Easing Sydney’s Congestion – Developing a Road Network for Tomorrow’s Sydney

1. Introduction

This paper is delivered in the context of a reinvigorated NSW economy which has grown faster than any other state with unemployment at or below the national average and expected to fall to 5.5 percent through 2017\(^1\). The NSW population of more than 7.5 million has also grown strongly (1.4 percent in 2015), above the national average of 1.3 percent\(^2\).

NSW has continued to grow through the transition from the investment phase of the mining boom to a more diversified economy underpinned by finance and professional services and a significant pipeline of public infrastructure projects.

Sydney is vital to the continuing growth and prosperity not only of the city but of the state and Australia. However, the city’s population growth has led to increasing traffic volumes and congestion not only during traditional peak travel periods but increasingly on weekends.

Major projects including Westconnex and Northconnex are already being delivered to connect the city’s motorway network. This is only part of the solution. Roads and Maritime Services (Roads and Maritime) is overseeing a billion-dollar program to tackle congestion on the network – we are doing this through a number of avenues including infrastructure and technology improvements as well as long-term strategic planning.

This approach will address the issues faced by road users every day across the Greater Sydney network both now and into the future. But the future will bring new challenges including:

- Changing expectations from our customers who are often time-poor
- Sydney moving from being an extensively developed city to one with a central ‘global’ pocket of high population densities
- Rapidly changing technology
- Government funding constraints
- Rising costs.

As we look into the future, we know we have these challenges to overcome as well as a significantly changing environment as “Tomorrow’s Sydney” becomes reality.

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\(^1\) NSW Budget 2015-16, Budget Overview p5
\(^2\) Australian Bureau of Statistics, September Quarter 2015
2. Population Growth and Global Sydney

Tomorrow’s Sydney will be home to almost double the population of today’s city.

The Sydney of 2060, not even a lifetime away, is forecast to grow to almost nine million people\(^3\). This trend is mirrored globally with 60 percent of the world’s population expected to live in cities by 2030, a 10 percent increase from 2016 figures and more ‘megacities’ with populations above 10 million people are predicted to emerge\(^4\).

Based on this, Sydney will be trending towards the realm of a megacity. Although it would be considered a small megacity in comparison to the likes of Tokyo and Shanghai, the associated demands on our city’s infrastructure and economy will be immense.

Sydney holds the unique position of being Australia’s first global city. Global cities are defined as those that service and support the complex and specialised economic activities of global markets. Global cities are not constrained by international borders and are known for driving innovation, creativity and positive economic, environmental and social outcomes. The *NSW Long Term Transport Master Plan*\(^5\) noted that a study by the Globalisation and World Centres Research Network indicated that Sydney was one of several Pacific Rim cities that had experienced a rapid rise to an “alpha” city status, reflecting Sydney’s position in the global economic network.

Transport has a critical role in supporting Sydney as a global city. Strong connectivity across the city, quality public transport networks and opportunities for walking and cycling all contribute to maintaining Sydney’s role as a centre of economic and social activity.

While one-off geographic features including ports, universities, shopping centres and planning regulations can generate intensive transport demands, population density is the main driver of outcomes across the network. London, for example, has 5100 people per square kilometre and has a highly developed mass transit system with reduced private car use.

Australian cities have significantly lower population density (Sydney has 2100 people\(^6\)) resulting in different outcomes with less mass-transport and a greater proportion of private vehicle use for work and leisure activities.

In Sydney some rapid changes are occurring as the population ages and the economy continues to experience predominantly ‘white collar’ services industry growth with other sectors in relative decline.

New apartment sales have accelerated and are now the predominate form of housing as population densities continue to increase markedly. There are now 21km\(^2\) of Sydney with population densities exceeding 8000 people per square kilometre and 93km\(^2\) of between 5000 and 8000 people.

Overall Sydney has 114 km\(^2\) of population densities of more than 5000, concentrated in the CBD centre and inner west, east, north and south of the CBD - Global Sydney (see Figure 1).

\(^{3}\) Australian Bureau of Statistics\(^\text{a}\) (ABS) population forecasts (2013). *Population Projections, Australia 2012 (base) to 2010.*

\(^{4}\) McKinsey 2016, *Urban Mobility at a Tipping Point*

\(^{5}\) *NSW Long Term Transport Master Plan*\(^\text{b}\) (2012, p. 28)

The rate of intensification is also increasing quite rapidly. In 1993, population-weighted density per hectare was 19 in Sydney, but by 2014 it had increased to 25 – an increase of 32 percent in 21 years.

The ramifications of what has been a low population density, aligned with planning policies, is that Sydney has a transport system very different with what, in population terms, is happening in four million people plus cities around the world. In particular, the rate of rail and bus use is comparably very low (see Figure 3).

