

Submission to Garnaut Review Forum 5

1 Introduction

This submission addresses two of the questions raised in Chapter 3 (Transport and planning) in the Forum 5 Issues Paper: Transport, Planning and the Built Environment. The particular questions are:

- What are the key barriers to the adoption of cost-effective and low-emissions mode use in the passenger transport sector? How might these be addressed effectively and efficiently by government policy?
- How can land-use planning and the built environment be managed more effectively to lower reliance on high emission patterns of transport behaviour?

Reference is also made to some of the material presented to Forum 5 by Professor Graham Currie. The submission has a particular focus on Sydney.

2 Sydney

Sydney is a sprawling city that arguably has grown way beyond the area that can be supported by a single multi-purpose centre, and particularly one that is no longer anywhere near its geographical heart. Regional centres have been introduced, however distances travelled and congestion have continued to increase.

A new metropolitan strategy (City of Cities-A plan for Sydney's Future) was announced in 2006 to cover the next 25 years. It proposed a vision of five waterfront cities (Sydney, North Sydney, Parramatta, Liverpool and Penrith) with "jobs, transport, services, entertainment and recreation close to everyone". The Strategy is at <http://www.metrostrategy.nsw.gov.au>. The introductory Premier's Vision is positively glowing, and commendably so, however what is missing is a credible transport plan that matches both the strategy's vision of a multi-centred region and the likely need for deep reductions in greenhouse emissions in the passenger transport sector over the 25 year period.

The Government's subsequent Urban Transport Statement covers the strategy issues well, but the rail infrastructure plans presented in the Statement are inconsistent, being predominately focused on increasing long distance capacity to the Sydney CBD. This apparently contradictory position between strategy and infrastructure seems to be due to a forward looking strategy being coupled with an old 10 year rail plan that would have been well on the way to implementation except for a significant public transport investment lag. The Statement is at http://www.nsw.gov.au/urban_transport.asp.

I asked myself in 2004 what a multi-centred structure could mean for the rail network, and my answer is presented in <RailPlan.doc>. It documents the guiding principles (a grid network of rail lines to and between major centres, including the five cities) and the specific route and technology assumptions made. It's certainly clear, however, that the additional scope of such a network (costing upwards of 40 Billion Dollars) in the likely timeframe needed is beyond the present resources of the state government, as noted below. I also responded to the city centre visions for Liverpool and Penrith, by covering both more localised rail possibilities and the contradiction within the Urban Transport Statement, in <Liverpool and Penrith.doc>, which, along with <RailPlan.doc>, accompanies this submission.

3 Land use and transport integration

Sydney seems to have had only mediocre success with the integration of transport with land use planning in the post WW2 period as it expanded beyond the viable size for a single centred city.

The prescriptive land use has been well meaningly designed to support public transport patronage, with designated regional centres first following the rail lines and then the infill areas, as the city has expanded. However, the development of public transport has not kept pace and its market share has declined substantially over the period, despite some more recent increases in absolute patronage numbers. Although it can be noted that some of the worst spatial aspects of edge and out-of-town development experienced by many US cities have been avoided with this prescription, Australian cities spend more of their wealth on transport and have “world leading” congestion costs, according to Professor Currie. This suggests an interesting hypothesis; that Australian cities are worse off through prescriptive planning and little public transport follow-through than they would have been with more sprawl.

There are many reasons for this mediocre success on the public transport side:

- Rising affluence, and declining real costs of motoring, have made cars much more affordable, and the rising ownership has led to political and economic pressure for road improvements.
- Australia’s governance structure, and current financial orthodoxy, tend to limit the size of the public sector in which public transport, particularly rail, has traditionally resided.
- A silo approach to budgetary approvals that tends to under-appreciate the whole-of-government benefits of public transport outside the direct portfolio. Professor Currie has listed land costs, equity, motoring costs, welfare, urban fringe problems, safety, obesity, climate change and peak oil concerns as issues that can benefit. There is also a lack of any formal mechanism for any of the above benefits, except for concession fares, to be attributed to the transport budget or paid collectively on behalf of the beneficiary groups.
- The effectiveness of the Sydney rail operator, CityRail also appears to be a key issue. CityRail has reportedly been benchmarked by TMG International against other rail administrations and found to perform poorly in many areas. The original benchmarking information, and comments on necessary allowances for local political and geographical conditions, has not been made public. The resulting high operating subsidies, that also allow legacy management and technology practices to be propped up, have presumably both limited the capital expenditure available, and limited the case for making that investment, to address other considerations (speed, convenience, safety and flexibility) that tend to be more important than price for many potential users.
- There are also network issues that detract from public transport. Each mode in Sydney seems to be run separately with it’s own fare structure, with poor integration of services and information that are needed to form a user-friendly network. There are seemingly no plans to integrate the fare structure between modes, and a contract to provide an integrated contactless ticketing system has recently been cancelled due, apparently, to the overwhelming complexity of the fare-collecting task required. A new metro line, with yet another fare structure, has the potential to make the situation even worse!

- An approach to road management that seeks to maintain, and even improve, travel times, under forecasts of increasing traffic, without reference to the impact on public transport. This tends to make the forecasts self-fulfilling under what is now known as “predict and provide”. The underpricing of urban congestion may also be an issue, although this theoretical issue can be very difficult to address in a practical manner.
- The particular tollway funding model used to fund limited access roads, that are needed by commercial and business vehicles, exploits the tendency for such roads to induce new private car travel, both from a shift out of public transport and from new and/or extended journeys. This in turn tends to create opportunities for even more tollways. Elasticities at Annex A to this submission show that time, rather than pecuniary costs, are the dominant source of such inducement. The perverse impact of the federal fringe benefits tax on motoring has probably also contributed to the effectiveness of this model.

The government’s credibility in land use and transport integration has also suffered over the Central Coast and South Coast satellite areas. These areas are now, to a substantial extent, low cost dormitory extensions of the Sydney metropolitan area, but poorly connected to it by public transport. This is due to the difficult terrain north and south of Sydney through which these steam era rail links were constructed. The government had promised higher speed connections, which would require extensive tunnelling to avoid damaging the spectacular scenery, but has now found that the costs would be so high that the new connections are not justified. The possibilities at present seem to be between greater self-containment of these satellite areas, and/or some rail improvements leveraged off work to provide pathways for rail freight that have better alignments and 24 hour availability. Meanwhile, the internal public transport for the Central Coast area is quite poorly developed, making it uncompetitive with growing car use, and the F3 freeway to Sydney is being widened! This suggests that there could be a case for some light rail on the Central Coast.

4 Recent patronage increases

Rising fuel priced and interest rates appear to have had a favourable impact on public transport patronage, as family budgetary constraints have tended to override the other public transport considerations, as listed above. In effect, those affected are now prepared to discount the importance of speed and convenience to save some money. This impact is reportedly less pronounced in Sydney than elsewhere, perhaps due to services not being available or already being very crowded. As speed and convenience tend to be energy intensive, these considerations may continue to be discounted under a carbon-constrained future. Above forecast rates of public transport patronage growth will, in turn, put more pressure on state transport budgets.

