

SYDNEY'S GROWTH ENGINES: DRIVING SYDNEY'S ROAD NETWORK NEEDS

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ABSTRACT:

Sydney, a global city, faces new and continuing challenges in providing efficient road-based transport infrastructure to serve its growth and sustain its economy. As the population, Port and Airport continue to grow, there is a need to prioritise upgrades to the more congested parts of Sydney's strategic road network. This paper looks at Sydney's growth engines, and how they are anticipated to expand. It considers the transport system performance to support Sydney's economy, and considers priorities for enhancing the motorway network and strategic road system over the next decade.

INTRODUCTION

Travel is a derived demand. Travel is ‘the joint consequence of land-use activity levels and transport capability’ (Blunden and Black, 1971). The starting point for identifying Sydney’s road needs is to understand the land use activities affecting travel, and how they are expected to change in the future. This paper will examine these factors, as well as consider how the road transport system is performing.

Sydney is Australia’s only global city (DOP, 2005). It is crucial to support Sydney’s economic growth in parallel with balancing social and environmental impacts. During the 19th Century, Melbourne was Australia’s leading city. Its wealth arose from agriculture and secondary industry and was spurred by the gold rush in the mid-1800s. During the 20th Century, Sydney became Australia’s pre-eminent city as tertiary industries became dominant. Land uses and transport development need to be planned to support and reinforce that role.

While the populations of some countries are forecast to fall in future as demographic shifts affect birth rates, Australia is expected to see continuing population growth. This growth has a high impact on Sydney, whose status as a global city results in much of the Australian population growth being focused on Sydney. Sydney contains 20 per cent of Australia’s population and 20 per cent of Australia’s jobs. It accounts for 25 per cent of Australia’s total annual production of goods and services. The population of Sydney is forecast to rise to 5.3 million in 2031 (DOP, 2005).

As the population grows, other pressures will emerge on Sydney’s transport systems. The port and airport will continue to grow strongly in line with restructuring of the Australian economy, employment will diversify and expand, and commensurate expansion in road freight, business trips and the movement of people will occur. Figure 1 shows the main areas of focus within Sydney.

This paper looks at the forecasts of growth in these and related areas, considers what pressures these will place on Sydney’s road network, and indicates the focus for future development.