As a result of this relatively low public transport mode share, Sydney has a high reliance on private cars (see Figure 3). Sydney ranks at the bottom of the sample for public transport trips compared to the number of cars per 100 people, where it has the highest level.

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7 Australian Bureau of Statistics, 1270.0.55.007 - Australian Population Grid, 2011
8 Australian Bureau of Statistics, 1270.0.55.007 - Australian Population Grid, 2011
Figure 2 – Rail and bus use in Sydney compared to various other international cities

Figure 3 – Sydney car ownership and use of Public Transport compared to international cities
3. Tomorrow’s Sydney – our transport challenge

When combined with the population statistics, these data help to explain the growing congestion problems faced in Global Sydney. It is rapidly approaching the population density of an overseas megacity but continuing its historic reliance on private cars for transport.

The conclusion from this is that in Global Sydney, there is no longer any space for an expanded road network; or the expense of road infrastructure is very high due to the intensity of development. During the peak periods, road space is overly consumed by single occupant vehicles at the expense of more efficient forms of transport including buses.

With these numbers and the rising population of Global Sydney, mass rail transit, as represented by the Sydney Metro is the most efficient form of transport to deal with growing transport challenges. For Roads and Maritime, in Global Sydney, our actions are most efficiently deployed on pinch point work, enforced clearways and continuing Sydney Coordinated Adaptive Traffic Systems (SCATS) optimisation. As many of the congested roads are council roads we will also need to work closely with Sydney’s councils to ensure full network benefits are maximised.

The heart of any city is its transport network which is why it is critical to develop an integrated system that not only addresses the demands of today’s Sydney, but one which can meet the demands of tomorrow’s Sydney. Long-term planning for our growing city is well underway but, even a fraction of that growth, demands immediate attention.

4. Traffic congestion in today’s city

As I’ve explained, across the wider Sydney basin there is low public transport use when compared to Global Sydney and other Australian and international cities. While public transport may be used by those who work in Sydney’s larger cities, for those who work elsewhere, private transport is by far the predominate mode of travel.

Population dispersion makes mass transit a challenge – but there is a clear need to push for greater bus use to improve road use and throughput. Transport orientated development needs to take place at and around transport nodes across the network, not just in Sydney’s CBD. Several reports have shown the centre of economic gravity increasingly moving to the west, with employment growth around business parks, the development of the airport in western Sydney and the emergence of a second CBD at Parramatta. With these developments there is also a need for targeted investment in arterial routes to connect nodes and from residential areas to nodes.

Greater use of the road space via public transport mode share can be increased through bus priority on the road network. Reliance on single-occupant private vehicles can also be partially addressed with T2 lanes, but population densities and development will need to increase significantly for sufficient economic returns to justify mass transit outcomes.

In response to this, and similar issues in other cities, Infrastructure Australia recommended in February 2016 that additional investment be made in infrastructure to improve access to mass road and rail networks and address an imbalance between the inner and outer suburbs9.

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9 Australian Infrastructure Plan 2016: IA Fact Sheet Cities 2016
Infrastructure NSW also recognised these capacity constraints in the 2012 State Infrastructure Strategy, stating that:

- “Investment in new and upgraded roads is essential to meet the transport task in Greater Sydney
- Many people in Greater Sydney will continue to work in Global Sydney, requiring expansion of both road and rail capacity
- Parramatta and other centres require investment to realise their potential.”\(^\text{10}\)

From the customer’s perspective, when we talk specifically about the road space, every Sydney motorist has a tale to tell about the impact of congestion on their daily lives. It only takes a breakdown, let alone a major crash, to bring traffic to a standstill, steadily rippling out across the network. A simple commute to work can be unexpectedly difficult, travelling times blow out and valuable working or family time life is lost.

A 12km peak-hour traffic jam on the Sydney Harbour Bridge is causing chaos for commuters following a serious car and motorcycle accident. The crash occurred just before 6am on Wednesday opposite Milsons Point Station. City-bound traffic is backed up 12km to the start of the M2. A Transport Management Centre spokeswoman said “The impact to the roads is pretty nasty.” Motorists could consider using Victoria Road and the Anzac Bridge, but those routes were really heavy as well, she said. Buses travelling across the bridge were experiencing delays of about 45 minutes and buses using Victoria Road and the Anzac Bridge were being delayed up to 60 minutes\(^\text{11}\).

In the simple terms, traffic congestion occurs when the volume of traffic exceeds the capacity of the road network. In today’s Sydney, population growth has led to increasing traffic volumes, with congestion found throughout the network, particularly during the weekday morning and evening peak periods and increasingly on weekends. The traffic volumes on these roads are steadily increasing, generally at a faster rate than additional capacity can be created, or alternative travel modes are available.

