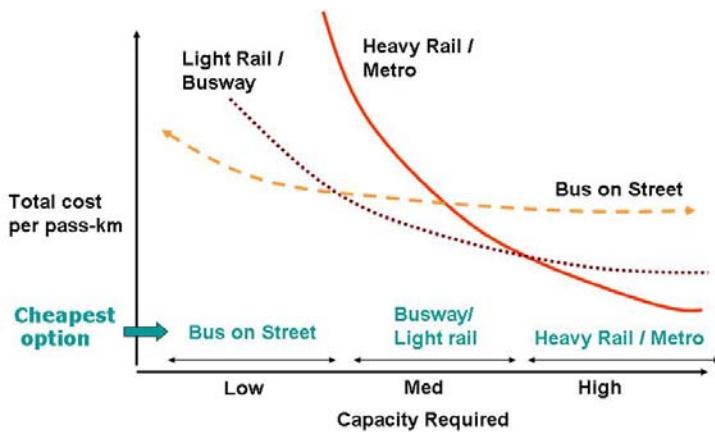
Step 4: Selecting the Most Appropriate Modes

Large cities like Sydney need a variety of modes to accommodate the variety of conditions in specific corridors and to meet a variety of travel needs. In selecting the most suitable mode for a given link or corridor it is necessary to consider a wide range of factors including overall cost and capacity, trip length, network integration and corridor conditions.

Overall Cost and Capacity

As shown below, different modes tend to be the most cost – effective in different situations: metros and heavy rail for high capacity medium to long distance routes; light rail and busways for medium capacity situations; and buses on regular streets for low capacity situations.

Cost – Capacity Relationship by Mode



Double Deck Heavy Rail is ideal for high capacity, long-distance routes



Light rail is ideal for medium capacity, short-medium distance routes, and city centres



Metros (Single deck) are ideal for high capacity, short-medium distance routes



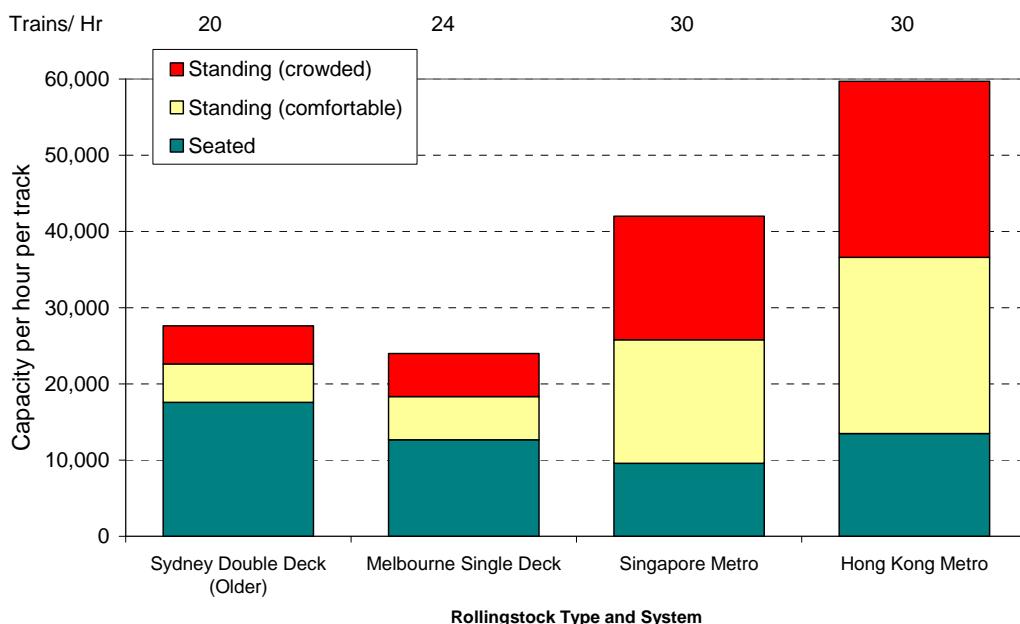
Busways are ideal for Medium-Low capacity, medium-long distance routes, but not for CBD's

Trip Length, Frequency, Comfort and Design

Trip length is also a key factor. For short trips comfort is not so important but high frequency is vital. For long trips, comfort and travel speed become important. For example Sydney pioneered double deck suburban trains to gain additional seating capacity for the typical long-distance trips from middle and outer suburbs and for intercity journeys – the average train trip in Sydney is nearly 18 km, twice that in many European and Asian cities. The extra seating capacity provides comfort, but at the expense of dwell time at stations. Double-deck trains can take up to 70 seconds to load and unload at busy stations like Town Hall in peak hours, limiting the maximum number of Cityrail trains per track per hour to about 20.

By contrast many metro trains overseas have multiple doors per carriage and limited seating. This allows fast loading and unloading – 30 trains per hour can be achieved. This can provide high overall capacity but relatively low seating capacity per hour. Train length is also important – Sydney's trains are 160m long (8 cars) and relatively long compared with many systems, though not as long as some, such as the very high capacity trains found in Hong Kong and Tokyo which can carry up to 2,000 passengers and up to 50-60,000 passengers per track per hour.

Seating versus Total Capacity: Examples of Heavy Rail and Metros



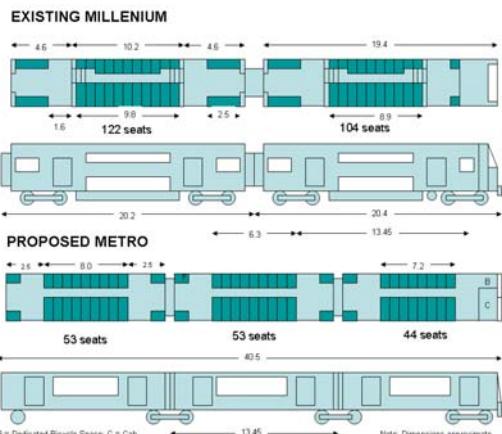
Similar considerations apply to light rail and buses. Light rail is often used for relatively short trips, and so some seats may be sacrificed to provide higher overall capacity. Sydney has recently introduced “Metrobuses” with limited seating and more space for standing for use on some of the shorter, more intensive bus routes.

Whilst extra capacity can be achieved at the cost of comfort by reducing seating capacity and adopting higher levels of crowding, the trend overseas is in the other direction. For example in Hong Kong rail planners are reducing the theoretical capacity of trains as they have found modern-day travellers want a higher standard of

comfort than in the past. Similarly, the latest “Spacium” metros for Paris adopt a high seating configuration, with some reduction in overall capacity but a high standard of comfort. Metros need not be “Sardine cans”.

Accordingly, **design standards** for different modes are proposed as part of the overall Strategic Plan (See Attachment 3 to Main Report). In particular a design is suggested for potential new metro trains, with 600 seats in a 160m long train, without sacrificing the traditional advantages of metro trains such as quick loading and fast acceleration.

Comparison of Rollingstock Designs



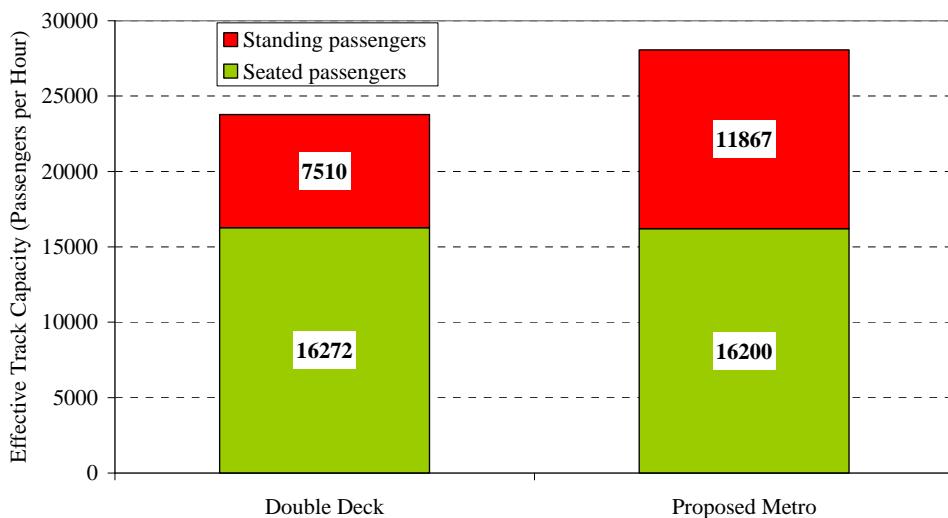
Cityrail Millenium and Proposed Metro



Bombardier “Spacium” Metro

This design allows up to 30 trains per hour, provided appropriate platform management systems such as screen doors, and automatic train control equipment is applied, for the proposed metro design. This provides the same seating capacity and greater standing and overall capacity than current double deck designs.

Effective Track Capacities: Proposed Metro versus Double Deck Design



Assumes 20 trains per hour for double deck, 30 trains per hour for metro. Standing Passenger Load calculated at density of 3 persons per square metre. Effective capacity = 90% of

Similarly design standards have been proposed for light rail vehicles to ensure compatibility and flexibility as well as appropriate levels of comfort.

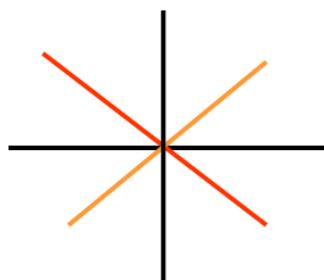
Network Integration

In examining the most appropriate mode for any given link in the system, it is also necessary to consider network integration issues. For example it is desirable that public transport systems operate through a CBD rather than terminating, to avoid use of expensive real estate for terminal stations or layover areas. Ideally there should be balanced loads from each end of a through route. Similarly, rail systems should have two or three branches feeding a single high capacity link through a CBD to fully utilise the capacity inherent with rail technology.

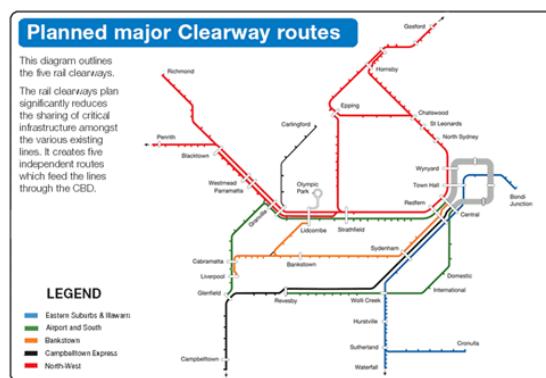
Networks should also be designed to minimise complexity whilst maximising utilisation. Unfortunately Sydney's rail system currently has numerous "flat junctions" which restrict capacity and cause operational difficulties, and a key task is to streamline this network. For example there are currently five alternative routes by which trains can run from Glenfield to the city, and three from Hornsby to the city. Genuinely radial systems as found in most cities are much simpler to operate.

Network Design: Genuine Radial versus Sydney's Rail System

A genuine Radial System



Sydney's Rail System



Corridor Conditions and Land Development Potential

It is also crucial to consider the environment through which any transport system is to operate, including the topography, availability of space in the corridor, adjoining land uses and potential for development. Sydney has difficult topography in some corridors, particularly on the North Shore, and a lack of space in some corridors, particularly in the CBD and inner suburbs.

This implies a need for tunnelling in some locations. Sydney sandstone is an ideal tunnelling environment in some respects. However depending on location, tunnelling through shale, mud or other material is required. Tunnelling under the harbour is particularly difficult given the depth of water and mud in some locations. Similarly tunnelling through the CBD is difficult because of underground obstacles in the form of existing rail, road, water, sewer, electricity and communications infrastructure as well as basements of buildings.

In all cases tunnelling is much more expensive per kilometre than surface construction, and hence the amount of tunnelling needs to be minimised wherever possible. For example the recently completed Epping – Chatswood rail line cost over \$200m per kilometre while the proposed CBD metro has a reported cost of \$4.8 billion for a 7-km system, or almost \$700m per kilometre. Where tunnelling is required, it becomes the major cost item. As a result, it is generally desirable to only use tunnelling solutions where high capacity heavy rail or metro systems are justified.