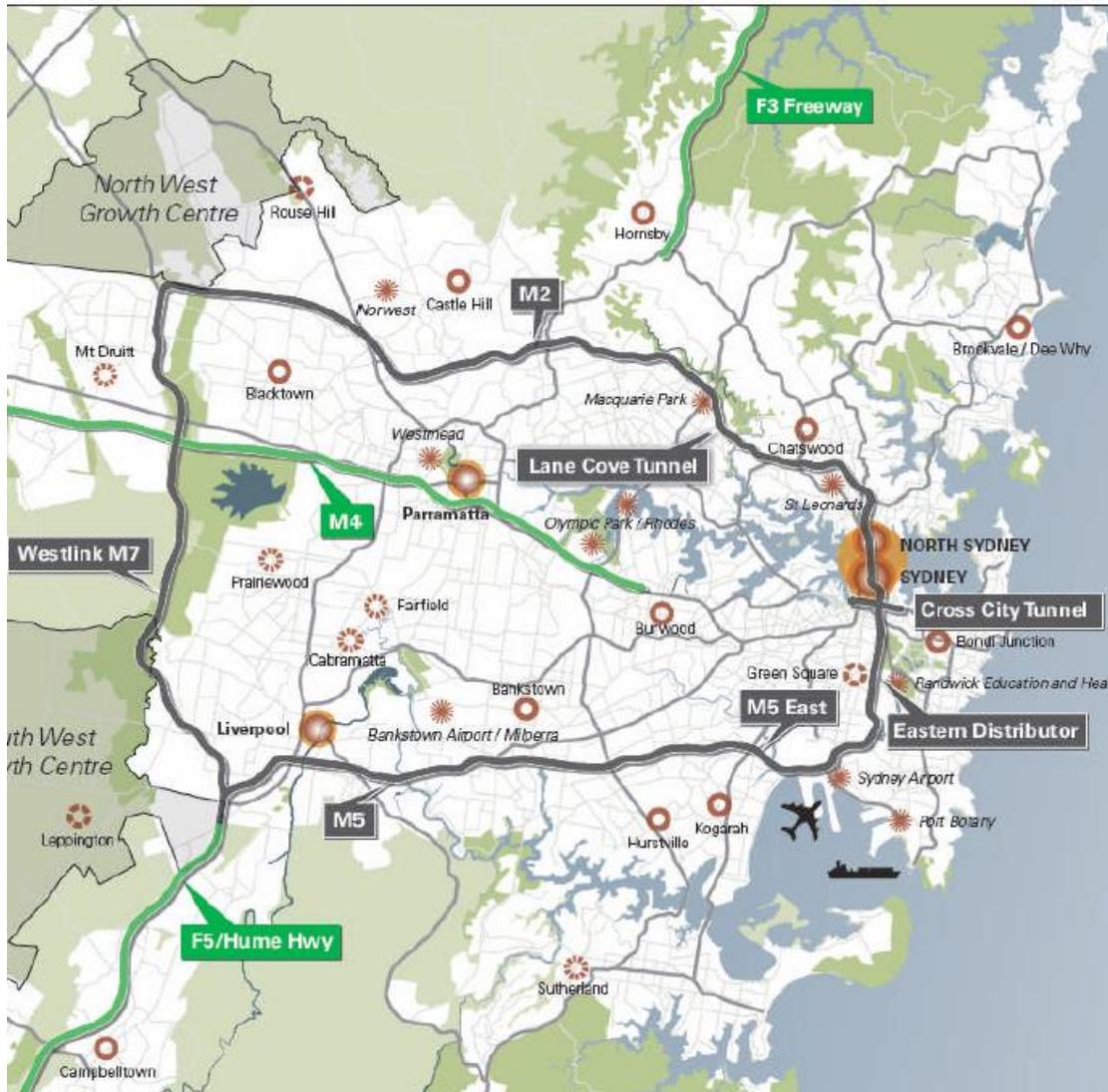
SYDNEY’S POPULATION

Sydney has a thriving population. In 1988, Sydney’s population was 3.5 million (DOP, 1988), and it reached 4.2 million in 2005. It is forecast to reach 5.3 million in 2031, and around 640,000 additional dwellings will be needed (DOP, 2005). This represents a future population growth rate of just under 1 per cent per annum. The population growth has created a vigorous city, with varied employment, educational, health and recreational opportunities, but it comes with pressures to expand infrastructure to ensure that the economy continues to support and serve the population.

In 1988, ‘*Sydney into Its Third Century*’ projected that there would be a ‘decline in the inner and middle suburbs... In 1986, these areas held about 40 per cent of the Metropolitan population but by 2011, they are likely to hold less than 30 per cent. The

bulk of Sydney's growth will be in newly developing areas in the north-west, west, south-west and in Gosford/Wyong' (DOP, 1988).

Figure 1: Sydney Orbital and major arterial road network



In fact, since 1988, these forecast changes have not occurred. Demographics and community aspirations have changed, and today urban rejuvenation and even gentrification of inner suburbs has become a significant movement. While many families still aspire to a new home in a new suburb on the urban fringe, inner suburbs have become the focus of changing lifestyles that reflect a more urban way of living, close to amenities and opportunities.

Today, the target is to 'provide 60-70 per cent of new housing in existing urban areas' (DOP 2005). The changing attitudes have seen that proportion reach as high as 90 per cent in some recent years, as families reconsider their attitudes towards the tradeoffs between suburban lifestyle on the fringe of the city and the opportunities available with inner-city living.

At the same time, household occupancy is falling as family sizes evolve. From 3.0 in 1981 (DOP 1988), and 2.65 in 2005, the number of persons per dwelling is forecast to fall to 2.36 by 2031. (DOP 2005).

The overall result of forecast population increases is that Sydney's additional inhabitants will be spread across the metropolitan area. The densest areas will remain the lower North Shore, Eastern Suburbs and Inner West, and the existing footprint of Sydney will include an additional 420,000 dwellings by 2031 as brownfields sites are redeveloped. However, there will also be an additional 220,000 homes on the urban fringe. Clearly there will be pressures for improvements to accessibility on the fringe, but also demands for improvements to congestion in existing areas as they grow in density.