A road is considered to have severe congestion when the average travel speed is less than 40 per cent of the posted speed. Many arterial roads have average travel speeds of less than 30 km/h in the morning peak\(^\text{12}\). Speeds on the motorway network are also low in places, with the M4 and M5 Motorways experiencing travel speeds below 40km/h and 50km/h in some locations in the morning peak. Motorists using the M2 experience travel speeds as low as 20km/h in some sections.

\(^\text{10}\) 2012 State Infrastructure Strategy. (p14)  
\(^\text{11}\) NSW Long Term Transport Master Plan, 2012, p101)  
\(^\text{12}\) The Australian newspaper, 9 March, 2016
Congestion negatively impacts the day-to-day operation of Sydney’s roads and, by extension, the economy of the region, the State and Australia.

In today’s Sydney, 17.6 million trips are made on each average weekday in Sydney, 75% of those on our roads. Traffic congestion costs our economy more than $5 billion per year – more than $1000 for every Sydney resident. That figure is forecast to blow out to $8 billion per annum by 2020 if nothing is done to tackle the problem. Traffic congestion wastes valuable time, reduces travel reliability, increases costly vehicle wear and tear and impacts air quality, increasing the flow of noxious pollutants into our atmosphere.

Demand for the limited road space on the Sydney network has hit saturation. The NSW Long Term Transport Master Plan recognised “the M2, M4 and M5 Motorways are all operating at capacity during the morning peak period. Other key bottlenecks including Victoria Road, Spit Bridge and the Harbour Bridge are also at capacity”.

The Master Plan identified 46 strategic transport corridors across Sydney’s Greater Metropolitan Area where high concentrations of travel demand occur during peak periods on all travel modes. Six of those corridors are considered highly constrained in meeting travel demand, while 11 face medium constraints. Patterns of growth are expected to drive even higher demand along these corridors.
corridors. Without action by 2031, peak travel times by road are forecast to increase by an average of 15 minutes between Parramatta and the CBD. The six most constrained strategic corridors are:

- Liverpool to Sydney Airport
- Mona Vale to Sydney via Dee Why
- Parramatta to Sydney via Top Ryde
- Parramatta to Sydney via Strathfield
- Rouse Hill to Macquarie Park
- Sydney Airport to Sydney City.

Figure 5 – Our most constrained strategic corridors

**NSW Long Term Transport Master Plan:**

*Without action, many of the medium constrained corridors will also be performing very poorly by 2031. In particular, the forecast growth in the south west and north west will put increasing pressure on the existing road network. By 2031, these corridors will be even more congested. Without a package of actions (the “do nothing” scenario), they will not have sufficient capacity to accommodate the volumes of traffic moving along them.*

5. What does all this mean for Tomorrow Sydney’s road networks?

What all of this means is that the road network will need to evolve to overcome the challenges posed by transport activities. This is reflected in changing consumer tastes and expectations and technologies on the demand side and improved data and management systems on the supply side. This evolution may be slow due to the inherent static nature of the network but effective government decisions, policies and regulation can make the adaptation process less painful to the community.

Planning now for changes in the future will be vital for Roads and Maritime, and our Transport for NSW cluster partners, in addressing congestion and catering for excess demand on our limited road

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16 (NSW Long Term Transport Master Plan, 2012, p83)
17 NSW Long Term Transport Master Plan, 2012, p83
space. In Greater Sydney, use is the best road transport planning prioritisation tool available. It is measured by the number of passengers per hour per lane on the existing road stock and can also be used to plan additions to the network. A summary of the use rates of a selection of transport modes is shown in this table.

![Transport Use Comparison Table]

**Figure 6 – Transport use comparison for selected modes**

Under most scenarios, private motor vehicles will continue to have the largest mode share in most communities. At the margin, people will want to drive less, only when alternatives are convenient, integrated, comfortable, fast and affordable.

The NSW Government is addressing this demand on our Sydney road network through major motorways projects including WestConnex and NorthConnex. The $16.8 billion WestConnex scheme is the largest transport and urban renewal project in Australia. It will increase motorway capacity to provide faster travel times, support Sydney’s growing freight task and, most importantly, keep our economy moving. The M4 and M5 corridors perform a crucial role in linking the global economic area in Sydney’s east with the growing population and major development areas across western and south western Sydney.

NorthConnex will provide a vital link for commuters and freight operators between the M1 Pacific Motorway to the north and the Hills M2 Motorway to the south. The new nine kilometre motorway tunnel will feature interchanges connecting to the existing motorway network and arterial roads. It will provide the missing link in Sydney’s motorway network and the National Land Transport Network between the M1 and the Sydney orbital network and will save up to 15 minutes for users of the Pennant Hills corridor, each day, every day, in both directions.