5 Sydney metro announcement

At this point in the submission it would have been logical to wrap up with criticism of state government management in the land use and transport area, coupled with some sympathy for its budgetary position. The government’s March (18th?) announcement of a Sydney metro, and affirmation that the four suburban CBDs identified in the metropolitan strategy are to be created (sic) to ease pressure on the Sydney CBD and to ensure residents worked close to home, has changed that, and required a reconfirmation of whether this submission remains of value.

The new \$12 billion plan is for the North West Rail Link from Rouse Hill to Epping to now be realised as a segregated high performance automated Metro Rail system, and extended to the Sydney CBD by connecting with another Metro Rail proposal from Top Ryde. More details are at <http://www.symlink.com.au>. The original plan was for the North West Rail Link to connect with the existing CityRail network at Epping, and for a new north-south CityRail link through the CBD to be provided to support both this new link and continuing rail growth into the CBD from the south and west.

Some more detailed information and observations are at Annex B. Basically the new metro proposal:

- Seems to have ended the contradiction, in that much of the future outer suburban rail growth to the CBD, apart from the northwest catch-up, is no longer supported.
- Is, in itself, a generally positive development although the loss of sectorisation opportunities could limit CityRail's ability to improve reliability.
- Does not, in itself, add anything to supporting a multi-centred city structure. Unpropitiously, there is seemingly little left in the transport budget for this purpose, most development interest in city centre style developments still seems to be in and around the Sydney CBD, and a new round of potentially traffic inducing tollway tunnels (the M4 East) are being planned.

6 Summary

The answer to both questions is the same. Land use and public transport provision need to be coordinated, and the latter better funded. The big three issues concerning public transport funding are:

- The scarcity of capital for investment in public transport where market intervention is needed to compensate for a lack of financial return.
- A lack of consensus and rigor over both the extent of the need for intervention, and the extent of changes required to other existing interventions that perversely impact on public transport.
- Minimising opportunities for using such interventions to cover inefficiencies at many levels, ranging from overall governance down to individual employment conditions.

The concept of a multi-centred city for Sydney seems positive, but requires the appropriate transport follow-through for potential benefits to be realised. The concept may also be relevant for the future of Melbourne, Brisbane and Perth where, to date, the electric rail networks are entirely radial to a single CBD.

Annex 1-VKT Elasticities

Elasticities as extracted from “Saving Oil in a Hurry” a draft paper by the IEA

Note that elasticities with respect to time are more significant than those with respect to price. They are particularly high for commuting.

TRACE, 1999, The Elasticity Handbook: Elasticities for prototypical contexts (deliverable 5), Costs of private road travel and their effects on demand, including short and longer term elasticities, contract no. RO-97-SC.2035, Prepared for the European Commission Directorate-General for Transport.

Table 2-3: Key Results from TRACE Project

Trip purpose	VKT with respect to		VKT with respect to parking charge				
	fuel price	travel time	average	distances 0-5 km	distances 5-30 km	distances 30-100 km	distances over 100 km
<i>Short term:</i>							
Commuting	-0.15	-0.48	-0.02	-0.10	-0.02	-0.01	-0.01
Business	-0.02	-0.05	0	0	0	0	0
Education	-0.06	-0.05	-0.01	-0.12	-0.02	0	-0.00
Other	-0.22	-0.19	-0.08	-0.30	-0.06	-0.01	-0.02
Total	-0.15	-0.28	-0.03	-0.18	-0.03	-0.01	0
<i>Long term:</i>							
Commuting	-0.25	-1.04	-0.04	-0.13	-0.06	-0.02	0
Business	-0.22	-0.15	-0.03	-0.02	-0.02	-0.03	-0.03
Education	-0.38	-0.84	-0.03	-0.17	-0.06	-0.01	0
Other	-0.47	-0.86	-0.16	-0.36	-0.18	-0.05	-0.00
Total	-0.31	-0.80	-0.07	-0.22	-0.10	-0.03	-0.02

VKT: vehicle kilometres travelled.

Annex 2-New Metro Observations

This annex provides further background information and observations on the new metro proposal and on prospects for a multi-centred rail network.

What seems to have happened is as follows: Firstly, the Epping to Castle Hill section of the North West Rail Link was originally promised for completion by 2010 but, along with many other rail promises at that time, not delivered. A new north south link through the Sydney CBD was also planned to provide the necessary increase in CBD track capacity. This non-delivery became an increasingly serious issue for the rapidly growing northwest, and planning for a new rail link has finally been completed as a precursor to construction. Meanwhile, CBD congestion issues have become more serious, and pressure has mounted for light or metro rail to provide relief. The government's response has been to announce a previously planned metro from the CBD to Ryde, but now with an extension to Epping and the northwest, and to set aside the north south CityRail link through the CBD. This is possible, because the metro provides an alternative means of expanding CBD track capacity.

While wanting to bypass CityRail's legacy management and technology practices is understandable, the joining of an outer suburban route to an already planned inner suburban metro could mean some challenges in optimising the rolling stock design. This is because the attributes of a metro, being high performance, rapid loading and frequent services are less relevant to an outer suburban railway where seating availability has traditionally been considered paramount. Future metro plans, be they new lines and/or extensions, could also have an impact on the final design chosen.

With respect to the metropolitan strategy, the new Metro Rail proposal can be seen as positive in that setting aside the north south CityRail link through the CBD removes the contradiction between strategy and infrastructure within the Urban Transport Statement. This is because much of the future outer suburban rail growth to the CBD, apart from the northwest catch-up and some extra services to relieve present overcrowding, is no longer supported. However, there is also a negative in that the planned sectorisation (untangling) of the CityRail network made possible by this link, to potentially improve reliability, will no longer be possible.

I envisaged that the north south link could be used to apply sectorisation differently, as developed in <RailPlan.doc>. This used the new north south link capacity to clear the City Circle of all outer suburban services, as well as to relieve present overcrowding. In turn, the remaining City Circle services (inner suburban to Homebush, Bankstown, Revesby and (newly) Hurstville) could be converted to more frequent metro style operation under CityRail management. I do recognise, however, that either version of sectorisation would have meant that any new rail line north of the harbour would necessarily have had to conform to CityRail standards, because it would be totally unrealistic for a third north south link across the harbour to be built.

Although it ends the contradiction, the new metro does not, in itself, add anything to supporting a multi-centred city structure. Unpropitiously, most development interest in city centre style developments still seems to be in and around the Sydney CBD, and with most of the transport budget till 2017 reportedly absorbed in this metro proposal to the CBD, little appears to be available for other rail developments. A new network of potentially traffic inducing tollway tunnels (the M4 East) is also being planned.

