

# Final Business Case Summary: F6 Extension - Stage 1



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# About this report

This document summarises the Final Business Case (the Business Case) for Stage 1 of the F6 Extension. The Project is part of a broader proposal to extend the F6 from Loftus to the New M5 Motorway at Arncliffe. The intent of extending the F6 is to connect southern Sydney with the broader Sydney motorway system, and in doing so, address constraints on accessibility, productivity and liveability.

This summary and the Business Case on which it is based, deals only with Stage 1 of the Program. Stage 1 delivers an underground connection to the New M5 at Arncliffe via twin tunnels that extend south to President Avenue at Kogarah. The Project includes a new intersection at President Avenue, where the motorway tunnels integrate with surface roads, together with supporting intersection upgrades. New shared pedestrian and cyclist paths are also part of the Project, making use of land within the motorway reservation.

The Business Case was developed between November 2017 and March 2018 by Roads and Maritime Services.

This Business Case Summary has been prepared by Infrastructure NSW, the NSW Government's independent infrastructure advisory agency.

**Figure 1** – Route map of the F6 Extension



## Strategic context

The Greater Sydney Commission's Plan for Sydney<sup>1</sup> describes a metropolis of three separate cities where residents of each city have easy access to jobs and services. The three cities are the Eastern Harbour City, Central River City and Western Parkland City. Complementing the Regional Plan for Sydney are five District Plans, developed to reflect the specific character and needs of the locations that make up each city<sup>2</sup>.

The Project sits within the Eastern Harbour City and is on the boundary of two of its Districts, the Eastern City District and the South District. The demography and characteristics of this area, collectively referred to as Southern Sydney in this Business Case, provide the context for the project.

### Growth in population and jobs

The Greater Sydney Commission forecasts that between 2016 and 2036 the population in the Eastern City District will increase by 32% and in the South District, by 28%. The area of the Project will be home to a significant proportion of these people, including in new developments such as the Bayside West Priority Growth Area, which will provide an additional 5,100 dwellings by 2036 in Arncliffe and Banksia<sup>3</sup>.

Jobs growth is also expected, with a 32% increase forecast in the Eastern District and a 34% increase in the South District, to a total of 899,000 by 2036. A significant share of these jobs will be in strategic centres near the Project Area, including Green Square Mascot, Kogarah, Hurstville, Sutherland and Miranda. Job numbers also reflect the fact that Port Botany and Sydney Airport, adjacent to the Project area, are major employment centres, with Sydney Airport alone generating 18,100 jobs<sup>4</sup>.

### Home to Port Botany and Sydney Airport

The importance of Sydney Airport and Port Botany goes beyond their role in jobs generation. Both are critical trade gateways for Greater Sydney and for the nation. Each year, 39 million people use Sydney Airport, and this is forecast to grow to 74 million by 2033<sup>5</sup>. Port Botany is the largest container port in Australia by volume of containers moved. Annual container traffic is forecast to grow from 2.4 million containers to 8.4 million by 2050<sup>6</sup>. This anticipated growth and productivity assumes the availability of supporting infrastructure connecting international gateways to key markets.

### Connecting Southern Sydney to the city and beyond

Providing improved connections to trade gateways and increasing freight productivity is one of the outcomes expected from the Government's current motorway investment in WestConnex. The WestConnex program and related projects include:

- Widening the M4 east of Parramatta and extending it at Haberfield
- Building the New M5 to boost capacity in the M5 corridor
- Linking the M4 and the New M5
- Building *Sydney Gateway* to link WestConnex with Sydney Airport and Port Botany.

Southern Sydney's connection to this increasingly integrated motorway system is via the A1. While the A1 is a vital arterial route through Southern Sydney, it offers a poor connection to Sydney's motorway network due to high congestion on the Princes Highway and The Grand Parade, where local and through traffic converge.

A high capacity, safe connection from Southern Sydney to the motorway network would improve productivity and increase the benefits of the existing motorway investment, and help to separate through traffic from local traffic, improving the accessibility and amenity of local roads and the areas around them.