These projects will directly benefit the communities they will run beneath, with an estimated 3000 trucks a day removed from Parramatta Road, and up to 5000 trucks a day off Pennant Hills Road. This will not only provide improved journey times, but will also deliver significant amenity benefits for local residents including the revitalisation of Parramatta Road.

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18 Asian Development Bank Study Source: Maximum passengers per hour per lane by urban roads – from an Asian Development Bank study
19 Littman 2013, *The new transportation planning paradigm*
The Western Harbour Tunnel project will be the next major motorway for development, expected to start at the beginning of the next decade. It will see the construction of an additional Harbour road crossing of about seven kilometres, connecting the WestConnex northern extension around Rozelle with the Gore Hill and Warringah Freeways. The Western Harbour Tunnel will relieve congestion on the Harbour Bridge and Tunnel, potentially diverting about 2000 vehicles an hour. There is also the M12 Motorway in development which will an about 17km link between the new airport in western Sydney and the M7.

While this gives a great overview of our work in building a connected motorway system for Sydney, there are a large number of other major road infrastructure projects in development and delivery which will significantly improve capacity and traffic flow. There are more than 30 major road upgrades currently being delivered in Sydney, many of these are in the western suburbs and are planned to support new growth areas. Some of these projects include The Northern Road in four stages, several stages for both Richmond and Schofields roads and Bringelly and Mulgoa roads as well as Narellan an Mulgoa roads.

While not specifically all in Sydney, Roads and Maritime has an ambitious task ahead to deliver the single largest series of infrastructure investments in the state’s history. Major project capital expenditure has more than double to $16 billion over the next five years to transform the state’s roads, freight and maritime network.

![Figure 7 – Western Sydney Infrastructure Plan projects](image)
6. Facing the Challenges

These major projects will address demand well into Sydney’s Tomorrow, but the NSW government also recognises the immediate need to reduce traffic congestion by improving the city’s existing road infrastructure as well as expanding it. The challenge is to reduce the impact of current road congestion and to slow the increase of future congestion, even as Sydney’s population continues to increase. The NSW Government has committed billions of dollars now and during the next decade to improve Sydney’s road network, and complimentary public transport system.

The State Infrastructure Strategy Update\textsuperscript{20} identifies key challenges including:

- Keeping Sydney’s roads moving and tackle congestion
- Catering for a growing demand for road travel without reducing safety, efficiency and amenity
- Extracting the optimum performance from the existing road network
- Building future network capacity and protect potential future road corridors
- Enhancing access to Sydney from growing regional cities
- Planning for population growth and integrating transport and land use planning more effectively.
7. Tackling Sydney’s congestion

To this end, Roads and Maritime has taken a number of steps to meet the challenges of delivering multifaceted solutions. Strategic planning will identify key corridors, looking at all options to optimise capacity using a variety of solutions including technology, real time decision-making information for motorists and infrastructure improvements for cars and to also prioritise buses.

Looking at the full mix is vital to getting the right solutions in the right places at the best cost/benefit ratio. In terms of measures to combat congestion, McKinsey’ 2013 infrastructure study shows potential benefits of intelligent transport systems’ projects compared to building new road capacity.

![Figure 8 – Potential gains of ITS projects against capital expenditure by benefit cost ratio](image)

Various areas of Roads and Maritime are working to this end. Given the multi-year, billion-dollar spend, Roads and Maritime has specifically established a program office called Easing Sydney’s Congestion (ESC), to deliver infrastructure improvements in both road capacity and information technology. For our customers, this will help ensure travel time reliability, even as traffic volumes continue to grow.

By using information and communications technologies, ESC will change how infrastructure is designed, built and operated.

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21 Australian Infrastructure Plan 2016, p27
<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Funding Amount</th>
<th>Year</th>
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<td>Cleanways</td>
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<td>M4 Smart Motorway (in packages)</td>
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<td>Urban Traffic Control Systems</td>
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<td>Northern Beaches BRT (on road package)</td>
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<tr>
<td>Bus Priority Infrastructure Program</td>
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<td>PT15</td>
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Notes:
The information is subject to change.

