

Infrastructure Australia

Project Business Case Evaluation

Project name	The Northern Road Upgrade (between Peter Brock Drive, Oran Park and Jamison Road, South Penrith)
Rating	Priority Project
Date of IA Board rating	9 February 2017

Location	Western Sydney, New South Wales
Proponent	New South Wales Government
Project timeframe	Construction between 2017 and 2020

Evaluation Summary

Growth in south-west Sydney is being driven by employment growth associated with the NSW Government's Western Sydney Priority Growth Area, and population growth associated with the South West Priority Land Release Areas. Development of the Western Sydney Airport at Badgerys Creek is expected to accelerate this growth. The Northern Road is a key north-south road in this region that provides access for freight and passenger transport accessing the M4 Motorway, Penrith, Glenmore Park, Mulgoa Rise, Orchard Hills, Luddenham, Bringelly and Western Sydney Airport. It will therefore play a critical role in facilitating the region's growth. Daily traffic volumes are anticipated to increase substantially on the road, leading to a 50% increase in average travel times along the corridor. This is likely to exacerbate existing deficiencies such as capacity constraints, congestion at intersections, limited public transport options and safety concerns.

The proposed project will upgrade a 31 kilometre section of the Northern Road between Peter Brock Drive and Jamison Road in three parts:

- Peter Brock Drive to Mersey Road
- Mersey Road to Glenmore Parkway
- Glenmore Parkway to Jamison Road.

A majority of the upgrade will be built as a four-lane dual carriageway road, with two dedicated kerb-side bus lanes. Provision is made for future expansion if required. Sections to the north of Glenmore Parkway will be upgraded to a six-lane dual carriageway, with two dedicated kerb-side bus lanes. The project is part of a broader program of works, the *Western Sydney Infrastructure Plan*, which includes an upgrade to Bringelly Road, and development of the M12 Motorway linking The Northern Road and the M7. The broader program is listed as a Priority Initiative on the Infrastructure Priority List.

The project is expected to cost \$1,632 million (P50, nominal, undiscounted), with construction to commence in 2017 and to conclude by 2020. The proponent's stated benefit-cost ratio (BCR) without wider economic benefits (WEBs) is 1.3 and the net present value (NPV) is \$405 million, using a 7% real discount rate and P50 cost estimate.

Infrastructure Australia's evaluation has identified a number of limitations in the proponent's business case. In particular, the business case presents a limited view of how the project fits into the development of western and south-western Sydney. Given the scale of the project, it would have been preferable if the business case had presented a strategic land use and network-wide perspective on the project. This point is relevant to the assessment

of future, related proposals, such as the connecting M12 motorway. In addition, the traffic modelling has not modelled journey time reliability or induced demand which may lead to disbenefits as traffic volumes approach capacity during the evaluation period.

Notwithstanding the limitations of the analysis, Infrastructure Australia is confident that the project benefits exceed its costs, given the expected growth in the area.

1. Strategic Context

Development initiatives in south-west Sydney, including the Western Sydney Priority Growth Area, South West Priority Land Release Area, and development of the Western Sydney Airport, are expected to lead to a significant increase in population and employment in the western Sydney area.

The NSW Government's Western Sydney Priority Growth Area is expected to support 57,000 new jobs over the next 30 years. Enhancing accessibility to the area will facilitate the successful delivery of these jobs, making it more attractive for employers to locate in the area, and will minimise congestion for existing residents and workers.

The NSW Government's South West Priority Land Release Areas are anticipated to result in 300,000 new residents. This will necessitate new and renewed transport infrastructure to realise the growth and provide transport access for people living in the region.

Western Sydney Airport is planned to commence operations in the mid-2020s, with an estimated 10 million passengers per annum by 2030. As Western Sydney Airport will act as a regional inter-modal transport hub for both passengers and freight, appropriate connections to key commuter and freight routes will be critical to link business, trade and employment centres. At present, the Australian Government and NSW Government are undertaking a joint scoping study on Western Sydney rail needs to consider the best options for future rail investment to service both the proposed airport and the Western Sydney region.