1. Greater Sydney Commission (2018), *A Metropolis of Three Cities*.

2. Greater Sydney Commission (2018), *Eastern City District Plan; South District Plan; Western City District Plan; Central City District Plan; North District Plan*.

3. Department of Planning and Environment, *Bayside West Precincts - Homes and jobs* (accessed June 2018) <http://www.planning.nsw.gov.au/plans-for-your-area/priority-growth-areas-and-precincts/bayside-west-precincts/homes-and-jobs>

4. Greater Sydney Commission (2018), *Eastern City District Plan*, page 70.

5. Ibid, page 68.

6. Ibid, page 68.



## Project need

The strategic land use and transport priorities for the Eastern City District and the South District revolve around growing business, jobs, services and housing all of which are connected and accessible, and creating and renewing great places and local centres.

These aspirations for productivity, liveability and sustainability cannot be met by the current transport infrastructure.

Connectivity between southern Sydney, the rest of the Eastern Harbour City, as well as the Greater Sydney Region is limited to three heavily congested local and arterial roads, where local and through traffic movements converge<sup>7</sup>.

Traffic modelling demonstrates that some road sections are already exceeding their capacity during the morning peak, with all key intersections on the Princes Highway and The Grand Parade expected to be operating over capacity by 2041.

Left unaddressed, growing congestion in the Project area will increasingly:

- **Constrain accessibility for residents:**

Between 2016 and 2041, morning peak journey times from Southern Sydney to major job hubs and strategic centres across Greater Sydney are forecast to increase by 50-90%. With just 150 metres of dedicated peak hour bus lanes, bus services will likewise be significantly impacted by congestion on the road network, with increasing queuing and delays likely to be experienced.

- **Undermine productivity:**

Commercial vehicles and freight travelling through Southern Sydney must travel long distances on local and arterial roads<sup>8</sup>. As congestion grows, so too will costs to business and productivity, particularly given the critical access functions of these roads to the Port Botany-Sydney Airport precinct, representing the country's largest container port and international airport respectively.

- **Worsen amenity in key urban centres:**

Southern Sydney currently experiences some of the highest traffic flows across Greater Sydney<sup>9</sup>, contributing to poor urban amenity in local centres such as Rockdale, Kogarah and Brighton Le Sands which are located on key roads.

Uncertainty around the future use of the land reserved in the existing F6 corridor has also led to underinvestment in this land, many sections of which provide poor amenity to the local community.

*Future Transport Strategy 2056*<sup>10</sup> outlines NSW's long-term transport plan to support the Greater Sydney Commission's *A Metropolis of Three Cities*. The transport plan identifies key corridors to support future land use and to enable people and goods to move efficiently around the city. The corridor from the Harbour CBD to Waterfall is included in *Future Transport 2056*, in which the first stage of the extension of the F6 is listed as a key priority.<sup>11</sup>

7. These are the Princes Highway, The Grand Parade and Marsh Street.

8. The journey through Southern Sydney requires negotiating 23 sets of traffic lights before reaching the first connection point to the motorway network.

9. For example, daily traffic movements on General Holmes Drive exceeded 64,000 vehicles in 2017. Transport for NSW (2017), *Traffic Volume Viewer*, GHD.

10. Transport for NSW (2018), *Future Transport Strategy 2056*.

11. Ibid, page 103.

# Project description

Recognising these challenges, the Greater Sydney Region Plan<sup>12</sup> and Future Transport Strategy<sup>13</sup> have identified investment in the Project as a priority initiative to be delivered in the next 10 years. The Project aims to:

- Improve journey times and reliability for all road users travelling to, from and through Southern Sydney (the *transport objective*)
- Support future growth and productivity by providing better connections to the rest of Sydney (the *productivity objective*)
- Enable improved land use and urban renewal around selected centres in Southern Sydney (the *city-shaping objective*).