Urban consolidation and opportunistic brownfields redevelopment of disused industrial sites will result in a scatter of infill development of dwellings within the present urban footprint. On the fringe, most new dwellings will be in the two major growth centres – the North West Sector and the South West Sector.

EMPLOYMENT

Sydney is indeed a global city. It contains 30 per cent of national employment in the financial and business services sector. It contains nearly half of Australia and New Zealand's top 500 companies. Sydney's economy is comparable in size to Singapore and is larger than New Zealand's.

Sydney is forecast to have another 500,000 jobs by 2031, taking the total to 2.5 million jobs (DOP 2005). This represents a growth rate of 0.8 per cent per annum. Almost half of the new jobs are expected to be in Western Sydney, already Australia's third largest economy. Major opportunities exist within the Western Sydney Employment Hub, a greenfields site that became attractive with the opening of the M7. The Hub is at the junction of the M4 and M7 Motorways, and so has high accessibility for freight and business vehicles. At full development it could offer around 36,000 jobs. A further 30 per cent of Sydney's new jobs are expected to be in the global economic corridor from Macquarie Park to the City through to Sydney Airport and Port Botany.

Jobs growth along the global economic corridor will place pressure on the transport systems in that area, but at the same time jobs growth in the west will require support from improved transport systems in the west.

SYDNEY AIRPORT

One of the key elements supporting Sydney as a global city is its airport, situated just 8 kilometres south of Sydney CBD. It is Australia's busiest airport for scheduled passenger services, and handles around 46 per cent of all of Australia's international and around 23 per cent of all domestic and intrastate passengers. Sydney Airport Corporation Ltd (SACL) has recently been carrying out the updating of its Master Plan. The draft plan points out that Sydney Airport is one of Australia's most

important pieces of infrastructure. The airport generates \$8 billion of economic activity, equivalent to 6% of the NSW and 2% of the national economy annually (SACL, 2009). It is an integral part of Sydney's economy and is one of the major growth engines of Sydney's economic and social wellbeing.

Access to Sydney Airport as a centre of economic activity is needed by passengers, freight operators and employees. Passenger movements through Sydney Airport are forecast to rise from the present 32 million passengers per year to around 78.9 million by 2029, growth of 146 per cent or an annual rate of 3.7 per cent. This would represent an average of 2.5 passengers per second each day in 2029. The Airport presently generates around 75,000 jobs directly, and there are expected to be an extra 100,000 direct and indirect jobs over the next ten years, many in the locality of the airport. Air freight through the airport is currently around 471,000 tonnes per annum, and is forecast to rise to around 1,077,000 tonnes by 2029, growth of 128 per cent or an annual rate of 3.3 per cent.

While virtually all freight reaches the airport by road, passengers and employees do have bus and rail public transport options. The mode split for access to the Airport is around 88 per cent by road based modes, including car, taxi and bus, with 11 per cent gaining access by rail (SACL, 2006). Overall, 49 per cent gained access by private vehicle. The 2009 Master Plan Preliminary Draft commits to increasing public transport access by 5 per cent. Even if this growth in public transport usage is achieved the growth in total passengers of 146 per cent and freight growth of 128 per cent, would leave a very greatly increased task for the road system to meet.

Despite recent challenges including SARS, terrorism and the global recession, air travel remains relatively cheap and is expected to remain in high demand into the foreseeable future. Larger, more efficient aircraft are ensuring air fares remain low, serving the demand for tourism and business travel within a global economy.

The road system in the environs of the airport will come under growing pressure, and the motorways connecting to the Airport will see ever increasing congestion in the absence of expansionary works.

PORT BOTANY

Port Botany is one of the key growth engines for Sydney's wealth. In 2001/2002, the output of Port Botany was \$1,480 millions, including value adding of \$815 millions. It generated more than 10,000 jobs, including more than 4,000 at the port (Sydney Ports, 2003 and 2006). Its prime market is Sydney, with around 80 per cent of containers being packed or unpacked within the greater metropolitan area. Apart from many manufactured imports, the port also serves the export of beverages, machinery, meat, cotton, manufactured goods, paper products, iron and steel, chemicals, non-ferrous metals and cereals.