The Northern Road acts as the backbone of these growth areas. It is a key arterial road for the area and provides access for freight and passenger transport accessing the M4 Motorway, Penrith, Glenmore Park, Mulgoa Rise, Orchard Hills, Luddenham and Bringelly as well as a connection to the Western Sydney Airport from the west. It is therefore integral to addressing the strategic challenges outlined above.

The project has previously been identified in a range of the NSW Government's infrastructure planning documents, including the *NSW State Infrastructure Strategy*, the *NSW Long Term Transport Master Plan*, and *A Plan for Growing Sydney*.

2. Problem Description

There are a number of existing deficiencies on The Northern Road, which independent of future growth in the region, will continue to impact negatively on levels of service. These include:

- A number of intersections are operating at capacity in the peak period or do not adhere to engineering design requirements
- The existing design does not satisfy requirements for the sign posted speed limit
- The Glenmore Parkway roundabout is not suited to heavy vehicles, despite the route being designated as a B-double route. There is inadequate shoulder width for heavy vehicles passing between Mersey Road and Glenmore Parkway
- Poor horizontal alignment
- Lack of bicycle and walkway facilities
- Limited provision for public transport.

Future growth of around 300,000 new residents, as well as 57,000 jobs, over the next 30 years will result in a marked increase in the level of traffic on The Northern Road.

Traffic will also be impacted by the development of Western Sydney Airport. The development of Western Sydney Airport is expected to generate an additional 1,254 vehicle movements per day during the construction period. Once operational, the airport is expected to lead to significant vehicle movements across the broader road network – for example, up to 47,000 passenger and employee trips and 42,000 freight trips per day during operation in 2031. These

trips will be spread in several directions. Nevertheless, given that the airport will be located just south of the existing junction of The Northern Road and Elizabeth Drive, The Northern Road will be a key route for some of this traffic.

As a result of this growth in Western Sydney, average daily traffic volumes are expected to increase along The Northern Road:

- an increase of about 40,000 vehicles per day to 75,000 vehicles per day from 2015 to 2036 between Glenmore Parkway and Jamison Road – parts of this section already operate at capacity for prolonged durations
- an increase of approximately 20,000 vehicles per day to 40,000 vehicles per day from 2015 to 2036 between Glenmore Parkway and Chain O Ponds Road – this would likely lead to volume/capacity ratios above 1.0 at some locations.

Based on the anticipated growth in road users, the level of service along The Northern Road is expected to deteriorate further and reach an unacceptable level. Average travel times along the corridor are estimated to increase by 50% between 2021 to 2041.¹

With no future upgrade, The Northern Road could be expected to experience the following:

- A decline in local accessibility over time
- A lack of adequate access to the Western Sydney Airport and throughout the Western Sydney Priority Growth Area
- A worsening of the crash rate, including a larger proportion of heavy vehicles using the road for both construction and operation services at the airport
- A loss of opportunity to improve accessibility and efficiency for public transport that will be using the road in supplying services to and from the airport
- A loss of opportunity to improve safety for pedestrians, cyclists and motorists through an off-road shared pathway
- Increased whole-of-life costs due to road deterioration and the maintenance of a road not designed to carry the forecast traffic volumes and heavy vehicle loads.

The current crash rate along The Northern Road is well above that of the state average for a road of its type, owing to unseparated bi-directional travel, relatively high proportions of heavy vehicles, non-compliant intersection layouts, poor property access and limited infrastructure for pedestrians and cyclists. It is likely that, unless design upgrades take place, increased traffic volumes would lead to an increased accident rate for the road.

3. Project Overview

The Northern Road Upgrade forms part of a wider program of works, the *Western Sydney Infrastructure Plan*, which also includes an upgrade of Bringelly Road and development of the proposed M12 Motorway connecting The Northern Road with the M7 motorway.