Liverpool and Penrith

1 Introduction

This submission is a combined response to the separate city centre vision documents for Liverpool and Penrith released on 24 November 2006.

While the reasons for selecting Liverpool and Penrith as additional regional cities, under the overall planning for Greater Sydney, are understood and appreciated, the State Government's transport planning activities seem inadequate to provide the required support and outcome.

In response, this submission covers transport issues, both from the possibility of additional transport development opportunities and the amelioration of adverse transport impacts, which could be addressed by the appropriate agencies.

2 Background

Greater Sydney has many attractions as a place to work, shop and play, but suffers from the growing disadvantage of high triple bottom line (economic, social and environmental) costs due primarily to the low overall density of occupation and the dominance of the off-centre Sydney CBD.

The Department of Planning has commendably responded with a new plan for Sydney's future as a City of Cities. This elevates a number of major centres, including Liverpool and Penrith, to Regional City status. The introductions to the vision for both Liverpool and Penrith explain the need for equitable access to infrastructure and services:

The Metropolitan Sydney is too big, both geographically and in population terms, to rely solely on central Sydney as the jobs, services, tourism and activities hub. Relying on only one key centre means that many people have to travel long distances for jobs and services. The concentration of functions in the city of Sydney means that cultural service and infrastructure resources are not distributed evenly across the Metropolitan area. The need for a major suburban centre closer to where the bulk of people live was recognised in the 1960s with the designation of Parramatta as a second 'CBD'. With the continued outward growth of the Metropolitan Sydney the new regional strategies are designating additional regional cities.

An underlying principle is that people should be able to access a range of jobs, health and educational services, cultural, entertainment and recreational activities and shopping without travelling long distances. Most people are willing to travel about an hour each day and the regional cities concept is about concentrating services to satisfy this.

Corresponding to this, the State Plan has a target to increase the percentage of the population living within 30 minutes by public transport of a city or major centre in Greater Metropolitan Sydney. Interestingly, the Transport and Population Data Centre's household travel survey from 2004 showed the total daily travel time per person had remained constant since 1999 at 79 minutes; higher than for any other city in Australia. The excess over one hour suggests just one cause of stress, or social cost, from living in Sydney.

The State Plan target should have an impact on how transport planning is being undertaken, as the current network, particularly rail, is highly focused on the Sydney CBD. The recent Urban Transport Statement comprehensively addresses the issue on Pages 6 and 7:

Since the establishment of the first colony at Sydney Cove, Sydney has expanded to become a city of over 4 million people, occupying an area of around 1700 square kilometres. Its early expansion was to the east and inner west and then to the north. As further development to the north and south has been naturally constrained by the Hawkesbury River and Woronora Plateau, the metropolitan area's most recent growth has been predominantly in the Cumberland Plain, in an arc north-west to south-west from the older urban areas.

Sydney's central business district, however, has remained on the site of the original harbour settlement. As a consequence, Sydney's CBD is nowhere near the geographic centre of metropolitan Sydney, and the pattern of Sydney's transport system – the road and rail spines connecting workplaces, shopping centres, and areas of highest residential density – does not resemble lines radiating from a central hub, as with many typical global cities. Rather, as the *'City of Cities'* map on page 9 indicates, Sydney's urban footprint is a V-shape or U-shape branching northwest and southwest from the CBD at its eastern point.

This V or U, which extends from around Rouse Hill in the northwest to beyond Leppington in the southwest, contains both major roads and rail lines, as well as the Metropolitan Rail Expansion Program's rail links supporting growth in the north and southwest. It includes the Global Economic Corridor from Macquarie Park through North Sydney and central Sydney to the Airport/ Port Botany, in which about 700,000 – or more than a third – of metropolitan Sydney's two million jobs are located. The CBD itself houses more than 300,000 jobs, 13% of the total. As one would expect, it is the most concentrated employment centre in Sydney, and notwithstanding the predicted growth of other major centres, will continue to be a major travel destination.

The particular historic and geographic configuration of metropolitan Sydney thus has its own constraints for transport planning which are in addition to the challenges faced by all modern cities. In Sydney, these challenges are characterised by:

- the diverse travel needs of a global city;
- forecast population growth of more than 1 million over the next 25 years in new and existing areas;
- current and increasing road and rail congestion in both peak and traditionally non-peak periods that are affecting the ability of trains, cars and bus services to meet Sydney's travel needs;
- highly constrained road and rail capacity to accommodate forecast growth in passenger, private vehicle and freight movements.

Sydney's transport system was established with the main objective of providing a largely suburban city with access to its main location of weekday employment: the CBD. Meeting the transport needs of a future Sydney will require a greater focus on cross regional transport and on servicing the regional cities in Western Sydney and other strategic centres around the metropolitan area. While recognising the continuing critical importance of the CBD, transport decisions which the Government makes now must reflect and support those future directions.

The city centre vision document for Penrith expresses the issue more simply on Page 49:

With Penrith identified as a regional city the provision of regional public transport facilities is important.

The provision of radial rail transport within Metropolitan Sydney dislocates large pockets of the population 'between the spokes' and results in a reliance on private vehicles. The attempt to reduce the reliance on central Sydney as a job location needs to be accompanied by a parallel increase in the provision of regional public transport networks around each of the regional cities to improve accessibility to surrounding and growing residential populations, in particular to areas not currently serviced with adequate public transport facilities.

The need for transport planning changes is clearly apparent from the above extracts, however, unlike the vision, the reality of transport planning appears to fall well short of what is needed for a multi-centred network.

3 Transport Planning

The rail infrastructure plans presented in the Urban Transport Statement are clearly focused on increasing long distance capacity to the Sydney CBD. For the North West Rail Link and the Redfern to Chatswood Rail Link, new services to the Sydney CBD (and the "Global Arc") are the only possibility. The situation is better for the South West Rail Link, as services to the Sydney CBD via Revesby and Liverpool will both be possible. However, existing services from Liverpool would need to be extended, as the only capacity available for new services from the South West Rail Link is via Revesby.

The rail infrastructure plans in the Urban Transport Statement indicate that the South West Rail Link will become part of a new sector, in combination with the Epping to Chatswood Rail Line and the Redfern to Chatswood Rail Link, after 2017. Much of the Clearways program is intended to increase longer distance capacity, such as is needed for the new links, so the long distance and Sydney CBD focus of rail operations will be further reinforced.

The State Plan appears to be designed to accommodate this focus with the following targets:

increase the percentage of the population living within 30 minutes by public transport of a city or major centre in Greater Metropolitan Sydney;

increase the share of trips made by public transport to and from the Sydney CBD during peak hours to 75% (currently 72%) by 2016; and

increase the proportion of total journeys to work by public transport in the Sydney metropolitan region to 25% by 2016 (currently 20-22%).

The unavoidable logic here is that the second target will be dominant. The first target need not have any direct impact on destination or transport choice, while the third will be partly achieved just with a strong outcome for the second. Having the second target dominate through an increase in long distance commuting will not necessarily, or optimally, deliver the sought after improved triple bottom line outcome.