For this reason, the NSW Government has made the strategic decision of expanding container operations at Port Botany, rather than elsewhere, as it is best located to serve the Sydney market. In total, Sydney Port Corporation is investing \$1 billion to expand port infrastructure to meet growing demand with the new berths expected to

be ready for trade by 2012. This will significantly intensify land side activity around Port Botany and the demand for high quality connections to key distribution centres mostly in Western Sydney.

With Sydney's growing population, the port is forecast to grow in parallel. The number of containers moving through Port Botany is expected to grow from the present roughly 1.38 million TEUs per year to around 3 million TEUs per year within 20 years (Sydney Ports, 2006). At present, around 20 per cent of these containers are moved by rail. It is a Sydney Ports target to increase this proportion to 40 per cent. Nonetheless, even if this target is achieved, in around 20 years the number of containers moving by road will roughly double because of the strong growth in overall container numbers (see Table 1). This will place further pressure on the road system around the port precinct. Should 40 per cent of containers be railed to an inland intermodal terminal, distribution by road from that terminal will create pressures on the roads in that vicinity.

Table 1: Forecast Growth in Sydney

	Current	Projected Future	Calculated Annual Growth Rate
Population	4.2 million in 2004	5.3 million in 2031	1%
Jobs	2.0 million in 2004	2.5 million in 2031	0.8%
Road freight	10.39 billion tonne-kilometres in 2003	17.85 billion t-km in 2020	3.3%
Sydney Airport – Passengers	32 million passengers pa (2007)	78.9 million pa in 2029	3.7%
Sydney Airport – Freight	471,000 tonnes pa (2007)	1,077,000 tonnes pa in 2029	3.3%
Port Containers (TEUs)	1.38 million pa (2008-09)	3 million pa in 2026	4.2%
Port Containers (TEUs) – Rail	20% 276,000 pa (08-09)	40% target 1,200,000 pa	7.5%
Port Containers (TEUs) – Road	80% 1,062,000 pa (08-09)	60% 1,800,000 pa	2.9%

The co-location of Sydney Airport and Port Botany and the strategic decisions to intensify both in their existing location presents a particular transport challenge for the road system. The level of heavy vehicle and light vehicle traffic generation from these facilities is very high. This traffic mixes with general traffic in the area and on the Orbital Motorway, creating heavy congestion in this vicinity.

ROAD FREIGHT

BTRE (2006) has forecast that the Sydney road freight task will grow at an annual average rate of 3.0 per cent per annum from 2003 to 2020. This will result in Sydney freight growing from 10.39 billion tonne-kilometres in 2003 to 17.85 billion tonne-kilometres in 2020.

This growth in the Sydney road freight task will see more trucks on the roads, and is likely to place more pressure on agencies to allow innovative vehicle types such as B-Triples for line haul, and innovatively configured Performance Based Standard vehicles (PBS vehicles) for specific tasks. This change in the vehicle mix may lead to management issues at some locations where heavy vehicles can have a disproportionate impact on overall flows, such as on steep or long grades and at tightly configured intersections.

Behind the growing urban freight task is not only growing population and increasing household wealth but also significant economic restructuring in Australia resulting in less local manufacturing and a significant increase in imports, with greater distribution demands from NSW ports and airports, predominantly by road.

SYDNEY'S MOTORWAY NETWORK

In recent years, the development of the Motorway System in Sydney has progressed. The Sydney Orbital is now in place, complemented by the M4 Motorway (the key artery serving the east-west spine between Penrith and Strathfield), and the M5/F5 (connecting Liverpool to the south western suburbs and Canberra). North of Hornsby, the F3 is the strategic link to the Central Coast, Hunter and beyond. This constitutes a network of more than 160 kilometres of motorways and freeways, including nine tolled roads, enabling efficient and direct travel around Sydney.