Project Stages:
- Design and/or Environmental Assessment
- Construction
- Procurement
- Rolling program with ongoing procurement and delivery

Figure 9 – Roads and Maritime’s Easing Sydney’s Congestion sub-program structure
7.1 Pinch Points

- $300 million for an expansion to the current Pinch Points Program
- $300 million for Gateway to the South Pinch Point Program
- $246 million for the current Pinch Points Program, including $21 million for clearways

ESC has identified major pinch points in the Sydney region. These congestion points occur at intersections where two large volumes of traffic meet, or sections of road where a bottleneck exists, causing a build-up of traffic and resultant delays often rippling out across the network. Pinch point projects improve the operational efficiency of Sydney's road transport network, improve traffic flow and maximise use of road space. Alleviating these pinch points helps ease traffic congestion and improves the consistency of travel times for motorists, particularly during peak periods, and result in better management of responses to incidents and planned events.

![Examples of pinch point improvements in Sydney](image)

Roads and Maritime has already completed more than 200 projects along 46 corridors in the past eight years, following the 2007 initial allocation of $100 million funding and a subsequent $225 million of funding.

The ESC program will target reducing the number of pinch points still contributing to congestion, by:

- Improving intersections
- Widening small sections of roads
- Widening or lengthening busy turn lanes
- Replacing heavily used roundabouts with traffic lights
- Implementing tidal flow traffic schemes
- Installing CCTV and variable message signs for incident and planned events management
- Improving pedestrian access to and across roads.

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22 Easing Sydney's Congestion delivery plan 2015, p22
From Sydney’s CBD through the southern suburbs to the Illawarra there are major arterial roads (including the Princes Highway, General Holmes Drive, the Grand Parade, King Georges Road and Davies Road), which carry large traffic volumes throughout the week and on weekends, resulting in congestion, low travel speeds and unreliable travel times. The Government has specifically funded the Gateway to the South Pinch Point Program to address congestion on these corridors.

The *NSW Long Term Transport Master Plan* recognises that connecting the F6 (M1) to Sydney’s motorway network is a major long-term priority. The NSW Government plans to progress a motorway project between St Peters, near Sydney Airport and Loftus in Sydney’s south.

Sydney’s Kingsford Smith Airport is the nation’s busiest airport and passenger numbers are forecast to more than double from 36.9 million in 2012 to about 74.3 million in 2033\(^\text{23}\) which will result in increasing pressure on the surrounding transport network.

Container movements at Port Botany are expected to grow from about 2.2 million in 2012/13 to 7 million in 2031\(^\text{24}\).

The Port Botany and Sydney Airport precinct is home to the State’s major container terminal and only international airport. It is Sydney’s second largest job centre and home to heavy industry, manufacturing, major distribution centres and residential communities\(^\text{25}\). The precinct is served by four of Sydney’s five most congested roads, the Eastern Distributor, M5 East Motorway, Western Motorway (M4), General Holmes Drive and Southern Cross Drive. Congestion lasts 11 hours or more each day on all four routes. The $300 million Gateway to the South program is targeting 13 key intersections in the short term.

The *NSW Long Term Transport Master Plan*\(^\text{26}\) outlines action plans to address pinch points and congestion in the Port Botany and Sydney Airport precinct, including:

- Planning for a light vehicle road underpass at the General Holmes Drive rail level crossing
- Developing a truck layover area in the Foreshore Road area with Sydney Ports Corporation
- Implementing one-way pairs road operation on Bourke Road and O’Riordan Street to manage increased traffic
- Widening Mill Pond Road to support increased taxi volumes and private bus operators accessing the Airport precinct.

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\(^{23}\) *Sydney Airport Master Plan 2033*, p9
\(^{24}\) *NSW Freight and Ports Strategy, 2013*, p25
\(^{25}\) *NSW Long Term Transport Master Plan, 2012*
\(^{26}\) *NSW Long Term Transport Master Plan 2012*, p20
Resident feedback to Pinch Point program:

I am writing to congratulate you and your team on the successful completion of the Princes Highway and President Avenue, Kogarah - intersection improvement project. The elegant design created to improve traffic flow through this intersection obviously involved a complex schedule of stages and the regular flow of notices to keep local residents informed about the project from start to finish were appreciated.

27 Easing Sydney’s Congestion delivery plan 2015, p22
7.2 Clearways

- **$100 million for an expansion of the current clearways program**

While the pinch point programs will address intersections that are congested, implementing clearways has significant positive outcomes for corridors.

Extended clearways have the same benefits as road widening but without the cost of significant construction and often property acquisition. Clearway corridors allow the entire available road capacity to be used by motorists, thereby enhancing the flow of traffic.

As traffic volumes continue to grow, not only will travel times deteriorate, but peak periods will also continue to spread across a longer time period. Significant queues and delays on the state road network can lead to unreliable travel times and “rat-running” through the adjacent local roads among other issues. Clearways can encourage greater use of state roads which improves safety and local amenity.