Rail operations have clearly been tuned to long distance commuting through adopting the present double deck carriage design with its emphasis on seated capacity. Although short distance travel can be handled, due to wide doors and accessible end vestibules, track capacity and journey times suffer with loading increases and station spacing decreases due to long dwell times and mediocre traction performance of Sydney's double deck trains. The recent decision not to purchase single deck trains more suitable for inner areas suggests that the needs of long distance commuting is to remain dominant, although there is possibly also a timing issue here in that single deck operations could not have been fully segregated from other services before completion of the Redfern to Chatswood Rail Link in 2017.

The fare structure also tends to support long distance commuting, due to the tapering fare scales currently in place. These scales also lead to poorer operating cost recovery figures for rail over buses, despite more favourable operating costs per kilometre for rail, due to the longer average distance travelled by rail users.

The strategic bus network plans are a welcome response to the mosaic of centres not adequately served by the present trunk networks. The bus mode here has advantages in quickly and flexibly meeting unsatisfied but uncertain demand. The situation for the newly designated regional cities is different as here the task is to build substantial patronage to support the growth of such cities over a longer term. Rail has a history of more strongly influencing land use outcomes than buses, particularly as many transport experts regard it as a more effective freely chosen alternative to car use than buses. Other experts argue the buses can be improved at a lower capital cost, but some acknowledge that more coercion may also be required to build patronage.

4 Heavy Rail Opportunities

There are opportunities for Sydney's rail network to be adapted to a city of cities environment, and the accompanying <RailPlan.doc> provides an example of what a multi-centred rail network could look like. This document was prepared in 2004 and submitted as a response to the Metropolitan Strategy, sent informally to RailCorp, and became a public document through its attachment to a Cross City Tunnel Inquiry submission (Submission 22).

Specifically for Liverpool, <RailPlan.doc> suggests [with added square bracket comments] a reconfiguration and extension of the Cumberland Line as follows:

The concept of Link Line 3 is to provide both Parramatta and Liverpool with direct or one-change access from all of the western [and Illawarra] rail routes, while minimising new construction in recognition of the limited patronage available. It replaces the core piece of the Cumberland Line, but diverges from it at either end. To the south, L3 takes the proposed Y junction from Casula to Georges River, and from Narwee dives south to a dedicated stub terminal station at Hurstville. There may be some synergy between this proposal and the construction of a direct Enfield to Illawarra freight link. To the north, L3 dives from Toongabbie to Hills Centre and then shares S2 [North West Rail Link] track to Castle Hill station and a turn-back (a separate terminating platform should not be required). This route has been chosen because of its acceptable grade and a minimum of new construction.

This concept increases the reach of the rail network for Liverpool, and for Parramatta, as is needed to support regional cities, over the predominantly radial access being provided under current plans. A modification of this concept could see the existing Cumberland Line (Campbelltown-Blacktown, extendable to Riverstone after duplication) supplemented, rather than completely replaced, by L3 to achieve even broader direct access to Liverpool and Parramatta, but at some cost to network efficiency.

Other benefits for Liverpool from <RailPlan.doc> include direct services from the South West Rail Line at all times and potentially faster Sydney CBD services via Granville from a suggested sector rearrangement, and a faster alternative route to the Sydney CBD via Revesby using cross platform interchange (eg at a new Georges River station) between L3 and Campbelltown (plus SWRL in peak periods)-Sydney CBD services.

Specifically for Penrith, <RailPlan.doc> suggests that the North West Rail Link be ultimately extended from Rouse Hill through Riverstone to Penrith, rather than to Vineyard as currently envisaged by RailCorp. This alternative would satisfy the operational need for a through connection to a permanent stabling facility, but appears to make better transport and land use sense by linking to a major western anchor (Penrith) and supporting the development of Marsden Park and the former ADI site, and the possible release of the Airservices Australia transmitter site between them. It would join the Western Line at the University of Western Sydney for Penrith and provide an enhanced service frequency in this section.

Another benefit for Penrith from <RailPlan.doc> would result from the suggested sector rearrangement. This rearrangement leads to a “Penrith Express” allocation of the northern pair of western line tracks to the Sydney CBD in a similar fashion to the “Campbelltown Express” route via Glenfield, Revesby and Sydenham being established under the Clearways program, and should result in faster services.

There is also a general network benefit from adapting rail to a city of cities environment, in that the new services, and more points of interconnection, provide many rail travel opportunities that would not be realistic with a strictly radial system. To this end, some cities already have, and other cities are considering, circumferential or ring rail routes to complement their radial rail routes.

5 Rail Impacts

Care needs to be taken with some potentially adverse impacts from heavy rail. The city centre vision for Liverpool notes on Page 44:

Integration of the city centre with important river assets is an important objective for the three Western Sydney regional cities: Parramatta, Liverpool and Penrith. An important advantage of Liverpool is its location on the Georges River and the proximity of a major activity hub – Moorebank Industrial Area, on the other side of the river. Better utilisation and protection of the environmental values of the Georges River will enhance liveability. On the other hand, the city centre is traversed by the railway line and the addition of the Southern Sydney Freight Line may further dissect the city centre from the river unless new initiatives are put in place.

The Urban Transport Statement reveals that track amplification for the Liverpool – Cabramatta section is envisaged by 2017, which will presumably just add to the adverse impact of the recently approved Southern Sydney Freight Line with respect to separation of the city centre from the river, and the more localised division of the Liverpool Hospital site. There seemed to be (presumably now lost following the SSFL approval) an opportunity to improve the latter situation through a localised lowering of all tracks to avoid the present level crossing.

As rail traffic through Liverpool increases over time it is logical for RailCorp to consider separating the trains from Bankstown from other services to improve reliability, and this is apparently behind the amplification proposal presented in the Urban Transport Statement. However, the fairly low loadings on the Bankstown via Sefton route would indicate that the new tracks could be poorly utilised. <RailPlan.doc> has an alternative suggestion, which is to complement its suggested Liverpool service improvements with a proposal to reroute the Bankstown line west of Villawood to terminate underground at Fairfield.

The benefits would be threefold; to avoid adding to the dissection problems at Liverpool described above, to provide Bankstown access to both Parramatta and Liverpool via one-change access at Fairfield and to facilitate a longer-term extension of the Bankstown Line from Fairfield to Prairiewood (shown as Bonnyrigg in <RailPlan.doc> which predates the announcement concerning this new centre).

While terminating train and stabling impacts can be avoided at Liverpool, they are inherent at Penrith due to its location on the edge of the suburban area. Alternative possibilities for stabling include covering the yards to provide a usable area for other city related activities or building new yards further from the station, the latter perhaps a little to the northwest, to release the presently occupied land for other purposes. Additional stabling for the Northwest Rail Link extension suggested in <RailPlan.doc> could also be included.