The Sydney Orbital is a circulating motorway that serves a variety of functions. Between Macquarie Park and Mascot, along with the parallel railway line, it is the prime strategic artery connecting centres along the global arc. More widely, it links the global arc to the south-west and to the north-west, and also forms a north-south distributor within the growing western parts of Sydney. Overall, high standard connections are provided. These link the CBD, the Port and Airport, North Sydney-Macquarie and the industrial and employment areas in Western Sydney. The Orbital provides access from Sydney's widespread residential suburbs, offering opportunities for workers to use the improved accessibility offered by the Orbital to reach their employment.

A study of Sydney's toll road network found that it is increasing the State's Gross State Product significantly, by as much as \$3.4 billion (or 0.89 per cent of GSP) by 2020, and is creating jobs, around 4,000 by 2020. Its economic contribution is comparable to that of Port Botany, and more than that of Port Melbourne and Melbourne Airport. From a review and update of the economic analysis of the various projects, it was found that the total economic contribution of Sydney's toll road network indicated a net present value of \$22.7 billion (Ernst & Young, 2008).

The environmental benefit, from minimising greenhouse gas emissions and noise, was found to be \$1.1 billion. Constructing the new motorways created opportunities for road users to expand their geographic accessibility using the network. These network benefits, relating to improved connectivity, business and residential development, and employment opportunities were in the order of \$600 million in 2007 growing to \$900 million in 2020. The Motorways also enable significant socio-economic changes including accommodating population expansion by facilitating

improved access to employment, supporting industrial and commercial change and accessing new residential development areas.

These measures of the value of the Motorway system demonstrate why there is such heavy daily usage of the system. Table 2 summarises the high volumes of traffic using the Motorways.

Table 2: Daily Traffic and Heavy Vehicle Volumes on Sydney's Motorways (2008)

	AADT	Heavy Vehicles	% Heavy Vehicles
Sydney Harbour Tunnel	80,000	2400	3.2%
Eastern Distributor Tunnel below William St	115,000	3680	3.2%
M2 at North Rocks	67,666	5830	8%
M4 at Toll Plaza	115,000	6325	5.5%
M5 at Milperra	85,000	6000	7%
M5 East Tunnels at Kingsgrove	99,300	8050	8%
M7 at Prestons	47,000	10100	22%
M7 at Eastern Creek	49,000	10500	21%

ROAD NETWORK PERFORMANCE

The major flows of traffic in Sydney occur on the strategic arterial roads. These are the highest order roads in Sydney's road hierarchy, which 'predominantly carry through traffic from one region to another forming principal avenues of communication for metropolitan traffic movements' (TA of NSW 1980). In Sydney the Motorways are at the top of that hierarchy, and they are assisted by the urban arterials connecting to them. Traffic flows and heavy vehicle proportions on the Motorways are shown in Table 2 and Figure 2.

Over most of their length the Motorways are of four lane configuration. Many of the urban arterials are of six lane configuration with many intersections, but some are four lanes. In some areas commerce and freight constitutes the key component of the traffic stream, particularly leading to the port and airport, and through Western Sydney's industrial areas. At other locations the movement of people is key, such as on the Warringah Expressway/Sydney Harbour Bridge and along Parramatta Road just west of the CBD. At locations such as these, Bus Lanes are provided to give travel time advantage to the bus flows. At both of these locations, more people travel in the Bus Lanes than in the other lanes combined.

To assess the performance of the urban arterial network, modelling of future years has been carried out within the RTA. By adopting the future population and employment projections of the Department of Planning referred to above, and assuming that no new roadworks are constructed in future, a stress test of the network can be carried out for some future year. The results can be mapped using plots of Volume to Capacity ratios (V/C ratios) to show where the most congestion would occur based on these assumptions. The map at Figure 2 shows the

performance of Sydney's road network for 2026 assuming that there is no new construction of roads to add to the current network in the future.

This analysis shows that, should no new roadworks be constructed, the most severe congestion would occur along the corridor from the Eastern Distributor, past the port and airport, along the M5 through Liverpool and along the F5 to Campbelltown. Other severe areas of congestion occur along the M4 Motorway, through the CBD and North Sydney and in Sydney's North West.