Clearways have been in place for several decades in Sydney and are directly aimed at reducing congestion where a road is carrying traffic close to its capacity. A clearway is investigated for a major state road if it meets the following criteria:

- Directional traffic flows exceed 800 vehicles per hour per lane; or
- Travel speeds are 30km/h or below during peak periods; or
- The road is a strategic bus or freight transport corridor for moving people and goods; and
- Alternative public parking close to local businesses can be found, taking into account the quantity and usage of business parking removed to extend or introduce a new clearway.

![Clearway sign on Princes Highway](image1)

![Clearway sign on Princes Highway](image2)

![Clearway on Princes Highway with bus using clearway](image3)

![New parking built to replace on-street spaces removed while creating clearway on Princes Highway](image4)

*Figure 12 – Examples of clearways in Sydney*

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28 Sydney’s Clearway Strategy, 2013, p9
29 Easing Sydney’s Congestion delivery plan 2015, p24
Each year, large numbers of vehicles are towed from clearways and we respond quickly to traffic obstructions to maintain traffic flow. In 2012/13, there were more than 7600 illegally parked or broken down vehicles towed from clearways, mostly in the afternoon peak period.

The *Sydney Clearways Strategy* outlines how we can get more from our roads now by introducing new or extended clearways on roads that don’t perform to expectations. Clearways and other congestion management measures will play an increasingly important role through the use of the entire road space for longer periods of the day, on weekends, and potentially on a broader number of major road segments.

Roads and Maritime recognises that clearway proposals can result in concerns from businesses which have on-street parking and as such, the program includes investigations into ways to replace lost business parking.

The challenge is to balance the competing needs of these local businesses and their customers with those of the broader community using the road network for their daily commute in a car or bus, or for carrying freight. In order to successfully balance these needs where business parking is removed to introduce a clearway, we will ensure alternate parking is available to customers in nearby streets.
7.4 Smart Motorways

- **$400 million to implement Smart Motorways**

While we are clearly planning and building motorways to create better connect this network, we are also on the brink of improving our existing motorways.

Smart Motorways use data collection sensors and regulatory tools to improve real time traffic management and achieve better consistency, levels of performance and safety, in turn helping to improve travel times, reduce crashes and reduce greenhouse gases.

Smart Motorways provide better use of existing road capacity at relatively low costs and in shorter timeframes than new build solutions. Smart Motorways initiatives provide improved road capacity, at rates equivalent to between $5 million and $10 million per kilometre. By comparison, new motorways and tunnels can cost between $50 million and $350 million per kilometre.

We will expand the use of Intelligent Transport Systems to motorways in the Sydney metro area, starting with the M4 Western Motorway which runs between Mays Hill near Parramatta and Lapstone in the foot of the Blue Mountains. The intelligent technology will help manage congestion on the M4. Vehicle detection systems will be located at regular intervals along the motorway to detect delays and congestion. New CCTV cameras will provide real-time information to traffic controllers to help monitor and manage traffic flows and incidents.

We expect the $400 million project will provide major benefits to western Sydney motorists, including:

- Boosting peak time capacity by up to 30 percent - the equivalent of adding an extra lane.
- Improving peak travel times by up to 15 minutes
- Improving travel reliability by up to 50 percent
- Reducing crashes by up to 30 percent.

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30 Infrastructure NSW, State Infrastructure Strategy: Update 2014, p49
Figure 13 – Smart Motorways examples of lane and information management

The proposed work is expected to include:

- Lengthening or widening entry and exit ramps
- New truck bypass lanes
- New lane management systems, additional emergency telephones and stopping bays and variable speed limit signs to reduce speed limits when heavy traffic, an incident or bad weather is present
- More CCTV cameras to provide real-time information to traffic controllers
- More variable message signs on the motorway and approach roads to inform drivers about expected travel times and traffic conditions.

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31 Easing Sydney’s Congestion delivery plan 2015
7.5 Urban Traffic Control Systems

- $200 million for improvements to urban traffic control systems

We recognise that technology has allowed us to manage road networks in more efficient and effective ways and this program will expand on that work. The NSW Long Term Transport Master Plan acknowledges that “as more of us use the internet, smartphones and other mobile technologies, we want real-time, relevant and personalised information about our transport options to help us make the best choices about how, when and where we travel. We also expect a transport system that is easy to navigate with clear signage, timetable and service information at train stations and bus stops, and current traffic updates on our roads”.

Within Sydney, the Transport Management Centre (TMC) monitors and manages the NSW road network, 24 hours a day, seven days a week, 365 days a year. The TMC also monitors and coordinates Sydney’s public transport operations across trains, buses, ferries and light rail during morning and afternoon peak travel periods, major planned events and unplanned incidents.