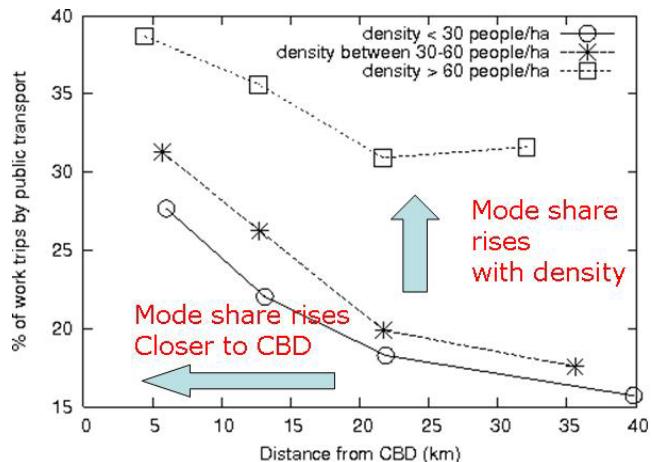
Similarly consideration is needed as to the extent of development which might ultimately follow the provision of improved public transport. While this can take decades to occur, there are already many examples in Sydney where rail has attracted development, such Bondi Junction, St Leonards, Chatswood, Hurstville, Strathfield, Hornsby and Parramatta.

Similar levels of development are expected to follow around metro stations, but somewhat less dense development is likely to occur around light rail. Busways tend not to attract development to the same extent as rail (with limited exceptions such as in Curritiba in Brazil) because of the environmental impact of large volumes of buses. Indeed most urban planners consider the use of light rail in particular as a major catalyst for transit oriented development and for high quality urban redevelopment.

Development Patterns and Transit Use



New Development around Subiaco Station in Perth



Relationship between Mode Share, Density and Distance from CBD in Sydney

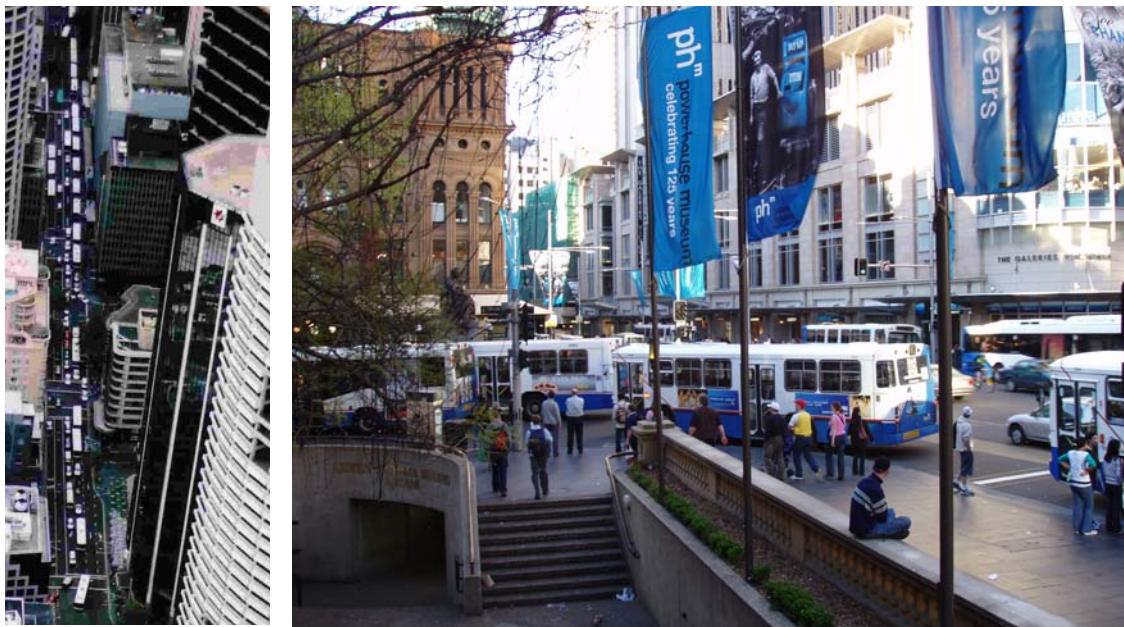
A particular consideration in Sydney is the CBD, which is a confined space with relatively narrow streets and significant congestion. Since the removal of trams in the 1950's on-street public transport in Sydney has been by bus. State Transit buses still only handle around 50% of the passenger numbers handled by the trams at their post war peak, but the city is now overwhelmed by buses, reducing amenity through their exhaust pollution and noise, and generating a low grade environment for what is Australia's world city and premium tourist destination.

The sheer volume of buses is also highly inefficient and takes up large amounts of space at key locations like Circular Quay for laying over between runs. There is a

clear case for replacement of many of these buses by light rail and metros, both to improve the amenity in the city and to improve the efficiency, capacity and appeal of the public transport system.

Cities around the world are pedestrianizing their city centres and in some cases introducing light rail to help create places where people want to be; for example case studies are provided in European Commission (2009) of cities like Nuremberg, Strasbourg, Cambridge, Oxford and Wolverhampton, where such moves are improving air quality, increasing commercial viability and bringing people back into the city centres.

City Centre Amenity Issues



Light Rail – Potential for Sydney CBD



George Street – now

George Street – future?

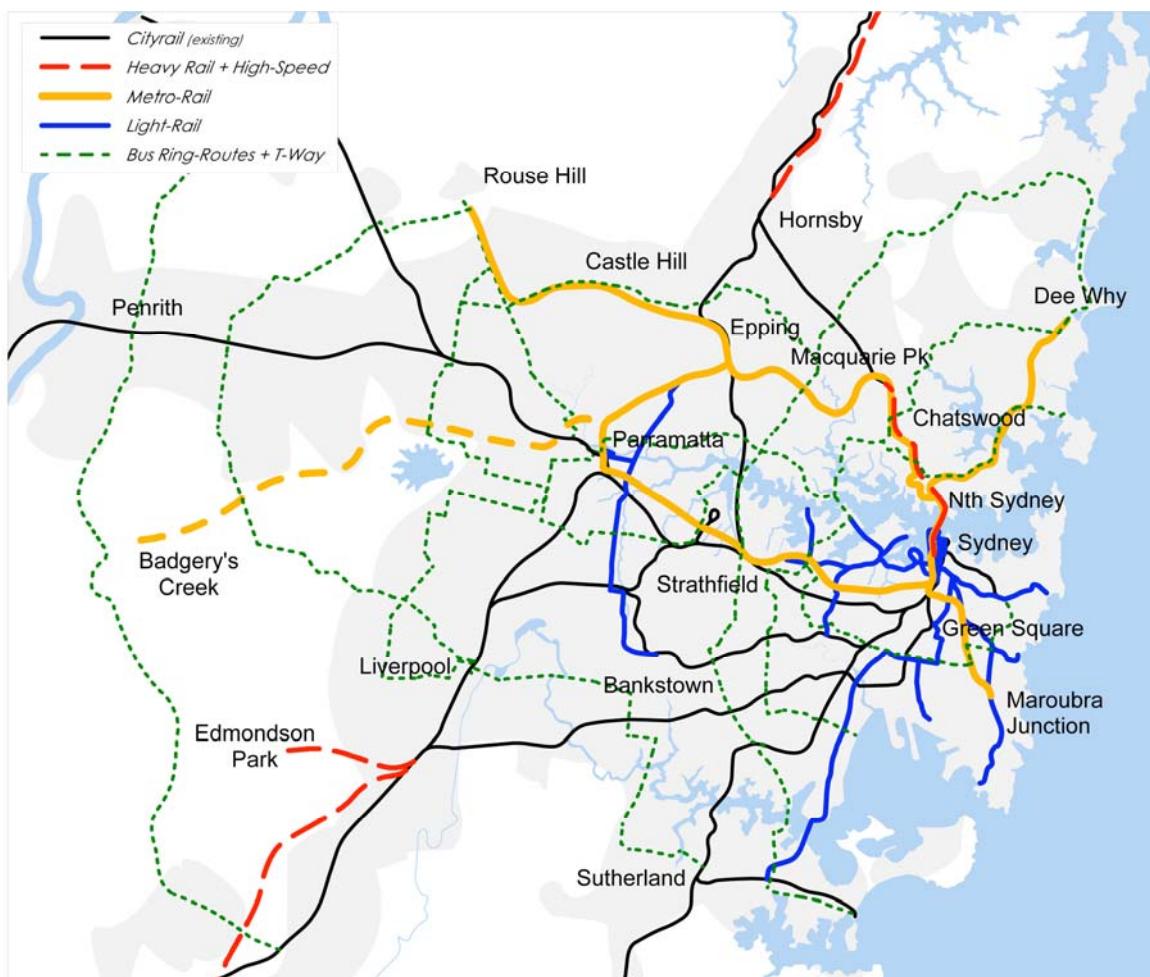
Source: City of Sydney

3 KEY FEATURES

Strategic Network and Preferred Modes

The twenty-six key links in the network were examined and preferred modes identified, as shown below.

Overall Strategic Public Transport Plan for Sydney



Details of the proposed links, including the rationale for selecting specific modes, are included in the Main Report and the Attachment Report.

Key elements include:

- Upgrades to the **Heavy Rail** System allowing a 50% increase in capacity
- A **Metro** network for more capacity, frequency and speed on key corridors
- **Light Rail** networks serving secondary corridors to the CBD and Parramatta
- **Bus-Based Ring Routes** for enhanced cross-regional travel

Heavy Rail Upgrade

- **Completion of key “Clearways” projects**

These include the Cronulla and Richmond Line duplication, additional quad track on the East Hills Line, and turnbacks at Liverpool

- **The SW Rail link from Glenfield to Edmondson Park**

This link extends the rail network to the South-West, which will see further urban growth in the future, and provides additional stabling for heavy rail trains. This line will enable high quality and high capacity services both to the CBD and beyond, and to Liverpool and Parramatta using the “Y” link.

- **A Fast North Shore link from Chatswood to Wynyard**

This provides a fast link from the North Shore into the CBD, saving at least 5 minutes travel time and providing increased capacity. The illustration below shows how the Fast North Shore Route will travel from the unused platforms at Wynyard, via the eastern lanes of the Harbour Bridge and across the Warringah Freeway on the same alignment originally used for trams. It then runs into a tunnel under the Pacific Highway with a new station under Miller Street and a potential station at Crows Nest, then parallels the existing North Shore from just north of St Leonards to Chatswood.

Fast North Shore Route and Metro over the Harbour Bridge



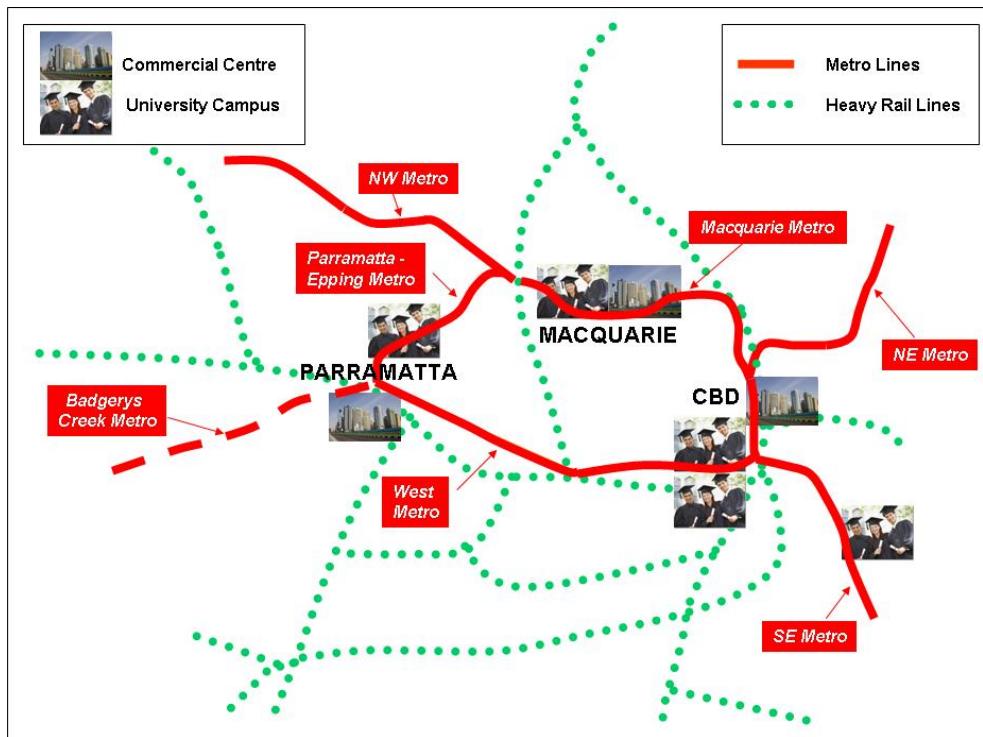
The plan also allows for development of **high speed rail network** including links to Newcastle and beyond, Canberra and beyond, and the Illawarra. The Metro Pitt Street corridor under the CBD is reserved to enable this to be provided.