Being located on one of the major corridors serving the airport, port and inner parts of Sydney, the M5 East carries heavy traffic on its four lanes. In particular it serves freight and business needs, with general passenger transport served by the parallel railway line. Six months after opening it was carrying around 82,000 vehicles per weekday. (Today, flows can exceed 100,000 vehicles per day.) Of this, around 3.7% were articulated vehicles, and overall there were around 8.8% heavy vehicles (SKM 2003). These are very heavy flows. With that high proportion of articulated vehicles, the M5 East is at capacity today.

At its eastern end, the M5 East merges with General Holmes Drive before running onto the Eastern Distributor. This section of General Holmes Drive serves the port and airport directly. It has four lanes in each direction and carries around 133,000 vehicles per day (RTA 2003). It is currently at capacity.

Fig 2 Modelled Sydney Level of Service (LOS) for 2026



The extent of land use intensification foreseen in the vicinity of the port and airport for the next couple of decades, and commensurate traffic generation described above,

would result in severe congestion on M5 East and General Holmes Drive should nothing be done.

This finding is consistent with the strategic importance of the route on the Sydney Orbital, and the servicing of the area through which it passes. The F5/M5 corridor from Campbelltown to the CBD serves a population of around 1.5 million people, representing around one-third of Sydney's population and almost 8 per cent of Australia's population. There are around 1 million jobs in the corridor, representing around 45 per cent of Sydney's jobs and 10 per cent of Australia's jobs. Forecasts to 2026 indicate these will increase to around 1.8 million people and 1.1 million jobs in the corridor (TDC, 2008).

In contrast, Victoria Road is a key commuting corridor. Planning is currently underway for the Inner West Busway, between Drummoyne and White Bay. This includes 3.5 kilometres of dedicated Bus Lanes and new Clearways, to serve the 200,000 commuters who catch a bus along Victoria Road each week (RTA 2009). The M2 Motorway in Sydney's North West incorporates Bus Lanes and serves a similar function of allocating space to buses to ensure fast and reliable bus services deliver people to their destinations in priority over private vehicles on the congested roads. As travel demand and congestion grow in future, demand for similar facilities will need to be monitored to ensure the continuing effectiveness of the road network.

DEMAND MANAGEMENT

The most powerful element encouraging people away from private road travel is good public transport. As can be seen from the above discussion, care is being taken to structure road development to complement rail public transport, and to support on-road bus facilities. Nonetheless, Sydney is a large city, and many origin-destination pairs are poorly served by public transport. Road travel will remain an important means of access for passengers in the future.

Other initiatives will continue to be supported, playing an important but lesser role. Teleworking, flexible working hours, commuting by foot or bicycle and limitation of parking within centres will contribute to the strategy. Careful land use planning, to achieve a reduction in the need for long private commutes, will also be crucial.

Within Sydney, road freight really has no competitor that can make a significant impact on the foreseeable needs to move freight by road. This is confirmed by the BTRE 2006 study. The recognition that there will remain significant numbers of freight movements on the road system is essential.

Transport pricing offers opportunities to encourage road users to think more about their travel. To reduce travel in peak hour, time of day tolling has been introduced on the Sydney Harbour Bridge. Other pricing initiatives may arise in Sydney, but pricing also has its limitations, and works most effectively when there are attractive alternatives such as improved public transport.

CONCLUSIONS

Sydney has earned its place as a global city as service industries have come to dominate its economy. With this status, Sydney has become an attractive place to live and work, and to find educational, recreational and health facilities. The main engines of growth are strong population and employment growth, expansion at Port Botany and Sydney Airport, and the concentration of much activity along the Sydney Orbital Motorway, especially through the global arc and extending to Liverpool and the southwest.

Over the next decade, there is a need to consider upgrades to these elements of the Orbital to support those key engines of growth within the Sydney economy. Similar enhancements in Western Sydney would focus attention on western segments of the motorway system to respond to large growth engines like growing employment centres. On the strategic arterial road network, initiatives to support bus priority will be required at specific locations where there are major commutes to strong centres.

Apart from infrastructure expansion needs, demand management will continue to be an important element of managing transport demands. The continuing debate about transport pricing (road, rail and public transport) will play a part in identifying ways to get the most out of our mature transport network.

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