The proposed project will upgrade the 31 kilometre Northern Road between Peter Brock Drive and Jamison Road in three parts:

- Peter Brock Drive to Mersey Road
- Mersey Road to Glenmore Parkway
- Glenmore Parkway to Jamison Road.

A majority of the upgrade will be to a four-lane dual carriageway, with two dedicated kerb-side bus lanes. Provision is made for future expansion if required. Sections to the north of Glenmore Parkway will be upgraded to a six-lane dual carriageway, with two dedicated kerb-side bus lanes.

¹ NSW Roads and Maritime Services (2015), *The Northern Road Upgrade between Peter Brock Drive, Oran Park and Jamison Road, South Penrith, Infrastructure Australia Stage 4: Business Case Assessment Template – Transport*.

The upgraded road will carry a posted speed limit of 80km/h across most of its length, as well as designated U-Turn bays. Two grade-separated intersections are proposed - one at the Northern Road / Bringelly Road intersection and the other at the Northern Road / M4 Motorway interchange. Other features of the upgrade include:

- Signals at existing intersections and the addition of new signalised intersections
- Designated turning lanes
- Heavy vehicle inspection bays
- Incident response facility
- Upgrade of the M4 interchange.

The upgrade of The Northern Road will be a key component of the broader growth of south-western Sydney over the next 30-40 years. Infrastructure Australia notes that the NSW Government's strategic transport planning for Sydney (*Sydney's Bus Future*) and structure planning for the South West Growth Centre envisage a significant role for bus transport in south-western Sydney, and a large number of bus services operating along The Northern Road in particular.

The project includes significant bus provision along its length by:

- Providing a bus only lane north and south
- Providing new bus stops
- Relocating existing stops to integrate better with The Northern Road and M4 Motorway interchange
- Providing bus bays at each signalised intersection.

The project also includes dedicated pedestrian paths and shared bicycle paths at various sections of the road, as well as bicycle and pedestrian crossings at traffic lights.

The business case presents a limited view of how the project fits into the development of western and south-western Sydney. Given the scale of this and related projects, and the scale and sequencing of development across this part of Sydney, it would have been preferable if the business case had presented a strategic land use and network-wide perspective on the project. Such an approach could have comprehensively considered:

- a multi-modal assessment to meeting projected transport demand
- associated improvements in public transport that would complement the proposed bus lanes forming part of The Northern Road Upgrade
- a range of land use issues, including the sequencing of development, which could affect the scope and timing of the projects in the *Western Sydney Infrastructure Plan*

This point is relevant to the assessment of future, related proposals, such as the connecting M12 motorway, as well as rail proposals that might serve Western Sydney Airport. The NSW Government and the Greater Sydney Commission are encouraged to address these issues further in their current work, notably the refresh of the NSW Government's *Long Term Transport Master Plan* and the Commission's long-term metropolitan plan, *Towards our Greater Sydney 2056*.

4. Options Identification and Assessment

A staged options identification process was performed for each section of The Northern Road Upgrade. This included options development workshops, value management workshops and multi-criteria analyses.

(a) Peter Brock to Mersey Road

The three options for the southern and northern sections were:

- Option 1 – Do Nothing (the base case)
- Option 2 – Upgrade The Northern Road to a four-lane divided road from Peter Brock Drive, Oran Park to Mersey Road, Bringelly with capacity for widening to six lanes if required in the future
- Option 3 – Upgrade The Northern Road to a six-lane divided road from Peter Brock Drive, Oran Park to Mersey Road, Bringelly

These options were assessed and compared on their economic, environmental and social performance and against the proposal objectives. Option 2 was identified as the preferred option following the development of subsequent access strategy, constructability workshops, community consultation and further design refinements.

For the intersection of the Northern Road and Bringelly Road, a do-minimum option was assessed against a number of upgrade alignments and grade separated alignments. A multi-criteria analysis at an options workshop determined the alignment would divert east from The Northern Road, south of Solway Road, travel over Bringelly Road by means of a bridge located about 400 metres east of the existing intersection, and rejoin the existing The Northern Road at Robinson Road.