Roads and Maritime operates the Sydney Coordinated Adaptive Traffic Systems (SCATS), a traffic management system that seeks to optimise road use. The system is able to react to changing traffic conditions by adjusting the phasing of each traffic light cycle.

Across NSW, more than 3400 traffic lights are currently coordinated, monitored and managed by SCATS. Sensors embedded in the road measure the flow and volume of traffic at each intersection. Regional computers analyse this information, calculate the best possible traffic light phasing, coordinate intersections, and adjust the light phases accordingly in real-time.
For too long, NSW has lagged behind the world when it comes to transport – but that’s changing. In the next few years I want to take things a step further for our customers, and that’s what the Future Transport Summit is all about. I don’t want to get dumped by the next wave of technology – I want to ride it.

As part of the ESC program, SCATS and the TMC systems will be upgraded, improving Sydney’s traffic management capabilities.

Updating SCATS will allow monitoring of real-time vehicle travel speeds, provide an understanding of where vehicles are travelling to and from and predicting the most efficient and reliable route for customers; and warn drivers of large vehicles if the vehicle is too tall to safely pass under a bridge or tunnel. Replacing the TMC’s current system will improve its capacity to respond to network information and reduce delays.

In its NSW Intergenerational Report, NSW Treasury offered a glimpse into the advances in technology which may be commonplace on our transport networks in the future:

By 2056, a combination of technologies and autonomous vehicles may allow vehicles, road systems, traffic controllers and even environmental sensors to seamlessly communicate with one another and automatically coordinate everyone’s trips, making them shorter, safer and more environmentally friendly. These new technologies could be supported by policies that help set incentives for using public transport and mitigate the impacts of congestion. For example, dynamic congestion pricing systems have been tried in cities overseas, and may well provide lessons for the New South Wales of the future.

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32 NSW Transport Minister Andrew Constance, Future Transport Summit, 2016
33 NSW Treasury NSW Intergenerational Report 2016, p51
7.6 Bus Priority Infrastructure Program

- $222 million for the Northern Beaches Bus Rapid Transit (BRT)
- $260 million for the Bus Priority Infrastructure Program (BPIP)

Road congestion severely impacts bus services, increasing travel times and reducing travel reliability. It is especially pronounced around the Sydney CBD during peak periods but as the regional population continues to grow, bus congestion is forecast to similarly increase. The NSW Government’s *Sydney’s Bus Future*\(^{34}\) plan identified the need to improve bus journey times by providing extra infrastructure on Sydney’s most important, or rapid, bus routes.

Four of these corridors will be upgraded under the Bus Priority Infrastructure Program (BPIP):

- Hurstville to Macquarie Park
- Rouse Hill to Hurstville
- Hornsby to Blacktown
- Castle Hill to the Sydney CBD.

The ESC office will deliver BPIP to enable faster, more reliable bus services. The program will see an investment of $260 million over 10 years for work including:

- Dedicated bus lanes and traffic light improvements
- Bus stop relocation
- Rationalisation of stop spaces.

As well as BPIP, another three rapid routes identified in *Sydney’s Bus Future* will benefit from additional investigation and potential development:

- B-Line - the Northern Beaches B-Line project which runs from Mona Vale-CBD - announced in 2014 with a capital budget of $222 million
- Burwood-CBD via Parramatta Road
- Parramatta-Ryde-CBD via Victoria Road.

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\(^{34}\) *Sydney’s Bus Future (2012) plan*
The Northern Beaches B-Line will deliver indented bus bays, more frequent services and longer service operating hours. Roads, bridges and intersections will be improved along the route and rapid bus services will run on a Turn Up and Go frequency, with an average 10-minute wait for a bus, all day on every weekday. The 27-kilometre rapid transit network will be supported by about 900 new commuter car parking spaces, thus encouraging people to leave their cars and catch the bus, reducing congestion in peak periods.

Other initiatives introduced by the NSW Government for bus passengers include diverting a number of peak bus services from Wynyard interchange via the Cahill Expressway to reduce delays and the introduction of buses with increased passenger capacity, around twice the customer numbers of normal buses.

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35 Easing Sydney’s Congestion delivery plan 2015
7.7 Complementary strategies

Roads and Maritime recognises that a range of strategies can help enhance the capacity and efficiency of the existing road network by addressing how, why and when people use it.

These strategies typically aim to reduce the need to travel, change travel times, encourage the use of alternative modes of transport rather than private vehicles, and change the travel routes.

While vehicles are the dominant users of Sydney’s roads, cyclists and pedestrians also compete for space on these constricted corridors. A transition to active transport modes such as cycling or walking, particularly if they reduce car trips, can help reduce congestion. The safety of drivers, cyclists and pedestrians using the region’s road network is paramount in the planning, design and construction of ESC initiatives.