Metro Network

A Metro Network is proposed to fill the most important gaps in the heavy rail system, and to link key commercial centres and universities with the rest of the public transport system. Seven key components are proposed, forming a connected ring:

- **West Metro** from Parramatta to Wynyard, via Strathfield
- **NW Metro** from Epping to Rouse Hill
- **NE Metro** from North Sydney to Dee Why
- **SE Metro** from the CBD to Maroubra Junction
- **Parramatta to Epping Metro**
- **Macquarie Metro** from Epping to Wynyard (using existing line)
- **Parramatta to Badgerys Creek Metro** (long term)

Key Metro Network Components



Key Features of the Metro Network

The metro network and rollingstock is designed to **maximise cost effectiveness** by:

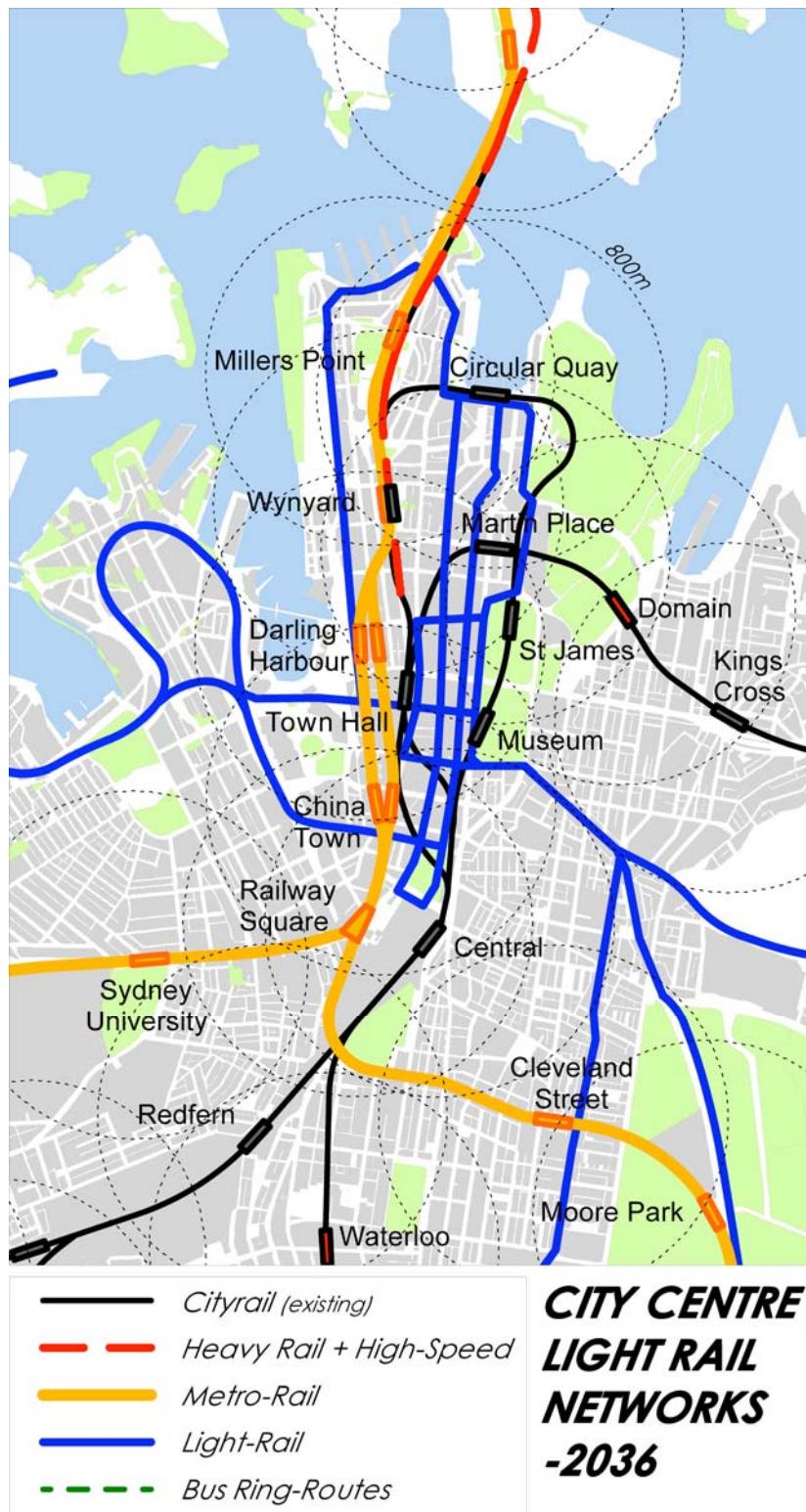
- avoiding any underwater crossings
- minimising tunnelling and deep underground stations
- using 162m long trains which are the same length and width as current double deck trains and are compatible with the existing stations
- utilising existing unused infrastructure, including the old Tram Platforms at Wynyard station and the four-platform station at North Sydney
- providing grade separated junctions at Central (where the SE and West Metros join); North Sydney (where the NE and NW metros join) and Epping (where the Parramatta and NW metros join). This enables 30 metro trains per hour through the busiest part of the system between Central and North Sydney.

Details of the Proposed CBD Networks

In the city and adjacent areas there would be new metro stations at Sydney University, Railway Square, Chinatown, Darling Harbour and Cleveland Street (and potentially also at Millers Point, serving the Rocks and the northern part of Barrangaroo).

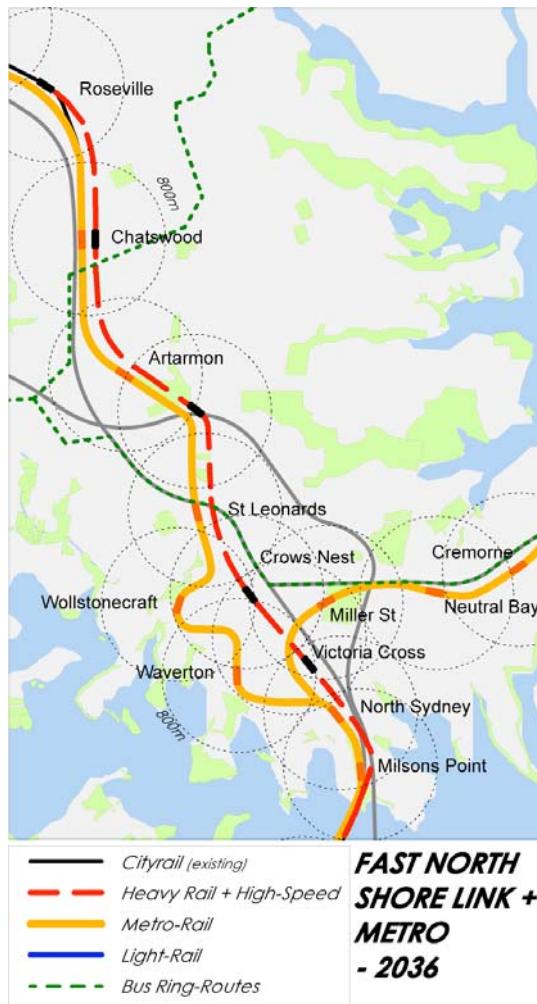
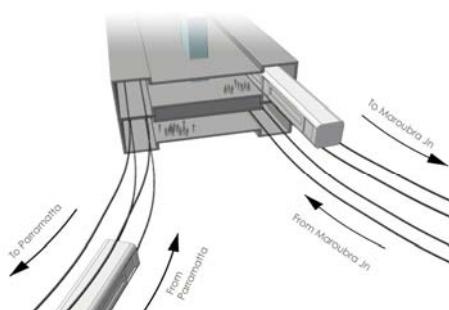
Wynyard station would be upgraded to six platforms, including four for heavy rail and two for metros. There would also be potential new heavy rail stations at the Domain and at Waterloo on the East Suburbs and Airport lines respectively.

This provides up to 20 additional rail platforms, and nine new rail stations in the CBD – South Sydney area over the next 30 years. This will expand the public transport system in what is the highest density region in Australia.



There would also be a significant light rail network in the CBD and inner suburbs (see later discussion).

Railway Square Station showing grade-separated junction for West and SE Metros



In the Lower North Shore, there would be new heavy rail stations at Gore Hill and potentially Crows Nest, and new metro stations at Miller Street, Neutral Bay, Cremorne and Spit Junction.

In Parramatta, there would be new metro platforms at Parramatta station and new metro stations at North Parramatta, as well as at Childrens Hospital, providing a total of five stations serving our second CBD, which extends from Westmead to Granville.

In Macquarie, the combination of the NW and Parramatta – Epping metros will feed up to 20 metro trains in each direction through the North Ryde area by 2036, with the potential for up to 30 in each direction long term (some of these would terminate/originate at St Leonards station, which would be modified to a four-track facility).

Across Sydney, the metro network will provide substantial capacity, speed and convenience improvements on the NE, NW, SE, West and Parramatta – Epping corridors. In the first four of these corridors, metros will at least double the potential capacity of the current bus system, as well as provide substantially faster services. This will allow many buses to be re-allocated to improved circumferential and cross-suburban routes. The proposed metro between Parramatta and Epping is also crucial as it connects people in Western and South-Western Sydney with the important job concentrations in the Macquarie – Chatswood – St Leonards area, while also connecting the skilled labourforce in the north shore with Parramatta, Sydney's second CBD.

Light Rail

Light Rail has the potential to transform the streetscapes and amenity of Australia's premium city, as has happened in numerous cities around the world, as shown in Melbourne below.



The Plan includes a number of Light Rail networks, specifically:

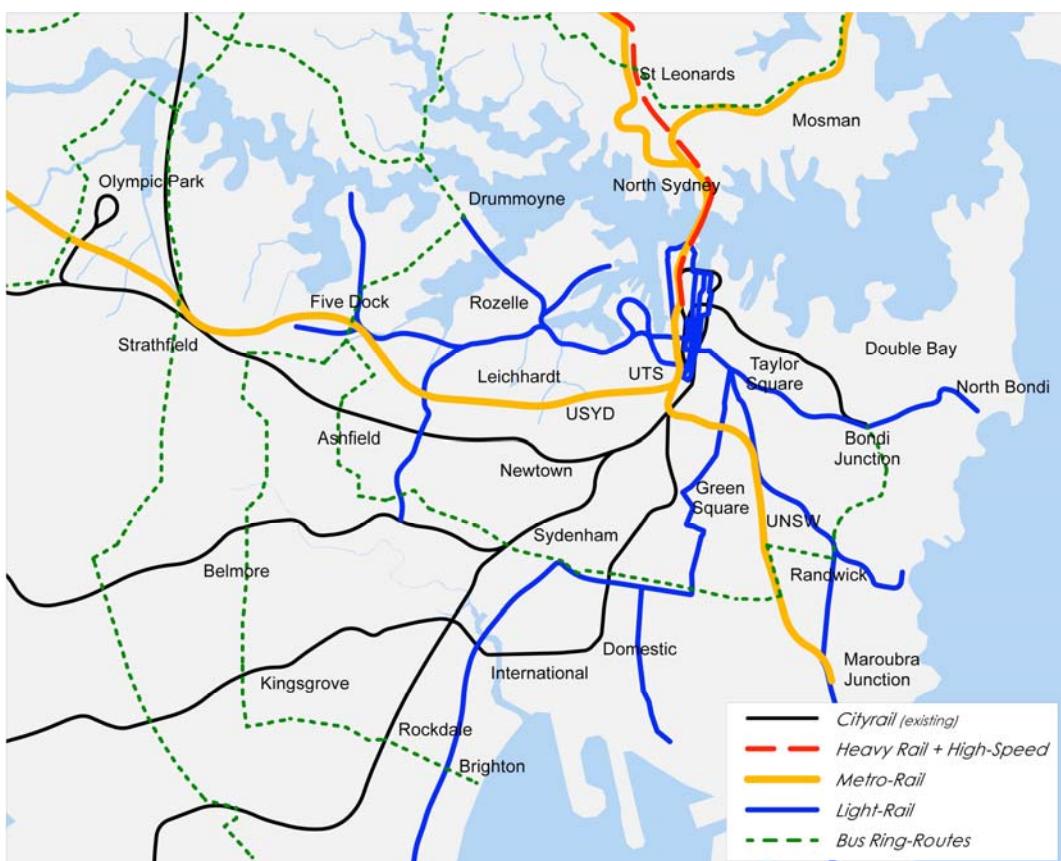
- A network for the **Inner Western** suburbs, building on the existing Light Rail line to Lilyfield, and including branches to Dulwich Hill, Drummoyne, Abbotsford, Burwood and White Bay.
- A network for the **South Eastern, Southern and Eastern** suburbs, including branches to Bondi Beach, Coogee, Maroubra, Botany and Cronulla via Mascot and the F6 corridor
- A network based on **Parramatta**, starting with conversion of the Carlingford Line to Light Rail and extension into Parramatta CBD, plus a link south to Bankstown utilising part of the Clyde to Rosehill branch (shared with freight traffic)

Within the CBD, it is proposed that there would eventually be three loop lines:

- a **North-South Loop** utilising Pitt and Castlereagh Streets, serving the Inner West network;
- an **East-West Loop** utilising Liverpool, George, Park and Elizabeth Streets, serving the SE, E and South lines; and
- an **Outer Loop** utilising Sussex, Bathurst, Elizabeth, Macquarie, Alfred Streets and Hickson Road, to link Barrangaroo, the Opera House, the Rocks and the King Street Wharf area to town Hall and the centre of the CBD.