(b) Mersey Road to Glenmore Parkway

An initial long list of 12 route options was evaluated in a stakeholder workshop held in April 2015. Representatives from Australian and NSW Government agencies completed a multi-criteria assessment (MCA) of the options, based on identified project objectives. This assessment cut the options down to a shortlist of four options – Central, Campbell Street, Eastern and Western - all of which included a separated dual carriageway consisting of six lanes, two for general traffic and one bus lane in each direction.

A preferred option workshop was then held in September 2015, involving State Government agencies, the Commonwealth Department of Infrastructure and Regional Development and local councils. Using a MCA, it was determined that the Eastern Option would be the preferred route for The Northern Road Upgrade between Mersey Road and Littlefields Road. For the alignment the north of Littlefields Road, two final options were considered – widening generally to the east or widening generally to the west of the existing alignment. Given the impact on dwellings of widening to the west, it was determined that widening to the east would be the preferred alignment.

(c) Glenmore Parkway to Jamison Road

Strategic level investigations identified two options for The Northern Road Upgrade between Glenmore Parkway and Jamison Road, both utilising the existing corridor alignment. These options were:

- Option 1 - Widen The Northern Road to an eight-lane divided road to the east of the current alignment
- Option 2 - Widen The Northern Road to an eight-lane divided road to the west of the current alignment

Options sitting outside of the existing corridor were excluded from further analysis. The preferred option was determined through an iterative design process which considered policy, strategic goals and the environment in a value engineering workshop. Option 1 was identified as the preferred option during the strategic design phase. This was due to reducing the impacts on the surrounding environment and a better match for future access requirements and traffic demand associated with proposed developments in the area.

Two options were also proposed for the existing bridge over the M4 Motorway. Option 1 was to demolish the existing bridge and build a new structure, and Option 2 was to retain and widen the existing bridge. Option 1 was adopted to allow integration with the project ramp requirements for so-called 'SMART Motorways'.

5. Economic Evaluation

The proponent undertook a full economic cost-benefit analysis of Option 2, evaluating a 30-year benefit stream against the construction and operating costs of the project. All costs and benefits were discounted to present values using a real discount rate of 7% per annum. All benefits and costs are presented in real \$2015-16.

The project is expected to cost \$1,632 million (P50, nominal, undiscounted), with construction to commence in 2017 and to conclude by 2020. The proponent's stated BCR without wider economic benefits (WEBs) is 1.3 and the NPV is \$405 million, using a 7% real discount rate and P50 cost estimate. Travel time savings from the road upgrade make up over 70% of the conventional benefits. Avoided crash costs and journey time reliability improvements constitute another 20% of the conventional benefits.

Given the strong forecast growth in population and employment, as well as development of the Western Sydney Airport and an adjoining Business Park, improvements in connectivity may lead to increased effective density, and hence WEBs. The project is estimated to generate WEBs in the order of \$208 million, which would increase the BCR to 1.5 and the NPV to \$613 million.

Infrastructure Australia has identified a number of potential limitations in the analysis, which could present risks to achieving the estimated economic benefits:

- The upgrade of The Northern Road will provide journey time reliability benefits through safety improvements and the consequent reduction of accidents and delays. Given that The Northern Road forms a key link between a number of origins and destinations, reliability benefits across the regional network could be sizeable. However, these reliability benefits are likely to reduce over time as traffic volumes in the corridor increase. The proponent did not estimate the average reduction in delay minutes per incident in the traffic model but applied a top-down assumption based on benchmarks in the literature to estimate the benefit
- The traffic model used to estimate future demand for the road did not estimate induced demand, which may lead to lower levels of benefits if the traffic growth approaches the capacity of the network during the evaluation period. Given the high growth in population and employment expected in the area, particularly with the development of Western Sydney Airport, it would be appropriate to estimate induced demand on the network. The proponent has tested the impact of lower benefits on the BCR and NPV through sensitivity tests, which provide less granular insights
- The proponent has recognised but not quantified the potential user and non-user benefits from increased provision of public transport along The Northern Road, for example, improved integration of passenger transport between modes.