6 Light Rail Possibilities

Both Liverpool and Penrith seem suitable for light rail developments, to complement the previously mentioned heavy rail suggestions, in providing the required greater focus on cross regional transport and on servicing the regional cities in Western Sydney.

For Liverpool, light rail links east and west of the city could serve higher density corridors and be connected by a north-south route through the city centre and the rail Station. Similarly for Penrith, light rail links north and south of the city could be connected by an east-west route through the city centre and the rail station.

7 Observations

It seems that while the city of cities concept, which proposes a number of regional cities, is motivated by a desire to bring jobs and key services closer to home, RailCorp planning is still dominated by continuing growth in long distance patronage, particularly work trips to the Sydney CBD and “Global Arc”, which may be contrary to this desire.

<RailPlan.doc> suggests two other important roles for rail, which are more compatible with the desire to bring jobs and key services closer to home. These are inner area services to the Sydney CBD, and cross-regional services for the new regional cities. Inner area services would be improved by a suggested sector reallocation and the possible reintroduction of single deck trains on some lines, made possible by a sector reallocation following the new Redfern to Chatswood Rail Link in 2017, and the construction of metro and/or light rail on some corridors not presently served by rail. The cross regional possibilities specific to Liverpool and Penrith have already been discussed, however others are also suggested in <RailPlan.doc>. The present double deck train design is not necessarily optimum for these other two roles.

Budgetary and timing issues can probably explain the apparent inconsistency between rail planning and the metropolitan strategy. Clearly RailCorp is currently having most difficulty with demand on longer distance services, and the North West Rail Link is already needed as noted in the Preliminary Environmental Assessment:

Sydney's North West is in the middle of a 60 year expansion (1970-2030) with significant population and employment growth. As a result, there is already a need for a mass trunk public transit scheme to address car dependency and positively influence travel behaviour.

Basically, RailCorp seems to be still predominantly catching up with the past, rather than planning for the future. This presumably stems from Clearways not being funded immediately after the 2000 Olympics, as requested, and the subsequent lack of funding for Action for Transport 2010. Consequently, RailCorp is now probably more than fully stretched, with budget, resources and time constraints, completing the Capacity and Service Improvement Initiatives listed in the Urban Transport Statement for the 2006-2017 period. Being fully stretched is also presumably why the Statement tries to present the strategic bus corridors as the complete supplement to the rail capacity and service improvement initiatives within the 2017 timeframe, when this is a problematical claim in at least two specific areas.

8 Conclusion

It appears that more emphasis should be placed on inner area rail services to the Sydney CBD and on cross-regional rail services to the new regional cities, to better support the desired triple bottom line outcomes for the Metropolitan Strategy. Most of the current rail capacity and service improvement initiatives, however, appear aimed at longer distance services to the Sydney CBD and Global Arc. Realistically, present budgetary, resource and time constraints presumably limit what else can be initiated much before 2017.

Future budgetary constraints may possibly be eased. For example, reducing average travel distances is also likely to improve rail cost recovery, as the fare scales are tapered with distance, and greenhouse concerns are likely to increase the emphasis of budgetary expenditure towards energy saving initiatives.

A Long-Term Rail Network Plan for Sydney

1 Introduction

This document presents a long-term rail network plan (Network Plan) for Sydney that considers both track layouts and service arrangements. The purpose of its preparation was to road test a number of previously suggested ideas, and some other new possibilities, in the environment of a total network. Being heavily and unashamedly influenced by the Christie (Long Term Strategic Plan for Rail) Report, the points of difference from that Report that have emerged during the preparation of this document have also been noted. A network map is provided at the end of this Plan.

The underlying thrust of the Network Plan is to optimise the speed, frequency, reliability and coverage of the rail network in order to attract and accommodate a significant increase in patronage and market share as the population of Sydney grows. The support for regional centres is also intended to help contain travel distances.

2 Some Fundamentals

The basis requirement of each potential customer is to travel from his origin to his destination when he desires, rapidly, reliability, conveniently (covering a range of issues) and at an acceptable price. In practice, many customers embark on more complex journeys, seeking “outside” access at intermediate locations and/or a circular completion.

Private cars or taxis potentially best match the above requirements, but can be limited in their ability to do so by vehicle availability, congestion, parking availability and cost. Public transport, except for the taxi service, does not seek to match the travel requirements of every individual directly but applies the properties of aggregation and networking in striving to provide a competitive alternative. Concentrated centres of activity and corridor development are helpful in achieving such aggregation.

Public transport operators meet the totality of individual customer’s requirements, which is a two-dimensional demand array, through the provision of a number of interconnected links that form a network. Each link is usually one-dimensional from point to point, although circular services can also be provided. The reasons for such operational simplicity are to achieve the required aggregation and to ease the task of management. Customers’ individual requirements are met by using one or more of the interconnected links to complete a journey. In general, interconnection in a complex network is better facilitated by service frequency than by coordination.

A network of individual rail links alone cannot meet the totality of the above requirements, due to the relatively high volume usage required by rail for an acceptable level of economic performance to be achieved. Walking, cycling, bus and light rail are means of supplementing rail to improve and to “mesh out” public transport into a full two-dimensional coverage. Although the running of individual rail and bus services can and should be separated, the customer should be presented with an integrated whole network with respect to information, fares and interchange. In this regard there may be merit in interposing a retail service layer between the customer and the (wholesale) rail provider, as this may be more easily integrated with other modes than the task of operating trains.

3 Key Features

3.1 Metro Conversion

Rail services in inner areas have deteriorated in recent years along with population shifts due to the need to provide more pathways for outer suburban services, and the conversion to an all double deck fleet with its extended dwell times, within the constraints of limited track capacity. The construction of a Chatswood-CBD-Eveleigh link to create additional capacity and a new operating sector provides, inter alia, an opportunity to reverse this deterioration.

Metro conversion of inner area services should allow more frequent, fast and reliable performance to be offered from single deck trains. The better performance will, in turn, allow more feeder and cross-linking bus arrangements to be established to help reduce the present problem of bus clutter, such as in the CBD. More motorised axles, more doors and an articulated design to match legacy platforms will be needed for these trains. A dual height pantograph design would need to be considered for these trains also to operate on new metro lines or extensions with lower profile tunnels.

3.2 Orientation

The CityRail network has an historic orientation towards the CBD. While the Network Plan continues, and augments, this historic orientation, this is less pronounced than in the Christie Report. Further, with the expansion of major centres, such as Parramatta, Liverpool and Olympic Park, as well as a number of smaller regional centres, the opportunity has been taken to propose cross regional services that support these centres while minimising the additional rail build required.

3.3 Warringah

There has been considerable discussion of the relative benefits of North Sydney or Chatswood as being the better branching point for a new railway to serve the Warringah peninsula. St Leonards and the former freeway corridor have also received some consideration. Such rail options are relevant in considering viable alternatives to the local urging for a long road tunnel to bypass Military Road.