The map below shows the proposed routes in the CBD and inner suburbs.

Light Rail and other Enhancements in the Inner Suburbs



Light Rail was found to be the most appropriate mode for these corridors, given the capacity required; surrounding land uses and potential for development; space available; corridor length and other conditions. For example:

- The goods line from Lilyfield to Dulwich Hill provides a particularly easy and low cost light rail extension serving existing and proposed medium density residential areas, such as the redevelopment of the Lewisham Flour Mill site.
- Anzac Parade and some of the other corridors in the East and South-East were originally tram routes and are ideal for the re-introduction of light rail
- The F6 corridor from Mascot to Sutherland is also ideal for light rail, since this avoids the cost and water table problems which would be involved with a fully grade separated metro.
- The Carlingford heavy rail line was originally built as a private light tramway, has steep grades and tight curves, and is not ideal for heavy rail. However conversion to light rail and extension from Camellia into Parramatta CBD would enhance access to Parramatta from this corridor.

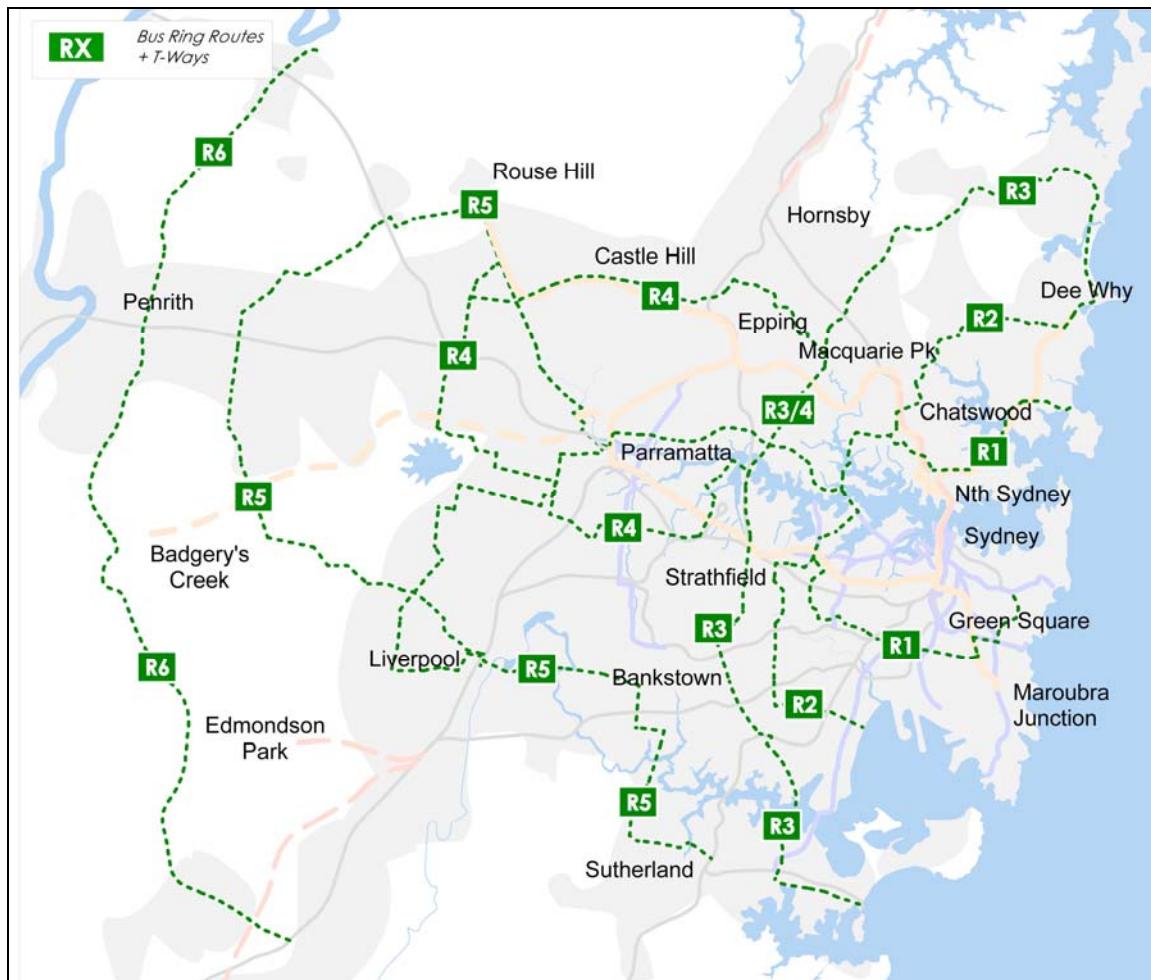
Other light rail routes are also possible. The important thing is for Sydney to realise some of the benefits which other cities, including Melbourne, Adelaide and in the future the Gold Coast, have recognised in having an environmentally sustainable light rail network.

Bus Ring Routes

The plan also includes Six Bus-based “Ring Routes” to provide for circumferential travel, including:

- R1 from Manly to Bondi Jcn via North Sydney, Drummoyne and UNSW.
- R2 from Dee Why to Brighton, via Frenchs Forest, Chatswood, Drummoyne, Burwood and Rockdale.
- R3 from Dee Why to Cronulla via Mona Vale, Gordon, Macquarie Park, Top Ryde, Rhodes, Strathfield and Hurstville and Miranda.
- R4 which is centred on Parramatta and runs from Castle Hill to Pennant Hills, Macquarie Park, Rhodes, Olympic Park, Lidcombe, Fairfield, and Blacktown back to Castle Hill.
- R5 from Rouse Hill to Sutherland via St Marys, Liverpool and Menai
- R6 from Windsor to Campbelltown via Penrith and Bringelly.

Key Bus Based Ring Routes



Bus-based systems are considered the most appropriate for these longer-distance, non-radial corridors, since they lack the demand density at this stage for rail based systems. However in the longer term some of these may justify upgrading to light rail or potentially metro.

Integration and Access

The overall system would be operated as a single, seamless system with:

- integrated fares and ticketing
- well designed interchanges
- integrated timetabling and real-time passenger information.

While the strategic networks will be significantly expanded from the current system, there will still be many people who live outside convenient walking catchments of the network. **Local bus** services would be enhanced, including the provision of demand-responsive services. The steady provision of metros and light rail on some of the busier radial bus routes will release more buses for local services.

In addition, it is proposed that there be **1,000 car park and ride** places added per annum over the next thirty years at strategic locations, where there is good road access (e.g. from motorways or major arterial routes); land available for the construction of facilities; and high quality (frequent and fast) rail, metro, light rail or bus services available. The map below shows planned locations of these key facilities (see Main Report for more details).

Strategic Park and Ride Facilities

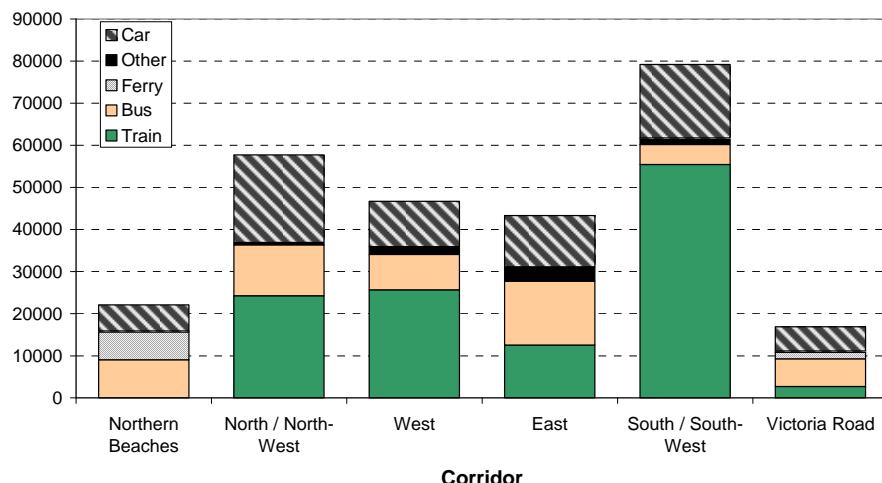


In addition it is proposed that there be up to **7,000 secure bike and scooter parking** facilities provided per annum across the network, at virtually every station, metro, light rail and ferry stop, and at major bus stops. Some of these should include shower / change facilities. Cycling extends the effective area of catchment of a station by a factor of nine times, and provides a healthy complement to public transport travel.

Capacity Enhancement

The plan also addresses the most strategic corridors, which are the South-West, North West, West, East and Northern Beaches corridors, as shown below, by providing new or upgraded heavy rail or metro lines in these corridors.

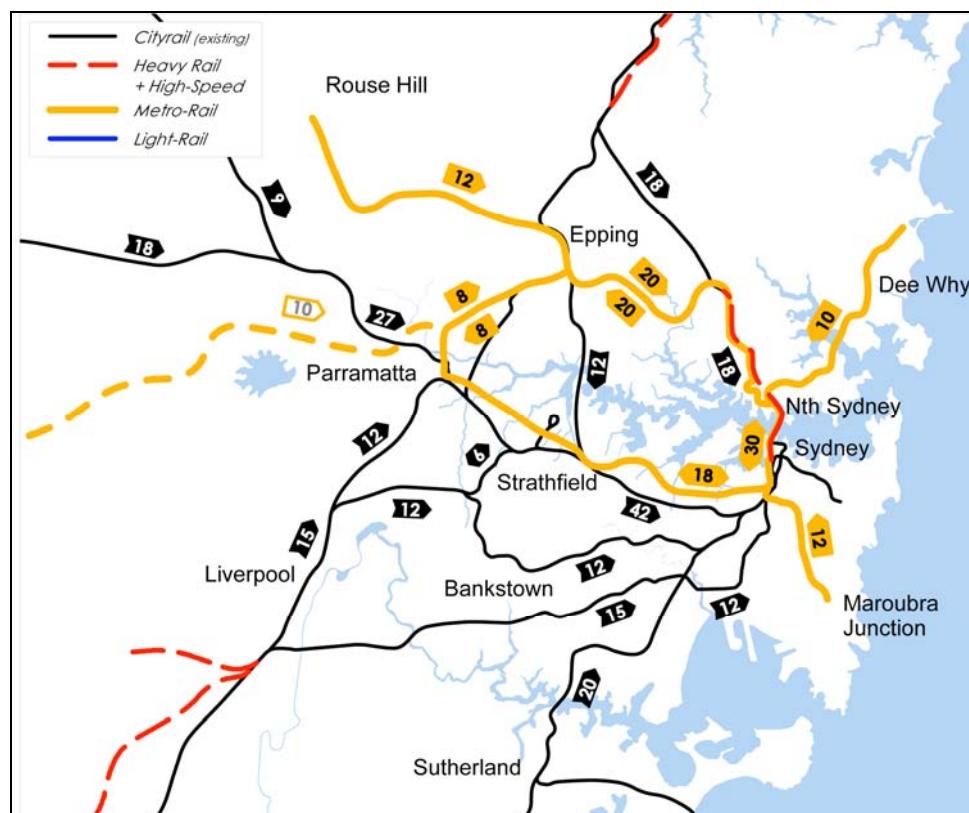
Passengers Travelling to CBD, 2006 Weekday



Source: NSW Transport Data Centre, 2008.

In terms of capacity, the plan provides for a 90% increase in the number of heavy rail and metro trains which could operate in the peak hour compared with 2006 (see below). It also provides for further expansion beyond 2036 including high speed rail.