The main elements of the project’s scope are:

- Twin motorway tunnels between the New M5 at Arncliffe and Rockdale Bicentennial Park at Kogarah. Each tunnel includes two lanes (that can be reconfigured to three lanes) with one tunnel carrying northbound traffic and one carrying southbound traffic. The tunnels connect to the New M5 tunnels in the north and to the surface road system in the south
- Tunnel portals within the existing F6 reserved corridor, including on- and off- ramps to connect the motorway tunnels to an intersection at President Avenue
- A widened President Avenue at the intersection, including slip lanes to provide connection to the new motorway
- An active transport corridor consisting of a dedicated shared pedestrian and cycle pathway and on-road facilities, from Bestic Street to Rockdale Bicentennial Park, extending over President Avenue via a footbridge. The corridor runs north-south, generally along the F6 reservation, deviating onto roads only where necessary to avoid residential property.

**Figure 2 – Stage 1 of the F6 Extension**



12. Greater Sydney Commission (2018), *A Metropolis of Three Cities*.  
 13. Transport for NSW (2018), *Future Transport Strategy 2056*.

## Options identification and assessment

The need to connect Southern Sydney and the Illawarra with the wider Sydney region has been long acknowledged, with a road reservation from Central Sydney to the then “planned motorway at Waterfall” included in the County of Cumberland Planning Scheme in 1951<sup>14</sup>. While successive Governments have invested in access to southern Sydney and the Illawarra<sup>15</sup>, the original plan to construct a major road along the existing F6 reserved corridor has not so far been implemented.

The need to increase accessibility in Southern Sydney, and to connect this growing area to the Sydney motorway system, remains.

### Where should the connection to Southern Sydney be?

Detailed investigation for the current project began in 2014 with consideration of where the southern connection to the motorway network should be<sup>16</sup>. Four alignments were considered: the F6, A1, A3 and A6. The outcome narrowed the alignments to the F6 and A6 and recommended these options be further investigated in a Strategic Business Case.

Eight possible concept designs for the F6 and A6 were then analysed<sup>17</sup>. Government supported the F6 corridor as the location of the connection to Southern Sydney and asked that a project be fully scoped using this alignment.

### What does the full project look like and how should it be staged?

The F6 Program extends from the M5 at Arncliffe south to Loftus. It emerged from a Business Case which examined options for the project, structured around separate geographic sections<sup>18</sup>. A Multi Criteria Analysis subsequently considered how the project could be structured as a staged series of motorway investments. The outcome supported Section A, from the M5 at Arncliffe to President Avenue at Kogarah as the logical first stage of the project. Government asked that this stage be developed in further detail and that investigations continue into two further geographic sections: Section B - from President Avenue, Kogarah to Taren Point; and Section C – from Taren Point to Loftus. A potential fourth stage, from Loftus to Waterfall, was not supported for further investigation for a motorway connection.

The concept design for this initial stage of the project was then refined to deliver a solution that supported improved connectivity, optimised the construction and engineering approach and minimised the impact on the community and the environment, including on private property.

14. [County of Cumberland Planning Scheme Ordinance, Local Government \(Amendment\) Act, No 18, 1951](#).

15. For example, the Captain Cook Bridge, opened in 1965; King Georges Road, completed in mid-1960's; Freeway extended from Waterfall to Bulli Tops, 1975.

16. Transport for NSW (2014), *Southern Sydney Access Investigations*.

17. Transport for NSW (2015), *Gateway to the South M1 Extension Strategic Business Case*.

18. Transport for NSW (2016), *F6 Extension Final Business Case*.

## Economic evaluation

A full economic cost-benefit analysis was undertaken of the Project in accordance with NSW Treasury guidelines. A standard discount rate of 7%<sup>19</sup> was used to express all costs and benefits in 2017 values.

### Costs

Construction costs were estimated<sup>20</sup> consistent with relevant guidelines<sup>21</sup>, and assumed a construction period of 2020 to 2024. Operating costs were calculated for a period of 35 years from the completion of construction, and include operating costs, annual maintenance costs and capital maintenance.