The Network Plan recognises that there is merit in providing two links to maximise the overall benefit, and has adopted a configuration in which these two links intersect at Brookvale.

3.4 Castlereagh

The Christie Report adoption of the Castlereagh Freeway corridor for new rail capacity has not been pursued in the Network Plan due to the lack of any known information to support such an adoption.

However the development of both Marsden Park and the former ADI site, and the possible release of the Airservices Australia transmitter site between them, has led to an alternative proposal in the Network Plan for this region. This proposal is to divert the planned North West Rail Link at Box Hill to serve Riverstone and these new areas before joining the Western Line at the University of Western Sydney for Penrith.

3.5 Sectorisation

The push towards sectorisation associated with the current “clearways” program has been pursued with the Network Plan, particularly with respect to CBD oriented services. As such, this aspect is probably more strongly addressed than in the Christie Report, which predates the sectorisation announcement.

4 Network Overview

The Network Plan is built up from nine basic lines with multiple branches, comprising a mix of Suburban, Link and Metro Lines. These are designated S1-S3, L1-L3 and M1-M3. M1 is formed from a conversion of existing inner area services while M2 and M3 are similar to the River and Central Lines proposed in the Christie Report. The needs of InterCity services are also considered.

A description of each of the nine lines follows, with the order of presentation influenced by their relationship to the key features described above.

5 Metro Line 1 (M1)

Metro operation is envisaged for the City Circle and the four inner area lines that connect to it to form Metro Line 1. These are the lines to Homebush, Bankstown, Revesby via International and Hurstville. There are then choices to be made about metro operation beyond Homebush and Bankstown.

The Liverpool via Granville service, and ongoing access to Campbelltown or Bringelly, is long haul and well loaded and therefore merits double deck suburban operation. Accordingly, these services need to be reallocated to another line east of Homebush, with Suburban Line 3 (the present North Shore and Suburban Lines) being the most obvious choice. This leads to the present Local Line being a stub terminal, and simplified track arrangements being provided to provide direct connections between Suburban and South, and Main and West, at Homebush. This decision also impacts on the service allocations to other lines as developed below.

The Bankstown Line extensions to Liverpool and Lidcombe are not heavily loaded and need to be accessed from Bankstown. Accordingly, metro operation has been adopted for these lines, but with the Lidcombe branch ultimately becoming part of Link Line 2. Occupancy of the busy Cabramatta to Liverpool segment has been avoided by diverting the former Liverpool via Bankstown service at Villawood, and extending it to serve Fairfield and Bonnyrigg. Some synergy with the western freight bypass may be possible with this diversion. The new station at Fairfield supports the development of a proposed regional centre at this location and provides one-change access to both Liverpool and Parramatta. The planned “clearways” turn-back at Liverpool will not be required for M1, but could be useful for Suburban Line 3.

Metro operation could also be provided south of Hurstville if separate tracks are provided to Mortdale or Oatley. It is assumed that the Hurstville operation will share tracks with freight during off peak periods, with a resort to Suburban Line 1 if problems arise. Ideally, there would be parallel running south of Wollie Creek to support this possibility, or a direct Enfield to Illawarra freight link to avoid sharing all together.

The City Circle has a Town Hall and a St James side, and two of the metro services would be allocated to each. The Revesby via International service has access only to the St James side, while the Homebush service would logically access the Town Hall side. This leaves one side each for Bankstown and Hurstville services which, however, need to share a common track between Sydenham and Redfern. There are implications for the junction arrangements between Sydenham and Wolli Creek, which are covered in a separate document.

Earlier operation of metro style trains, ahead of the provision of a dedicated metro sector, may be warranted for services to Homebush and Revesby. The benefits would be a better combination of local and through trains for the Homebush route and more convenience for Airport customers on the Revesby route. Mixed operation of metro and suburban double deck trains would be required to Homebush and around the City Circle for this to be achieved.

6 Suburban Line 1 (S1)

Suburban double deck operation is envisaged to continue on the Eastern Suburbs and Illawarra Lines, which, due to the establishment of M1, would exclude the all stations to Hurstville/Mortdale services. With Metro Line 2 following closely the Christie Report's River Line, a limited extension of the Eastern Suburbs Line just to Bondi has been shown. Without M2, an extension to UNSW and possibly beyond may be more appropriate, but then this would only be with suburban double deck trains.

Services are split three ways to serve Cronulla, Waterfall and Wollongong, with the latter presumed to experience strong growth if the Waterfall to Thirroul segment is improved. A limited InterCity service to the south coast is also possible from Sydney Terminal, using Suburban Line 2 (Campbelltown express) to Sydenham before diverting to S1. Because Hurstville local services have been diverted to M1 in the Network Plan, south coast InterCity services joining S1 south of Sydenham will reduce the usable track capacity north of Sydenham to Bondi.

Some capacity augmentation north and south of Sutherland may be necessary to accommodate the mix of express, stopping and freight services.

7 Suburban Line 2 (S2)

It is convenient to allocate the label Suburban Line 2 to the services connecting to the southern end of the proposed Chatswood-CBD-Eveleigh link, so that Suburban Line 3 carries on from the existing Sector 3. Because the Liverpool via Granville service has, as a consequence of the M1 metro conversion, been allocated to Suburban Line 3, other services must be displaced from this line and transferred to S2.

There is logic in choosing to allocate the Blacktown to Penrith segment to S2, and providing access from the new CBD link at Redfern to the Main Line near Newtown to do this. The outcome is quite neat, with S2 then carrying both Campbelltown and Penrith express services, and the four InterCity services to Newcastle, Blue Mountains, Southern Highlands and (up to the S1 connection) South Coast. The new CBD link can be fully utilised with this arrangement, as Inter City services to the southern highlands and the south coast will then be able to occupy pathways left available by the Penrith express services branching at Redfern.

The Main Line to Homebush, the express tracks to Blacktown and all four tracks from Blacktown towards Penrith would thus be allocated to S2. Some augmentation of the Revesby to Campbelltown segment of S2 may be necessary to separate adequately fast and stopping services. The Network Plan shows Bringelly services to be fully allocated to Suburban Line 3 and to run via Liverpool, but some leakage to S2 at Glenfield may become necessary due to constraints on Suburban Line 3.

The cross-harbour segment of S2 could use either the two eastern Bridge lanes or a new tunnel. Both have been shown, as alternatives, on the network map. For the former, new road capacity, such as an eastern ring route from Mosman to Woollahra, may need to be provided in order to help free up the required Bridge capacity.

As noted above, there are benefits from establishing two rail links into Warringah, with one being from North Sydney. A key issue is the choice between S2 and Suburban Line 3 to support this connection. S2 has been selected due to the common construction work around Crows Nest and the provision for Link Line 1 capacity that results, compared with the attraction of extending trains otherwise terminating at North Sydney on Suburban Line 3. S2 then connects exclusively to the Chatswood to Epping link north of Crows Nest, avoiding any service mixing with Suburban Line 3. This Warringah branch of S2 would serve Brookvale and points further north.