Capacity of the Proposed Heavy Rail and Metro Peak Train Paths (2036)



4 FUNDING AND IMPLEMENTATION

Current Transport Costs

In 2006, Sydneysiders spent over \$22 billion on their cars for urban trips, or about \$5,000 per man, woman and child. This included the direct costs of owning and operating cars, such as petrol, tolls, paid parking, maintenance, depreciation, insurance and registration charges. This implies a direct financial cost to motorists of over **\$660 billion** over the next 30 years, even if there was no increase in the number of kilometres driven on our roads.

In addition motorists generate a further \$18 billion annually in external costs. These are borne by others, including other motorists, pedestrians, public transport users and the community generally. External costs include congestion, accidents (over and above insurance payments), greenhouse gas and other emissions, subsidies for roads and parking and other costs such as noise and water pollution.

Estimated Costs of Cars in Sydney for Urban Use (2006).

COMPONENT	\$ million	\$ / Veh-km	\$ / Pass-km	% of Total
Petrol/ fuel (at \$1.40 / litre)	\$5,886	\$0.18	\$0.12	14.3%
Tolls	\$319	\$0.01	\$0.01	0.8%
Paid Parking	\$309	\$0.01	\$0.01	0.8%
Private Out-of-Pocket	\$6,515	\$0.20	\$0.14	15.9%
Other User Costs *	\$16,370	\$0.50	\$0.34	39.9%
Total User Costs	\$22,885	\$0.70	\$0.48	55.8%
Congestion	\$9,597	\$0.29	\$0.20	23.4%
Accidents	\$3,072	\$0.09	\$0.06	7.5%
Greenhouse Gas Emissions	\$118	\$0.00	\$0.00	0.3%
Air Pollution	\$972	\$0.03	\$0.02	2.4%
RTA Subsidies	\$589	\$0.02	\$0.01	1.4%
Unpaid Parking	\$2,803	\$0.09	\$0.06	6.8%
Noise, Water Pollution, Other	\$1,001	\$0.02	\$0.02	2.4%
Total External Costs	\$18,152	\$0.55	\$0.38	44.2%
Total Costs	\$41,037	\$1.25	\$0.86	100.0%

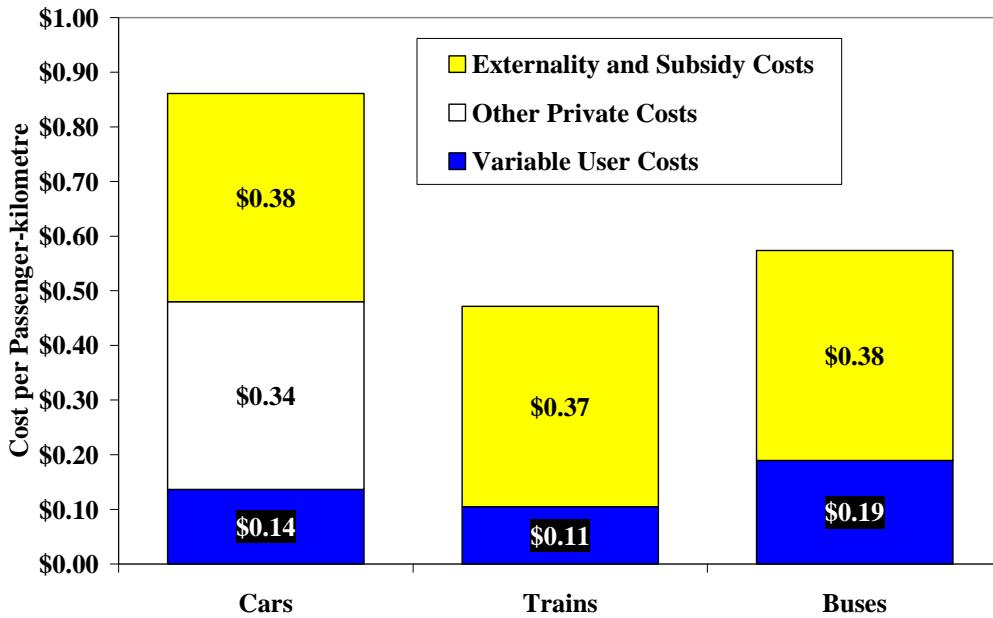
Source: Glazebrook (2009) * Depreciation, registration, insurance, maintenance.

By contrast we spent only \$3.2 billion in 2005/6 on public transport, including both the fares we paid and direct subsidies by government, with a further \$360 million in external costs. Cars are thus our most expensive mode, costing 86c per passenger-km compared with 47c for rail and 57c for bus (all figures include externalities and for 2006). Our current transport system is too heavily weighted to cars, the most expensive and least sustainable mode.

Why is this? Certainly cars are often convenient, and we pay for that convenience. But another key factor is that as motorists we are only aware of the costs of petrol,

tolls and paid parking when we make a trip, and these “variable user” or “out of pocket” expenses are only about one-sixth of the total costs to society, or even less for people provided with free parking at work or company car benefits. In effect we subsidise each other to drive more than we should, and in the end we all pay for this as a community.

Costs per Passenger-kilometre for Cars and Public Transport in Sydney (2005/6)



Source: Glazebrook (2009). Note “operator” costs are covered by fares plus direct subsidies to the operator. In addition there are other subsidies to the RTA for construction of buslanes, T-Ways etc.

A More Sustainable Future

Sydney thus has an inefficient and unsustainable transport system. But Sydney is also very vulnerable to future oil price rises and to measures to reduce greenhouse gases. The overall 30 year plan is designed to restore some balance by allowing a doubling of public transport patronage. It is estimated to cost \$40 billion over and above the \$90 billion which maintenance of the current spending level to 2036 would entail.

This may seem a large amount, but in fact it would require allocation of resources equivalent to **only 6% of our current direct car-related expenditures** and would lead to substantial long term financial as well as environmental and health savings. As indicated in Chapter 2, “business as usual” will see vehicle kilometres of travel rise by at least 30% by 2036, whereas the 30 year plan will hold VKT at current levels.

The 30 year plan would result in a **saving of at least \$100 billion in directs costs to motorists**, with additional savings in external costs. In particular in the absence of this plan, congestion and greenhouse gas emission costs are likely to increase rapidly as we properly price in the costs of climate change, whilst fuel bills are also likely to rise steeply in future.

The 30 Year Plan is thus not only environmentally responsible, it is economically sensible. It will help Sydney survive the coming challenges.

Funding Options

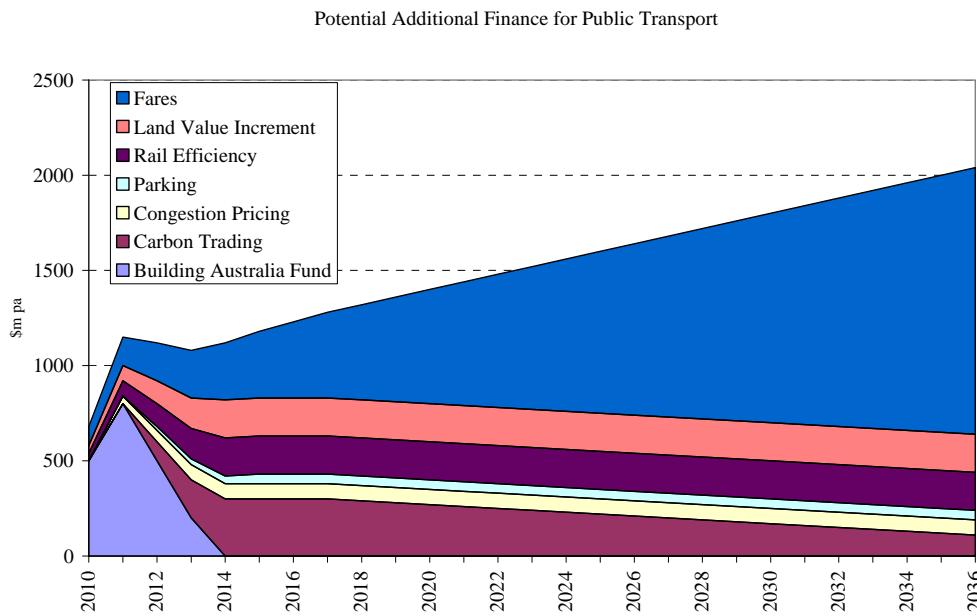
Whilst the 30 Year Plan makes overall economic sense, we still need a way to actually finance it. In this context, it is expected that there would need to be significant borrowing in the early years to enable the infrastructure to be put in place as soon as possible. However borrowings have to be repaid. Fortunately there are a wide range of options for raising the additional funds required for repaying the borrowings for capital investment and meeting the increased operating costs involved in implementing the plan. Examples of the options and various assumptions associated with them are shown below:

- **Infrastructure Australia Fund.** Latest indications are that there may be in the order of \$10 billion available shortly in the first allocation of this fund across Australia for transport related projects, with potentially more in future. It is assumed that Sydney receives a total of \$4 billion from this fund over the next few budgets.
- **Carbon Trading:** This is assumed to be introduced in 2010-11 at a modest initial rate of A\$20 / tonne CO₂. If applied to all CO₂ emissions in Australia, this would amount to approximately \$11 billion pa. It is expected that the CO₂ price will escalate over time – the most recent IEA report indicates potential of US\$90 - \$140 per tonne. At the assumed rate of A\$20 / tonne, and assuming public transport in Sydney was allocated 15% of the per capita revenue available from Sydney, this would amount to \$60m pa in 2010/11, potentially rising to perhaps \$300m by 2014, then declining slowly thereafter as carbon emissions fall.
- **Congestion Pricing:** The State Government recently introduced a mild form of congestion (time-based) pricing on the Harbour Bridge in the mini-budget. Earlier research indicated that a \$6 cordon charge for vehicles entering the CBD would raise approximately \$60 million pa after allowing for exemptions and elasticity effects (Glazebrook, 2005). Alternatively, a \$1 peak period toll on Sydney's motorways could raise in the order of \$80 million pa.
- **Parking Levies:** The State Government collected \$44m in 2002 from the parking levy applied in the CBD, Parramatta, Chatswood, Bondi Junction and St Leonards. The levy was recently raised in the mini-budget. It is assumed that extension of the charge to other key centres, and increases in the rates for the existing major centres could therefore raise an additional \$50m pa.
- **Increased Public Transport Fares.** A 20% real increase in fares phased in over four years to 2012, would generate \$200m pa extra revenue by then. If fares were then held constant in real terms, but patronage increased by 2.5% pa (in line with capacity in the proposed plan) then fare revenue would continue to increase over time.
- **Efficiency Gains:** Recent reports to the Government (IPART, 2008) have highlighted areas within the rail network where significant cost savings could be achieved through improved efficiency, including train and track maintenance, staffing levels on stations, and driver-only operation of trains, as well as in central management. It is assumed that various measures could result in efficiency savings building up to \$200m pa for rail (minimum) after five years.

- ***Land Value Capture.*** Proposals have been put to the State Government by the Property Council to replace the current State Infrastructure Charges with a Tax Increment Financing system. This approach is fairer than up-front levies and causes less problems of housing affordability. It is assumed that such a financing vehicle is developed and applied more widely, for example to areas within 500m of light rail stops, and one km of new rail stations or stations which are undergoing redevelopment. It is estimated that this could generate \$200m pa within 5 years.

The figure below illustrates how these combined funding initiatives could raise the required revenues. Note that these revenues are on top of current fare-box revenue as well as existing government subsidies, which are assumed to be maintained in real terms at constant per capita levels. Note also that all costs and revenues are in today's (2009) dollars.

Potential Financing Options for the 30 Year Plan



The revenue from additional fares builds up steadily over time as patronage grows, and is very significant over the 30 years of the plan. However other sources, particularly the Building Australia Fund and Carbon Trading will be important in early years in enabling major projects to commence.

While nobody likes new taxes, it is important to recognise that the 30 year plan will lead to much larger savings for motorists, and also large savings in road construction (on projects like the M4 East), by enabling overall traffic volumes to be held constant.

Clearly there are other possible combinations of these and other financing options which could be used. The key conclusion is that it is feasible for Sydney to build a world class public transport system, using only a relatively small proportion of the total expenditure currently being allocated to our cars. The question to ask is: How viable will our city be in 30 years if we don't move in this direction?