Operating costs were calculated on the assumption that the motorway would be subject to a toll. The tolling framework developed for the Project is consistent with other motorway projects. Heavy vehicles will pay three times the toll of light vehicles, reflecting the greater wear and tear that trucks have on roads. This is consistent with other recent motorways including WestConnex and NorthConnex.

Capital costs used in the economic evaluation were estimated to be \$1,899 million (\$1,383 million at Present Value) and operating costs \$613 million (\$145 million at Present Value). Total project costs were \$2,512 million or \$1,527 million in Present Value terms.

The cost estimate used for the economic evaluation was based on Treasury NSW guidelines and includes a P50 probabilistic Monte Carlo evaluation<sup>22</sup> of the risks to develop the contingency amount.

### Benefits

Extending the F6 from Arncliffe to Kogarah is expected to produce direct benefits in transport, productivity and city-shaping:

- **Transport** benefits result from reduced travel time and better reliability – for cars and buses; better connectivity for active transport; and improved road safety. These benefits are estimated at \$2,005 million.
- **Productivity** benefits result when it is easier for people to get to jobs, for businesses to access their markets, and for heavy vehicles to move more efficiently through Southern Sydney. The productivity benefits of the project are estimated to be \$236 million.
- **City-shaping** benefits result when access for residents is easier, when through traffic is removed from local centres and more certainty is provided around planning and investment. City-shaping benefits are estimated at \$137 million.

The benefits of the project have been assessed over a 30-year operational period<sup>23</sup>. The residual value of assets with a lifespan greater than 30 years has been valued at \$88 million and included within the calculation of transport benefits.

19. With sensitivity testing at 3% and 10%, consistent with NSW Treasury guidelines.

20. With advice from Aquent Consulting Pty Ltd.

21. For example RTA (2008), *Project Estimating Guidelines, March 2008*, version 20; Department of Infrastructure and Transport (2011), *Best Practice Cost Estimation Standard for Publicly Funded Road and Rail Construction*.

22. Determined by probabilistic analysis, a P50 value provides a 50 percent level of confidence that the estimated cost will not be exceeded at project completion.

23. Consistent with NSW Treasury Guidelines.

## The outcomes of the analysis

The Business Case estimates that the Project delivers total direct benefits of \$2,378 million at a cost of \$1,527 million, resulting in a Net Present Value of \$851 million and a Benefit Cost Ratio of 1.56. Eighty-four percent (84%) of the benefits result from transport improvements and 57% of these are savings in travel time.

These results are summarised in Table 1, which also shows the outcome if transport and wider economic benefits are considered without city shaping benefits, and if transport benefits alone are considered. The analysis indicates that even if only direct transport benefits are included, the project has a Net Present Value of \$478 million and a Benefit Cost Ratio of 1.31, indicating that for every dollar invested in the Project, there will be a return of \$1.31.

Sensitivities were performed on the economic results to test their robustness. These included increasing the capital and operating costs to reflect P90 estimates<sup>24</sup>; applying discount rates of 3% and 10%. All sensitivities analysed indicated a BCR greater than 1, except when comparing the costs of the project to the transport benefits only (without productivity and city-shaping benefits) and discounting these values at the higher rate of 10%.

Sensitivity analysis was also completed assuming different amounts of the F6 reserved corridor were released from its current road zoning. These BCRs were also all greater than 1, with the most conservative assumption, that there would be no benefit from the release of the existing F6 corridor, returning a BCR of 1.21.