Some capacity augmentation north of Epping may be needed to accommodate the mix of express, stopping and freight services serving Hornsby and the Central Coast. The North West Rail Link is included in S2, and an alternative route for this link, through Mobbs Hill on the deferred Parramatta Rail Link route and an electricity easement to also serve West Rocks Road before reaching Franklin Road, is also shown on the network map. This alternative may help support the case for Link Line 1. After Box Hill, as already mentioned, S2 diverts to serve Riverstone, Marsden Park and the ADI site before joining the Western Line at the University of Western Sydney for Penrith.

Thus the Penrith services through both Blacktown and Castle Hill will be allocated to S2. Some capacity augmentation between St Marys and Penrith may be needed due to this combined operation.

8 Suburban Line 3 (S3)

Suburban Line 3 is made up from the existing North Shore Line, Harbour Bridge crossing and the Suburban Line to Homebush. From there, S3 is allocated the southern tracks to Granville, the tracks to Glenfield and Bringelly, and the slow tracks to Blacktown (Richmond branch platforms) and the Richmond Line. Additional platforms at Newtown, probably to the west of the King Street overbridge, are shown in the Network Plan to facilitate interchange with Metro Line 3. The Strathfield to Epping service is also included as a third branch of S3. There could be some leakage of Richmond trains onto S2 at Riverstone due to S3 capacity constraints.

North of the Harbour, there is need for an all stations to Gordon service and a key stations to Gordon and all to Berowra service. Therefore, as at present, there will be a service imbalance north and south of the CBD and some trains, at least in peak periods, will start and finish at North Sydney. If S2 crosses the Harbour by tunnel, this arrangement can continue. Otherwise, new turn-back facilities, including a third platform, would need to be established at Waverton.

If, as suggested in the Christie Report, additional capacity to the Central Coast is required, then the North Sydney terminators could be extended to serve this. The Network Plan shows additional tracks from Roseville to Gordon from where a tunnel route to the north can be launched with a portal just south of Pymble. The route of this tunnel would also allow a stub terminal station serving the St Ives town centre to be established, and for the Gordon terminators to be extended to serve it.

Alternate stopping at Waverton and Wollstonecraft could be introduced at the same time to minimise delays, and/or the St Ives to Epping service may be a candidate for metro conversion provided mixed metro and suburban double deck operation is considered acceptable.

9 Link Line 3 (L3)

The concept of Link Line 3 is to provide both Parramatta and Liverpool with direct or one-change access from all of the western rail routes, while minimising new construction in recognition of the limited patronage available. It replaces the core piece of the Cumberland Line, but diverges from it at either end. To the south, L3 takes the proposed Y junction from Casula to Georges River, and from Narwee dives south to a dedicated stub terminal station at Hurstville. There may be some synergy between this proposal and the construction of a direct Enfield to Illawarra freight link. To the north, L3 dives from Toongabbie to Hills Centre and then shares S2 track to Castle Hill station and a turn-back (a separate terminating platform should not be required). This route has been chosen because of its acceptable grade and a minimum of new construction.

Link Line 3 services would probably only stop at key stations in accordance with the concept of providing fast trains between centres that has been espoused by the Warren Centre. Suburban double deck trains would be the preferred choice for L3, considering the route sharing with S2 and S3 services, but the use of metro style trains would reduce the tunnelling costs into Hurstville and Hills Centre.

10 Metro Line 2 (M2)

Metro Line 2 has been taken directly from the River Line of the Christie Report as it clearly provides much that is useful. A pair of spur routes from Kingsford to Little Bay in the east, and from Pyrmont to Five Dock in the west, have been added. These will provide coverage to otherwise neglected areas and increase the service frequency through the CBD.

11 Metro Line 3 (M3)

The southern part of Metro Line 3 from Newtown is as proposed for the Central Line in the Christie Report. However there are several differences to the north of Newtown. A Chatswood to Brookvale link is retained as part of M3, but this has been extended from the interchange with S2 at Brookvale to Manly. As S2 provides a CBD oriented service from Warringah, M3 can continue beyond Chatswood with a complementary role to link other inner areas. Accordingly, the Network Plan has M3 continuing further west through Lane Cove and Hunters Hill to share with M2 the Drummoyne to Rozelle sub-harbour route. Between Rozelle and Newtown, M3 serves Glebe, with interchange to the Five Dock spur, and Sydney University.

Overall, M3 provides a Warringah to Cronulla service through an inner western ring with interchange to all other CBD oriented lines, rather than serving the CBD directly as envisioned for the Central Line in the Christie Report.

12 Link Line 1 (L1)

Link Line 1 provides a service between Parramatta and Crows Nest via Epping and Chatswood. It shares a Parramatta stub with M2, absorbs a duplicated Carlingford Line, shares capacity with S2 between Epping and St Leonards that is available due to S2 having a branch to Warringah, and has a dedicated stub platform at Crows Nest. L1 could also share with S2 the Mobbs Hill to Epping segment if this, rather than the Main Northern Line, is used as an alternative take-off point for the North West Rail Link. Otherwise, this tunnel segment would be solely for L1 services and a less expensive low profile tunnel for metro style trains could then be considered.

The line is not likely to be heavily patronised, and the originally envisaged concept of connecting through Parramatta as a main route to the west conflicts both with sectorisation goals and the poor alignment of the Carlingford Line. However, the cross regional linkages that L1 provides are enticing, the site limitations at Epping preclude the use of other modes for interconnection with S2 and S3 services, and there is only a limited amount of new construction required. It is likely that short trains would be sufficient for the L1 service, and, although suburban double deck trains would be suitable, metro style trains would be necessary if low profile construction were used for the Mobbs Hill, and Parramatta stub, tunnel segments.

13 Link Line 2 (L2)

The concept for Link Line 2 is similar to that for L3, and that is to provide key centres with direct or one-change access from all of the western rail routes. For L2, the key centres are Olympic Park and Bankstown. As with L1 and L3, some shared operation with other lines is envisaged where capacity is available to contain establishment costs.

The first step in establishing L2 would be for the M1 Lidcombe branch service to absorb the Olympic Park shuttle, and also serve Pippita, by providing a through underpass link at Lidcombe. This underpass may have other benefits, such as reducing conflicts or providing an emergency routing, for some CountryLink services. The completion of L2 would involve separating the Bankstown to Olympic Park service from the rest of M1, and extending this service at either end to serve Hurstville and Epping.

The southern extension would require a dive east of Bankstown to serve Roselands, join L3 south of Beverly Hills and share the L3 stub terminal at Hurstville. An interchange station would be established at Beverly Hills. Some synergy with an Enfield to Illawarra freight link may also be possible with these works.