Staging and Timing Options

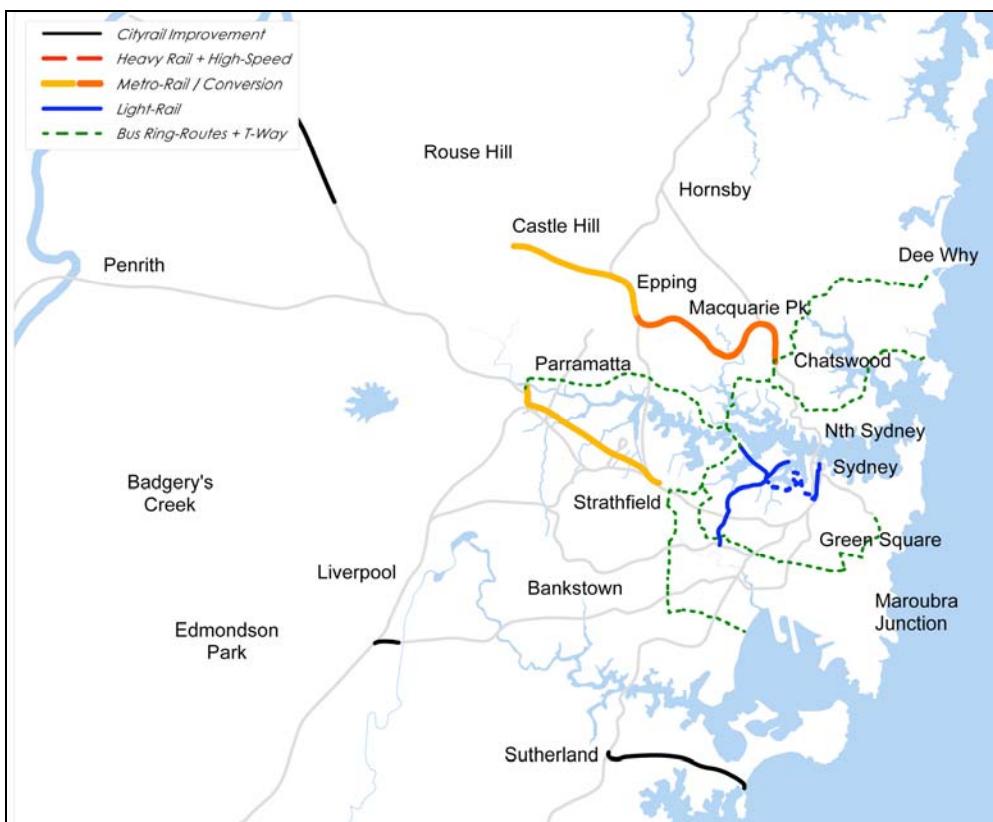
The issue of priority and timing for any specific links is ultimately political, but should reflect consideration of current needs, future growth, funding available and technical issues such as the need for stabling facilities for trains, or to find locations to commence tunnelling operations.

An indicative staging plan is set out below covering three broad time periods: Stage 1: (2009- 2016); Stage 2: (2016 – 2026); and Stage 3: (2026-2036). There would also be some projects expected after 2036, such as some of the high speed rail projects. More details of staging options for heavy rail, metro and light rail are included in Attachment 5 to the main report and in the Strategic Benefits and Staging Plan, but some summary information is shown below.

Stage 1 (2009 – 2016)

This includes high priority projects to address key transport needs, as shown and briefly discussed below.

Potential Staging Plan – 2009-2016



(a) Completion of Key Heavy Rail Projects.

This includes completion of the Cronulla and Richmond line duplications, the first stage of the SW rail link (remodelling of Glenfield station and associated Park and Ride facilities) and other clearway projects such as the Liverpool turnback.

(b) NW Metro and Macquarie Metro Stage 1

The first stage of the NW rail link, from Epping to Castle Hill, would be built as a metro, together with the conversion of the Epping – Chatswood line for metro operation. Significant planning work has already been done on the NW rail link, and no major change is required for it to be built as a metro, since the trains proposed are identical in length, width, door height etc. An early start on construction is therefore possible, with tunnelling commencing from the vicinity of Franklin Road station.

This is a key corridor with substantial existing needs and further pressure as population growth continues in the North-West and job growth occurs in the Macquarie area. The first stage allows metro trains to be run from Castle Hill to Chatswood, with six services per hour proposed on opening. South of Chatswood there would be 18 heavy rail trains per hour (compared with 13 at present) to handle the extra passenger volume. The metro trains would be stabled at the existing six track yard at Lavender Bay overnight, but would be able to operate to the maintenance centre on the West Metro (see below) via the main northern line.

(c) West Metro Stage 1 (Parramatta – Strathfield)

The route proposed for this link is mostly at grade, close to the M4, with short tunnel sections approaching Parramatta and approaching Strathfield. It provides high quality rail access to Olympic Park, and excellent options for Park and Ride facilities immediately off the M4. Six services per hour in each direction are proposed initially. There is spare capacity at Strathfield on heavy rail trains (especially those starting empty at Homebush, and also the intercity trains from the north) for passengers from the metro heading east. The route passes close to major industrial areas so there are various options for establishing the main metro train maintenance facility in the area, which could be accessed using the Carlingford line if necessary.

(d) Inner West and CBD Light Rail Stage 1

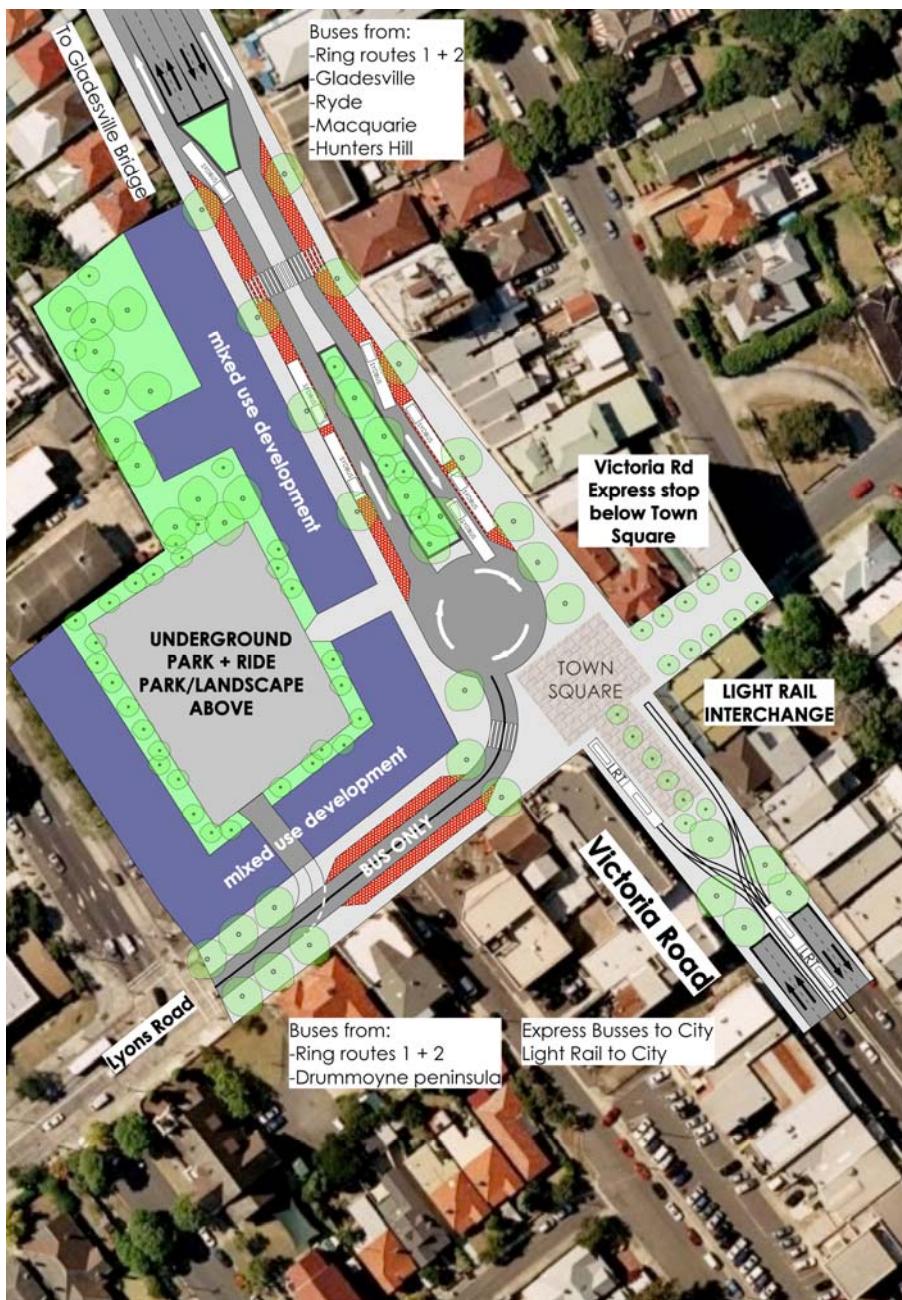
This incorporates a number of projects, all of which could be completed by 2016. Later extensions can include branches to Burwood and to Abbotsford via Five Dock, where there would be an interchange with the West Metro. The proposed elements for Stage 1 include:

- The extension of the existing line from Lilyfield to Dulwich Hill, which can be commenced in the near term, with construction starting by 2010,
- A short cut-off tunnel under Pyrmont, which reduces travel time by 5-6 minutes for services from Glebe and points west to the city (a service to Fish Markets and Wentworth Park from Central via Pyrmont would continue as at present)
- The CBD loop from Hay Street to Circular Quay using Pitt and Castlereagh Streets. Most services from the inner west would run into the core of the CBD using this loop.
- A branch from Rozelle Bay to White Bay.
- A branch from Rozelle Bay to Drummoyne, providing increased capacity in the Victoria Road corridor.

As illustrated below, the intersection of Lyons Road and Victoria Road, Drummoyne is considered to be the ideal location for an interchange on the Victoria Road corridor:

- It is the natural location for connecting the range of bus services to the north and west with the high capacity link to the CBD.
- It allows creation of an efficient and low-cost interchange between buses and light rail, and the development of a town square, associated mixed use development and additional open space on the NW side of the intersection.
- The natural topography facilitates diverting car traffic (and express buses) under the intersection, in conjunction with an underground park and ride facility, which will reduce traffic inbound to the city.

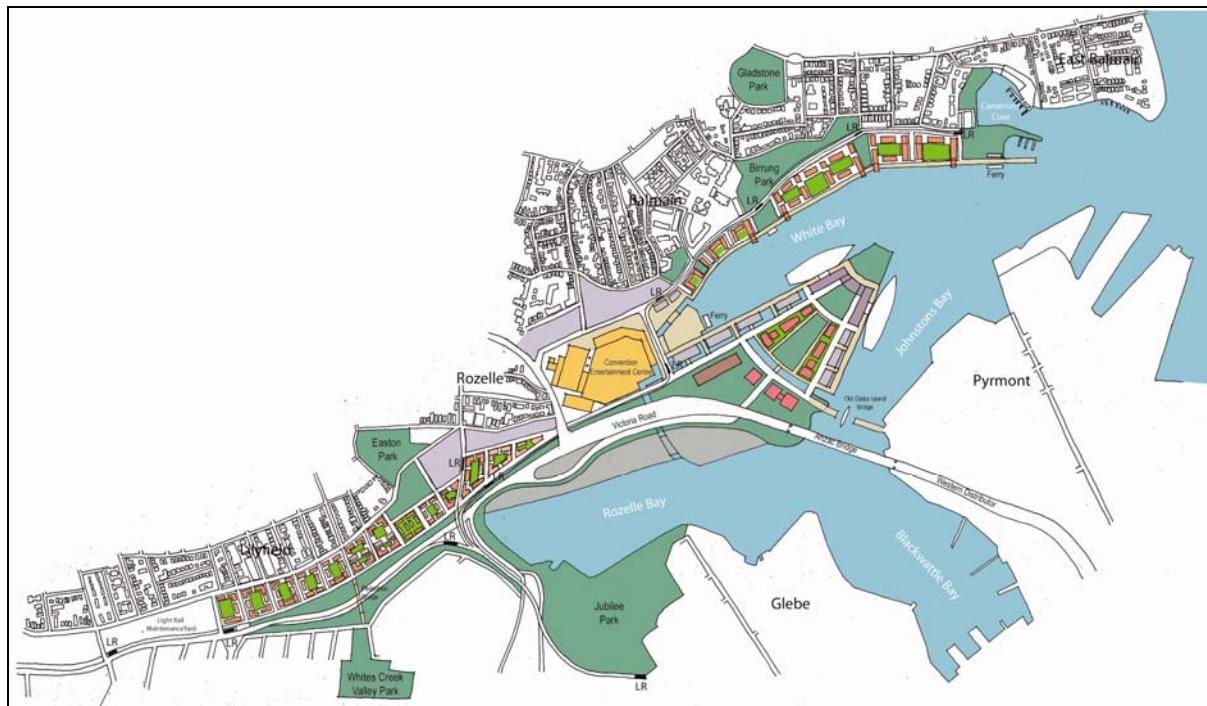
Proposed Drummoyne Interchange and Town Centre