<b>Table 1 - Outcomes of the analysis</b>	
	<b>\$'m</b>
<b>Costs</b>	
Capital expenditure	1,383
Operating expenditure	145
<b>Total costs</b>	<b>1,527</b>
<b>Benefits</b>	
Transport (including resource Cost Corrections)	2,005
Productivity (Wider Economic Benefits)	236
City-shaping	137
<b>Total benefits</b>	<b>2,378</b>
<b>Outputs</b>	
<b>Transport</b>	
Net benefits	\$478m
Benefit cost ratio	1.31
<b>Transport and productivity benefits</b>	
Net benefits	\$714m
Benefit cost ratio	1.47
<b>Transport, productivity and city-shaping benefits</b>	
Net benefits	\$851m
Benefit cost ratio	1.56

24. Determined by probabilistic analysis, P90 values provide a 90 percent level of confidence that the estimated costs will not be exceeded at project completion. The project's capital cost at P90 for construction is estimated to be \$2,064 million (unescalated).



## Deliverability

The Business Case proposes that the Project will be delivered by Roads and Maritime Services using its tested project management framework for developing and delivering major road projects. A strong governance structure is in place to support both the planning and delivery of the project.

### Procurement

The Business Case does not recommend a procurement and delivery strategy but canvasses the packaging and delivery options and outlines the way in which those options will be evaluated. A delivery strategy will be recommended after further consideration of:

- the market's capacity for the project
- key interdependencies with the New M5
- the interface between the Project and any subsequent stages of the F6 extension, and
- the operational arrangements between the Project and the wider motorway system.

### Timeframe

The concept design in the Business Case will be developed into a reference design and included in the Environmental Impact Statement for community and stakeholder feedback during the second half of 2018. Engagement with the market will be undertaken before full procurement activity begins early in 2019 leading to a construction contract being awarded during the third quarter of 2020.

Construction is expected to begin towards the end of 2020 with Stage 1 of the F6 extension opening in the last quarter of 2024.

### Key risks and mitigation

The Business Case reflects a robust risk management process that has identified risks to the Project and describes how these risks will be managed. Using tunnel construction for the motorway minimises direct land use and property impacts, which are largely limited to the area of the intersection at President Avenue, Kogarah.

While disruption and impacts on land use and local amenity will be minimised, key risks remain, including:

- connecting to the New M5 and ensuring an integrated operating system
- mainline tunnelling, including geological and geometric constraints, and
- scheduling and cost.

The Project Risk Management Plan articulates these key risks and includes appropriate mitigating actions for each.

## The Infrastructure NSW view

The *State Infrastructure Strategy 2018-2038* considered the F6 Extension and the Beaches Link projects and noted that both projects provide connections to areas that have seen significant increases in congestion associated with their expansion over the last four decades<sup>25</sup>. The Strategy recommended that these two projects be subject to scrutiny against other potential government investments, particularly in relation to their relative city-shaping benefits and that any decision to invest in Stage 1 of the F6 Extension should be subject to a Business Case demonstrating a positive economic return.

The current Business Case provides this analysis and demonstrates strategic merit, a well-defined project scope and a positive BCR of between 1.31 and 1.56, depending on the quantifiable benefits included. Under sensitivity testing, the analysis continued to return positive BCRs in all but one scenario.

Based on recommendations from Infrastructure NSW, the traffic modelling guiding the Business Case was refined and peer reviewed<sup>26</sup> before the analysis was finalised. Similarly, escalation and contingency allowances were reviewed in response to Infrastructure NSW's view that a high tempo market and project unknowns, such as the procurement methodology, made forecasting these costs more difficult. Costs were further tested through sensitivity analysis. Revenue forecasts assume that the F6 extension will be a tolled road. While the modelling uses a tolling regime that is consistent with agreed principles for motorway charges, Infrastructure NSW is encouraging proponents across projects to consider broader network management implications when making tolling decisions.

The F6 Extension Stage 1 has a long development history and the core issues and opportunities are well understood. The preferred option described in the Business Case is highly likely to deliver significant service improvement and the net benefits claimed. This, together with the governance arrangements in place to deliver the project, represent a sound basis for Government's investment decision.

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25. Infrastructure NSW (2018), *State Infrastructure Plan 2018-2038: Building Momentum*, page 139.

26. By ARUP.