The northern extension would require a dive between Olympic Park and Rhodes to allow L1 services to reach the S3 terminus at Epping. An additional southbound platform, or possibly two new platforms, would be required for L2 services at Olympic Park to accommodate the simultaneous provision of L2 services and S2 based event services from Sydney Terminal and Blacktown.

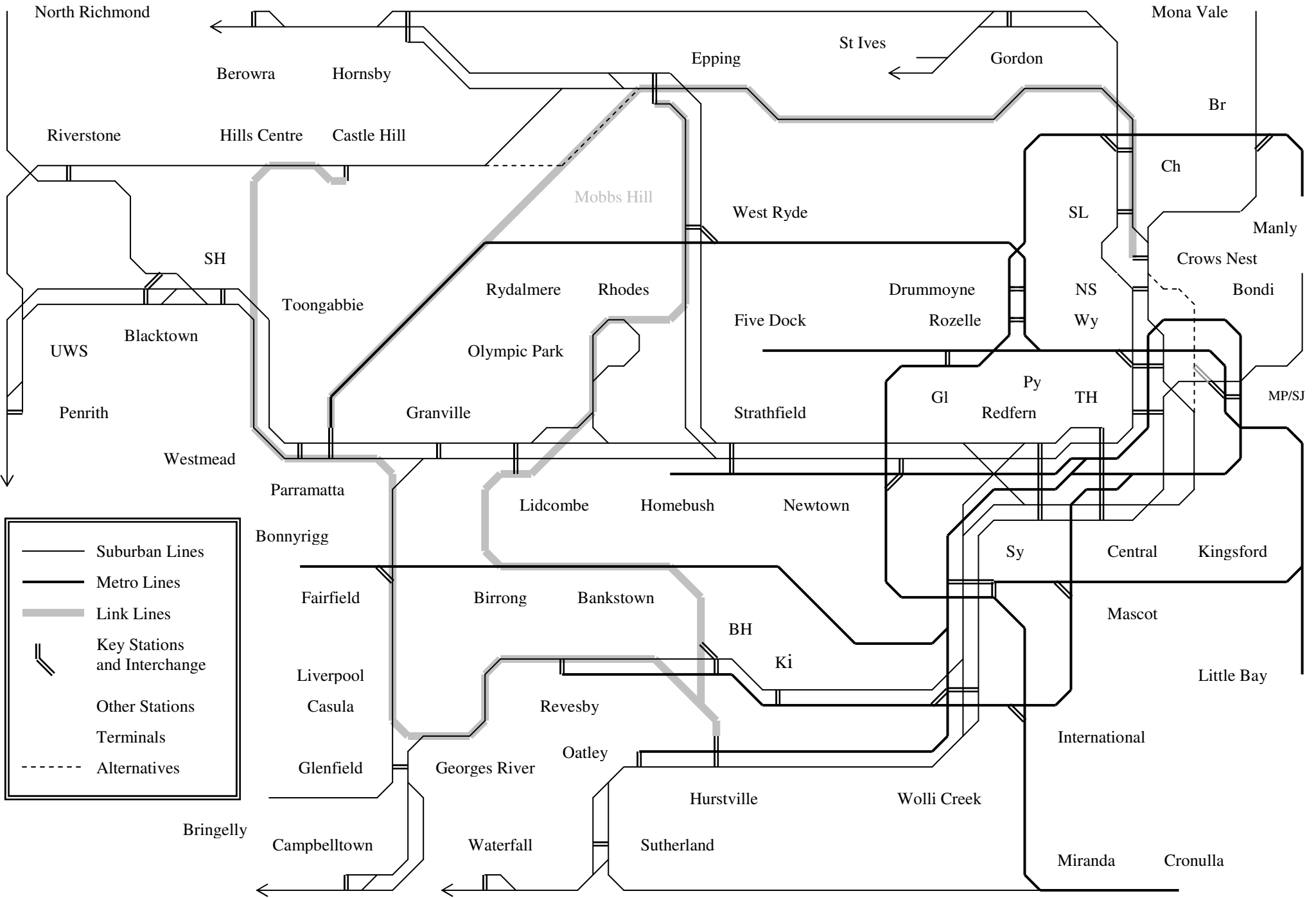
Metro style trains would be provided on L2, probably short trains normally but built up during event loads, and accordingly most tunnelling work could be of low profile construction. L2 services should enable a significant reduction of the event bus task to Olympic Park to be achieved.

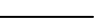






14 Network Summary

A brief summary of the individual branches for each of the nine lines that comprise the Network Plan is presented in the following table. A network map is presented on the next page.

Line	Between:	And:
M1	<ul style="list-style-type: none"> ▪ Homebush ▪ Bonnyrigg via Bankstown 	<ul style="list-style-type: none"> ▪ Revesby via International ▪ Oatley
M2	<ul style="list-style-type: none"> ▪ Parramatta via West Ryde ▪ Five Dock 	<ul style="list-style-type: none"> ▪ Little Bay ▪ Sydenham via Kingsford
M3	<ul style="list-style-type: none"> ▪ Manly via Chatswood 	<ul style="list-style-type: none"> ▪ Cronulla via International
S1	<ul style="list-style-type: none"> ▪ Bondi 	<ul style="list-style-type: none"> ▪ Cronulla via Hurstville ▪ Waterfall ▪ Wollongong
S2	<ul style="list-style-type: none"> ▪ Penrith via Castle Hill ▪ Hornsby/Wyong via Epping ▪ Mona Vale 	<ul style="list-style-type: none"> ▪ Penrith/Springwood via Parramatta ▪ Campbelltown via Sydenham
S3	<ul style="list-style-type: none"> ▪ Berowra via Gordon ▪ St Ives ▪ North Sydney/New Central Coast via Gordon 	<ul style="list-style-type: none"> ▪ Richmond via Blacktown ▪ Epping via Strathfield ▪ Bringelly via Granville
L1	<ul style="list-style-type: none"> ▪ Parramatta via Epping 	<ul style="list-style-type: none"> ▪ Crows Nest via Chatswood
L2	<ul style="list-style-type: none"> ▪ Epping via Olympic Park 	<ul style="list-style-type: none"> ▪ Hurstville via Bankstown
L3	<ul style="list-style-type: none"> ▪ Castle Hill via Parramatta 	<ul style="list-style-type: none"> ▪ Hurstville via Revesby

The S3 makeup is potentially the most complex. One service plan of five elements out from Strathfield could be: all Blacktown; all Epping; key Liverpool all Bringelly; key Blacktown all Richmond; and key Granville all Liverpool, which perpetuates the long (up to 15 minutes) waiting time problem for some users at crowded Town Hall. More frequent services (using only three elements) to reduce this waiting time would probably require some peak period leakage into S2 from Bringelly at Glenfield and/or from Richmond at Riverstone to provide enough total capacity on these routes.



-  Suburban Lines
-  Metro Lines
-  Link Lines
-  Key Stations and Interchange
-  Other Stations
-  Terminals
-  Alternatives