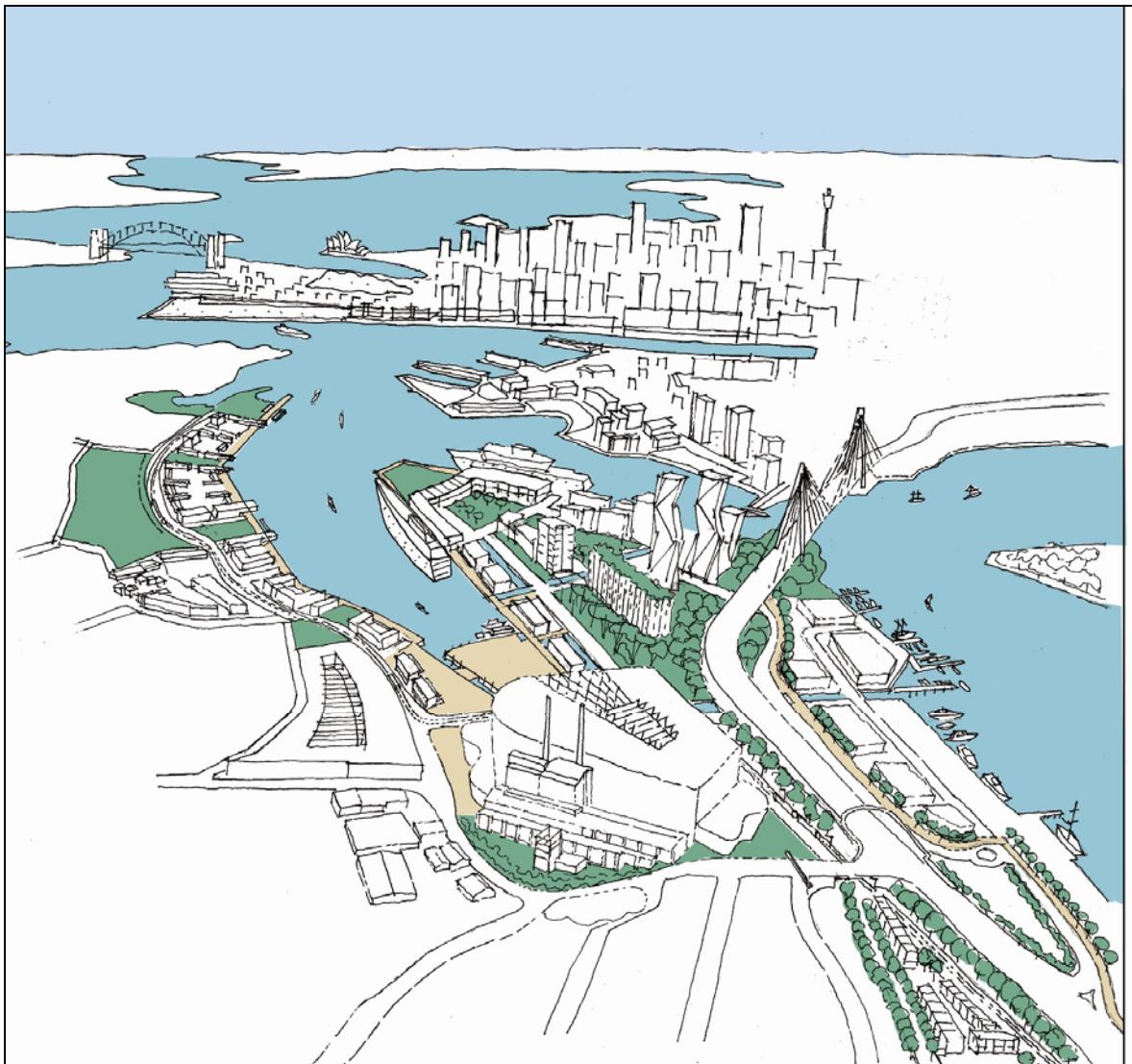
Light Rail provides the ideal mode for enhancing public transport in the Inner West. There is significant spare capacity on the existing system, enabling traffic to be reduced in the area through the provision of improved public transport services and strategic park and ride facilities. Light Rail can also support transit-oriented development on former industrial or other land in locations such as Rozelle Bay, White Bay, Wentworth Park and the Flour Mill site in Lewisham. For example, illustrated below is one possible scheme for the White Bay – Glebe Island – Rozelle Goods Yard area, developed by Margaret Petrykowski (2009), featuring:

- Low rise (2-4 storey) townhouses and apartments in the Rozelle Goods yard area, plus a light rail maintenance facility underneath a park and ride facility (topped with a park), in the cutting south of Lilyfield LRT stop.
- A refurbished White Bay Power Station and associated Convention and Entertainment Centre. This would complement the existing convention centre in Darling Harbour and cater for smaller and specialised events
- A new International Cruise Ship terminal with two berths and associated hotels and other facilities on Glebe Island, as well as berths for smaller vessels such as Harbour Cruise operations.
- Low rise apartments along the edge of White Bay with some mixed use development at the southern end close to the convention centre.
- Extensive additional open space in all precincts, together with continuous public access to a waterfront promenade along the edge of the harbour.
- An extensive cycleway network connecting with other regional and local cycleways.
- Additional ferry services to Circular Quay / King Street Wharf. Suggested stops would be next to the Convention Centre and at the northern end of White Bay.

Concept Plan for the White Bay, Glebe Island and Rozelle Goods Yard



Source: Petrykowski (2009)

Potential Redevelopment of Glebe Island, White Bay and Rozelle Yard

Source: Petrykowski (2009)

(e) Bus Ring Routes

It is also proposed that the first two Bus-Based Ring Routes (R1 and R2) would be established in the 2009-2016 period.

This will involve:

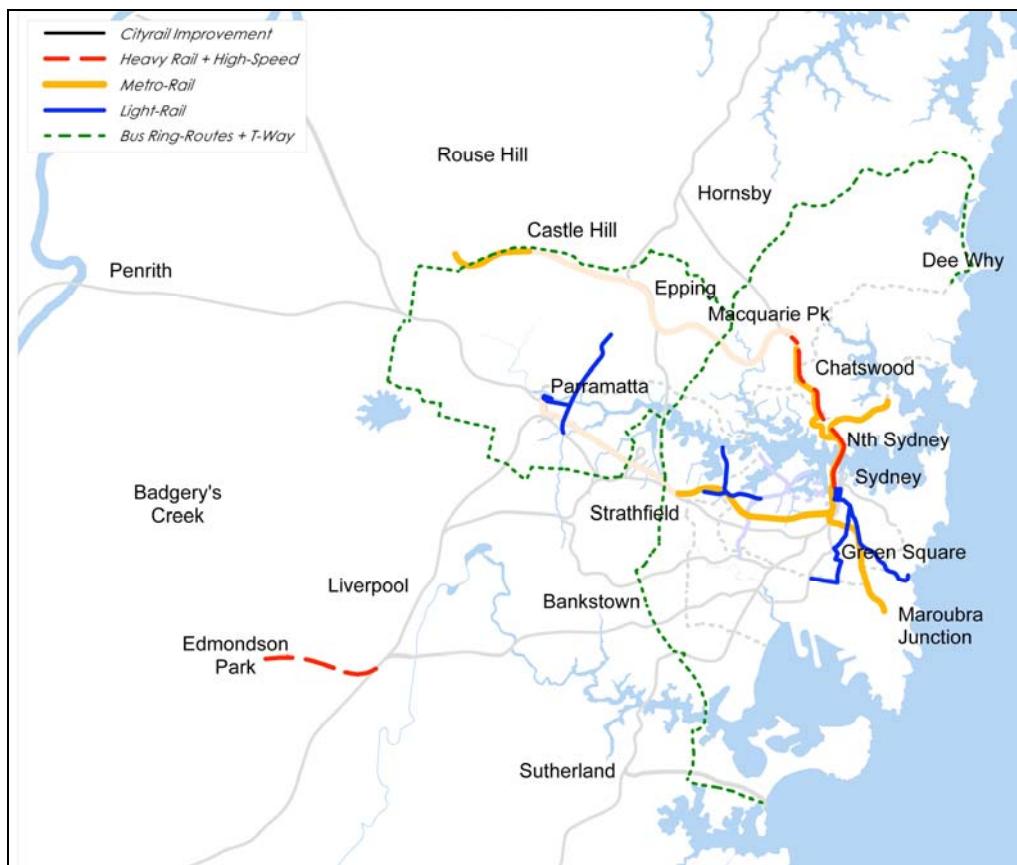
- Establishment of regular services on these routes (at least every 10 minutes in peak periods), including fast, limited stop services which operate over several segments as well as local all-stops services on single segments
- Progressive implementation of bus priority along these corridors, starting with use of “B” signals at intersections, progressing to the use of full signal priority, to the provision of dedicated bus or transit lanes and finally to full busway standard where justified.

Stage 2: 2016 - 2026

Key projects proposed for this timeframe include (see map below):

- The Fast North Shore Link (Chatswood to Wynyard) and the SW Rail Link.
- Completion of the Macquarie Metro, with conversion of the existing line from Chatswood to Wynyard for metro style operation.
- Stage 2 of the West Metro (Strathfield to Wynyard) and NW Metro (Castle Hill to Rouse Hill).
- The first stage of the NE Metro from North Sydney to Spit Junction.
- Extension of the LRT network in Sydney, and creation of the first LRT line serving Parramatta by conversion of the Carlingford line.
- Bus Ring Routes 3 and 4.

Potential Staging Plan – 2016-2026

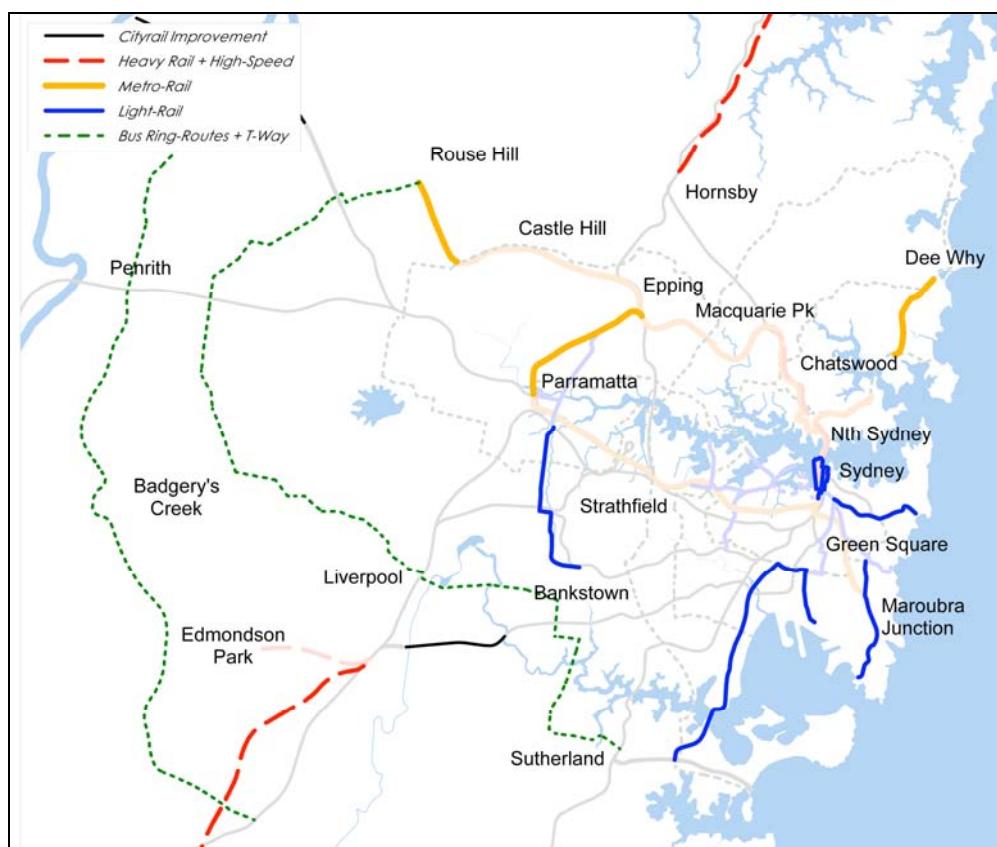


Details of the construction plan for the Fast North Shore Link and the Metro in the vicinity of Wynyard station are provided in the Main Report. This covers the issues to do with closure of two lanes on the Harbour Bridge and eventual reopening of one of the lanes after replacement of most of the buses crossing the bridge by the metro and additional heavy rail trains.