Balancing the travel task will be a primary focus for Sydney’s future transport network.

In addition to personal behavioural changes, planning and operational approaches can help ease congestion. Placing different land uses close to one another (mixing residences with offices and/or retail) helps reduce the effort of moving between them.

‘Park once’ districts can facilitate accomplishing multiple tasks in a single vehicle trip. Variable tolling (for example, Sydney Harbour Bridge and Tunnel tolls) is another approach to expanding the capacity of existing roadway systems by encouraging trips to be made outside peak periods.

The non-build solutions area is one for potential focus in the future.

CCTV camera monitoring and enforcement

Closed circuit television (CCTV) cameras are already a vital tool for managing the road network, collecting tolls and responding to emergency situations but much greater potential exists, for example, enforcement of T2 lanes and clearways. Boosting CCTV speed and erratic driving enforcement on state highways using existing road safety cameras also has significant potential and is an area open to further study.

Big data and strategic road transport planning

‘Big data’ is a term that is often used but rarely well-explained. In the roads portfolio, significant potential exists to undertake traffic modelling using for example phone identity data for origin – destination\(^{36}\) in concert with Roads and Maritime access to existing Google bluetooth data covering speed.

\(^{36}\) GHD study for BITRE 2014
Smart phones and social networks

Almost all mobile phones on sale now are ‘smart phones’ meaning that they provide mobile internet access and geolocation technology. This means that they can provide real-time information about demand for the road network but also allow for a whole host of mobile websites and applications provided by third parties. These innovations are based on close to universal access to the internet and social networks that enable communities of strangers to build trust as they use the road network. Interesting technologies and apps enabled by smart phones and social networks include:

<table>
<thead>
<tr>
<th>Go Get, Hertz 24/7</th>
<th>Uber changing the narrative from “I want a car” to “Why would I even want a car”</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keyless access</td>
<td>• GoCatch GoCar already launched</td>
</tr>
<tr>
<td>• Location via smart phone.</td>
<td>• Lyft expected to launch soon.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waze provides turn by turn directions, crash locations and petrol prices using crowdsourcing.</th>
<th>Peer to peer or collaborative consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Can direct traffic away from pinch points, better utilising capacity.</td>
<td>• Car next door on demand</td>
</tr>
<tr>
<td></td>
<td>• DriveMyCar longer term rentals</td>
</tr>
<tr>
<td></td>
<td>• Spinlister bicycle rental.</td>
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</tbody>
</table>

Figure 16 – Some technologies and apps on the rise

The internet of things

The impact of the ‘internet of things’ will also have an impact on how users demand road space, as more and more information is available to drivers (and presumably also to Roads and Maritime) on the condition of passenger vehicles, motorbikes, bicycles as well as freight vehicles.

Cisco estimated that the Internet of Things (IoT) generated $1.2 trillion of value in 2013 alone, based on a survey of over 7500 people in 12 countries including Australia. In transport, increased computer processing power and data (collection, analytics and openness) are helping to connect customer journeys across modes. The UK Government estimates that this will improve passenger journeys, safety and the efficient transportation of goods.

Customers benefit from improved journeys, enabled by linked in-car sensors and displays providing real time information about road and traffic conditions and updated guidance to avoid congestion and traffic incidents. For road planners and transport providers, vehicles could be routed away from expected bottlenecks based on whole-of-network congestion maps that are continuously updated with vehicle speeds and locations.

Safety can continue to be improved with vehicles increasingly able to anticipate and avoid collisions. Freight operators could also continue to improve efficiency through connected sensors and shared data along supply chains.

Other technological innovations which may have an impact include ITS and GPS enabled technology for buses and importantly the prioritisation of flows using smart traffic light sequencing.
8. Conclusion

It’s clear there is no easy fix for Sydney’s traffic congestion, nor is there only one fix. It is through using a multifaceted approach that starts at strategic planning and leads to delivery that we will see the best possible results. There will also potentially need to be a shift in people’s travel behaviours, but this will only come through transport options that are convenient and connected.

It will require consultation between stakeholders, ongoing Government commitment through planning and funding and a raft of short, medium and long-term solutions.

We cannot afford to delay tackling congestion – to do so places the economies of Sydney, NSW and Australia at risk. Our road network is the vital link in a successful and growing city.

Roads and Maritime, Transport for NSW and the NSW Government are committed to addressing and alleviating Sydney’s road congestion pressure for the benefit of commuters, tourists and businesses alike.

Our multi-faceted, billion-dollar action plan for Sydney’s Tomorrow is well under way and will ensure Australia’s first global city continues not only to grow but to thrive.
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