Stage 3: 2026 – 2036

This involves completion of the main metro network (SE line; Parramatta – Epping Line) as well as the remaining LRT networks and Bus Ring Routes 5 and 6.

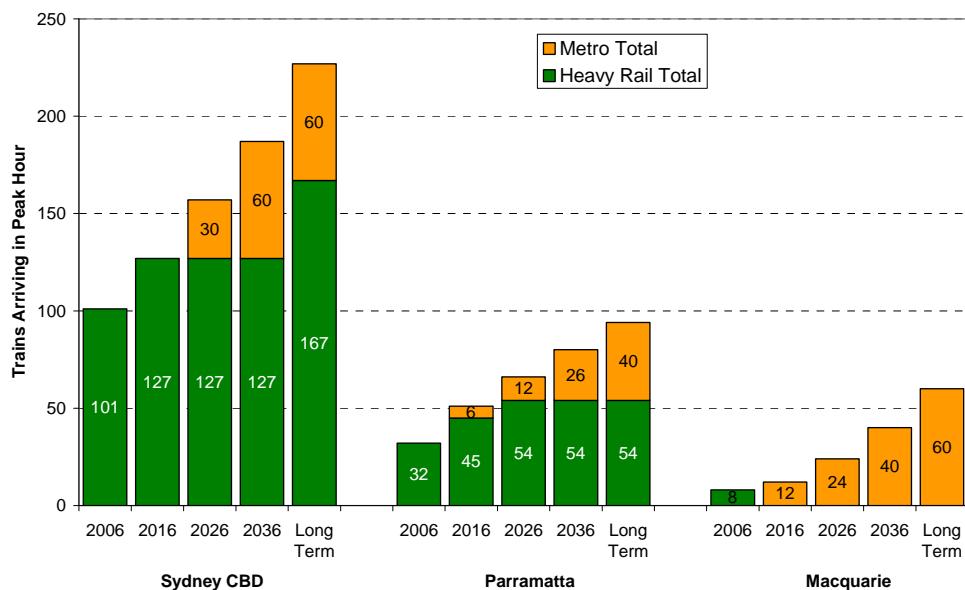
Potential Staging Plan – 2026-2036



Long Term (beyond 2036)

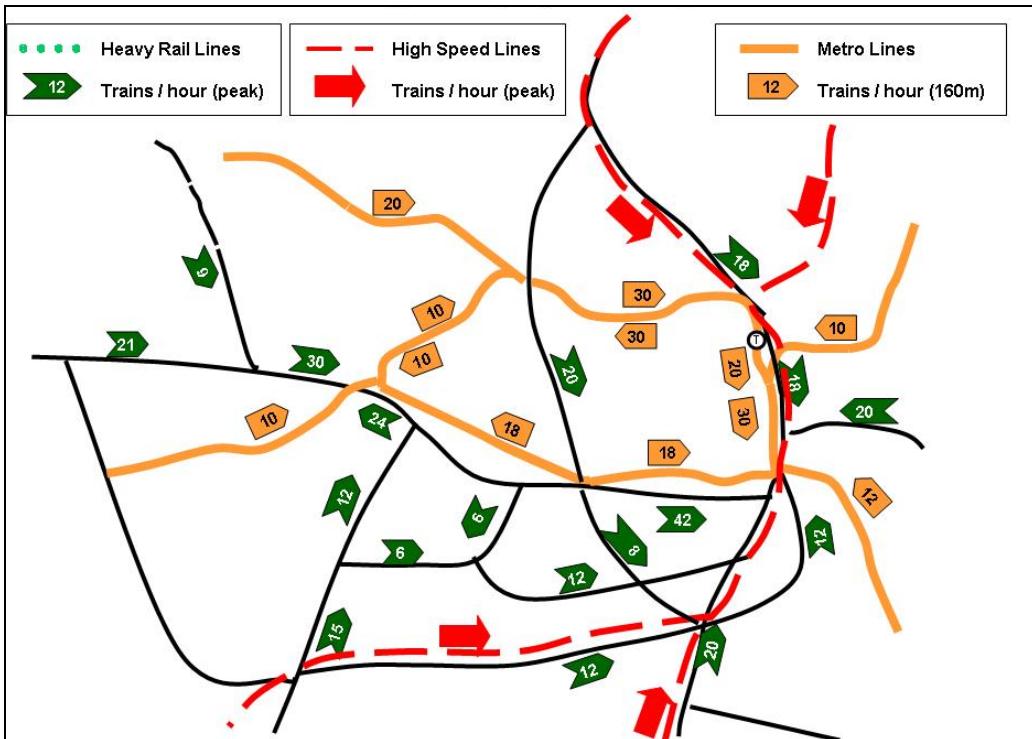
This would be the probable timeframe for completion of major high speed rail lines to the north and south in conjunction with the next harbour crossing for heavy rail. The Badgerys Creek metro would also likely be built after 2036. As shown below, the total heavy rail / metro capacity to the CBD, Parramatta and Macquarie will build up continually over time.

Heavy Rail and Metro Capacity to Key Centres



Additional cross-regional links, such as from Strathfield to Hurstville and Penrith to Leppington, may also be viable in the longer term. As indicated below, the Plan provides scope for further increases in services from the west, south-west, south, north-west and north-east.

Potential Long Term Heavy Rail and Metro Network



Implementation

Immediate Action

While the details of some proposed enhancements such as the metros will need further investigation, a number of projects included in the proposed plan have already been investigated in detail and could be commenced almost immediately. These include the remaining rail clearways projects, as well as the first extension of the LRT line to Lilyfield. There have also been numerous studies of extension of the LRT line into the CBD. Some bus ring route projects could also be commenced in the near future.

In addition, there could be an early start to the NW rail link (as a metro), for which there has already been much detailed planning undertaken. The first stage of the West Metro (from Parramatta to Strathfield) could also be started in the relatively near future, assuming funding support from the Infrastructure Australia Fund.

The present time is an ideal time for Sydney to build for the future. Interest rates are extremely low, and there is a need to stimulate employment and economic activity. Governments are suddenly willing to commence major infrastructure programs after years of running down our assets. The time for action is now.

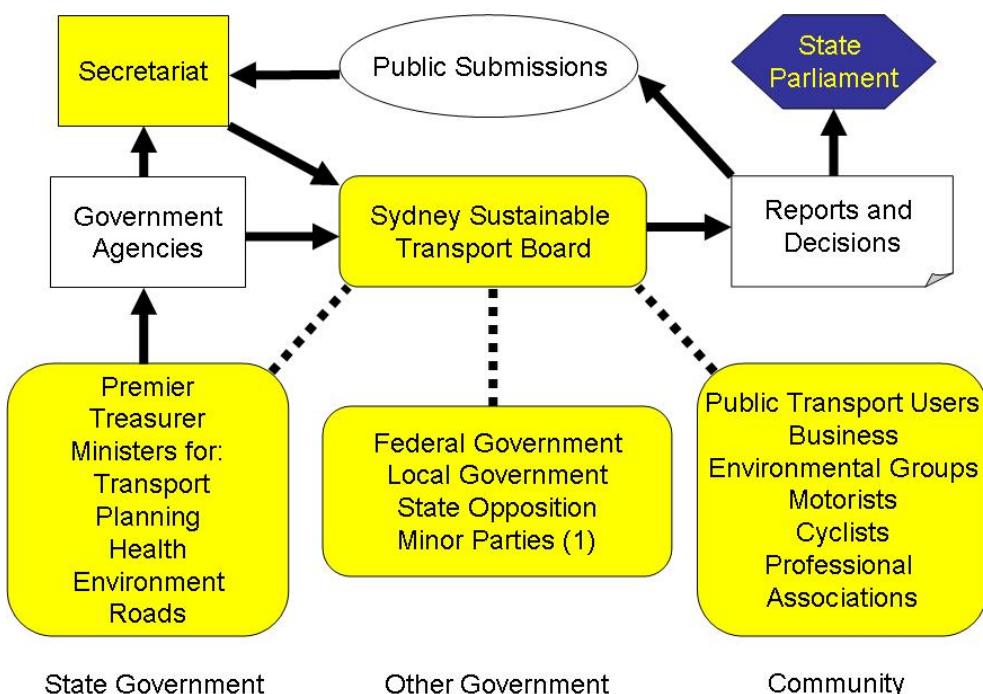
Changes to Organisational Arrangements

The history of Sydney's transport planning and implementation in recent years suggests that there would be long term benefits in changing the current organisational arrangements. This should be aimed at:

- **Ensuring a genuine integrated approach** incorporating all modes. Current organisational arrangements are based on specific modes (for example a metro authority has been established purely to handle metros, and there is little interest in light rail at all within government).
- **Minimising the politicisation** of transport decisions. There are many examples in the past of decisions which appeared to owe more to considerations of marginal seat politics than to genuine assessment of needs. Sydney needs a long term plan which is robust and has multi-party support.
- **Opening up the process** to enable wider involvement of the public and of key stakeholders. Currently most planning is done in great secrecy, and in due course specific projects are announced. The extent of public involvement is minimal. Only one option is ever put forward, and the only feedback sought is on minor issues. A new process is needed to tap the knowledge and values of the public, outside experts, public transport users, cyclists and motorists as well as key organisations such as Local Government and environmental and business groups.

One option for this would be to establish a **Sydney Sustainable Transport Board**. The Board would be established under legislation, and be responsible for the Planning, Funding and Delivery of an Integrated Sustainable Public Transport System for Sydney.

Possible Structure for Sydney Sustainable Transport Board



Board membership for example could include seven State Government Ministers (Premier, Treasurer, Ministers for Transport, Planning, Health, the Environment and Roads); one representative from each of the Federal Government, Local Government, The Opposition and the Minor Parties; and one representative (chosen on rotation basis) from each of Public Transport Users, the Business Sector, Environmental Associations, Cyclists, Motorists and relevant Professional Bodies.

These outside organisations represent key stakeholders in Sydney's Transport System and in its transition to a more sustainable future. They also have key interests in relation to some of the revenue streams identified earlier, including fares, general government subsidies, road congestion and parking charges, land value increment charges and the proceeds from carbon trading.

The Board would be supported by a full time professional secretariat, established under the legislation, with expertise in all modes of transport as well as land use planning, environment, health, economics and other relevant disciplines. Its annual budget would be set by the Board within guidelines also laid out in the legislation. It is essential that the Board have sufficient resources to adequately assess government and private submissions, prepare reports, and carry out independent research (such as benchmarking Sydney's public transport against other cities, or conducting surveys of users etc).

Such a Board could perhaps meet a number of times annually, for example:

- To receive and discuss State Government' Annual Draft Submission on funding and expenditure for the coming year. This would be published on the Board's website and submissions requested from the public / interested parties.
- To consider responses received to the Government Submission (as summarised by a Secretariat), to formulate recommended changes and to publish those recommendations for further comment by the public.
- To finalise the Funding and Expenditure Program for the following year following consideration of the second round of responses above.

This process would subsume current arrangements such as the IPART determinations of fares, or the annual Budget process which is conducted entirely within government at present.

In this context it should be remembered that the majority of funds for the public transport system in future will come from fares (i.e. the actual users) or from the other specific sources listed and that general government subsidies will gradually form a lower share of the overall funding, although they will still need to be maintained in real per capita terms. This will provide a much clearer nexus between the costs of the system and the beneficiaries, and avoid the problems in the past where public transport is seen as an optional extra, unlike other basic services such as water, sewerage, roads, or electricity.

Conclusions

Sydney is fortunate in being able to draw on a great public transport legacy, left by Bradfield and others. However in recent years it has underperformed and is in danger of losing its world city status as a result. More importantly, all cities face a major challenge to plan and build more sustainable transport systems in the future, in particular in light of the threats from peak oil and global warming. For example the International Energy Agency (2008) recently warned that (p37):

“The world’s energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable – environmentally, economically, socially. But that can – and must – be altered; there’s still time to change the road we’re on. It is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the two central energy challenges facing us today: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low carbon, efficient and environmentally benign system of energy supply. What is needed is nothing short of an energy revolution”

An analysis of the real costs of our transport systems and an appreciation of recent events shows that it makes sense economically, as well as environmentally, to move towards a greater reliance on walking, cycling and public transport. But this can only be achieved if the current funding and organisational arrangements are overhauled, and if a viable, cost-effective and well supported long term plan is developed.

This report aims to help in that process.

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