Notwithstanding the above limitations, Infrastructure Australia is confident that the project benefits outweigh its costs, given the significant growth expected in the region and the positive impacts on the broader transport network.

Proponent's Stated Benefits and Costs	Present Value (\$m, 2015-16) @ 7% real discount rate	% of total
Benefits		
Travel time savings	\$1,167	72%
Vehicle operating cost savings	\$42	3%
Avoided crash costs	\$194	12%
Journey time reliability improvements	\$142	9%
Savings in externalities	-\$12	-1%
Residual value	\$78	5%
Total Benefits⁵	\$1,611 (A)	100%
Costs		
Capital costs (P50)	\$1,191	99%
Operating and maintenance costs	\$15	1%
Total Costs⁵	\$1,206 (B)	100%
Net Benefits - Net Present Value (NPV)¹ without WEBs⁵	\$405 (C)	n/a
Benefit-Cost Ratio (BCR)² without WEBs	1.3 (D)	n/a
Wider Economic Benefits (WEBs)	\$208 (E)	n/a
Net Benefits - Net Present Value (NPV)³ with WEBs⁵	\$613 (F)	n/a
Benefit-Cost Ratio (BCR)⁴ with WEBs	1.5 (G)	n/a

Source: NSW Roads and Maritime Services (2017), *The Northern Road Upgrade: Peter Brock Drive, Oran Park to Jamison Road, South Penrith – Infrastructure Australia Stage 4 – Business Case - Addendum: Update of economic analyses and integrated land use and transport planning.*

Notes:

(1) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A – B).

(2) The benefit-cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).

(3) The net present value with WEBs (F) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) – B)

(4) The benefit-cost ratio with WEBs (G) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) ÷ B)

(5) Totals may not sum due to rounding.

Capital costs and funding

Total capital cost (nominal, undiscounted)	\$1,632 million (P50) \$1,752 million (P90)
Proponent's proposed Australian Government funding contribution	\$1,305.6 million of approved funding sought
Other funding (source / amount / cash flow) (nominal, undiscounted)	\$326.4 million NSW Government contribution

6. Deliverability

The proponent considered alternative procurement methods to mitigate construction and delivery risks, for each section of the upgrade. The following methods were selected by the proponent:

- Peter Brock Drive to Mersey Road – construct-only option using a Schedule of Rates contract model
- Mersey Road to Glenmore Parkway – Design and construction separated. Design is to be delivered by the NSW Roads and Maritime Service (RMS). Construction would be based on a NSW standard conditions of construction contract.
- Glenmore Parkway to Jamison Road – A concept design is to be developed by RMS. Detailed design and construction would be delivered using an accelerated Design and Construct procurement process and a lump sum contract method.

The proponent has undertaken a benefits realisation plan which establishes clear objectives and performance measures to be applied for each road user benefit identified. Project completion reviews will be undertaken at three key points:

1. After project development – measure the success of the development phase
2. How well the tendering, construction and implementation phase was undertaken
3. 2 years after opening – establish the accuracy of the traffic and benefit estimation.

It has been the approach of Australian Government to deliver “roads first; airport second”² to ensure that critical road network upgrades are in place in advance of Western Sydney Airport. The impetus has therefore been to advance and deliver The Northern Road Upgrade in anticipation of increasing traffic volume rather than in response to it at a later stage.

The proponent also sees a benefit in accelerating delivery of The Northern Road Upgrade before a forecast industry peak of infrastructure procurement, known as the ‘wave’ procurement strategy. By doing this, market resource capacity and value would be captured and applied, hence avoiding a forecast shortage of local industry resources and associated price increases.

The full six stage program for The Northern Road Upgrade works is condensed, reflecting the need to support current growth, and have in place the expanded road in advance of the anticipated growth:

Infrastructure Australia supports the proponent’s intention to conduct a post-completion review of the project to accurately gauge whether works have delivered high levels of service, and identify any lessons that could be used to inform future projects.

The proponent is of the view that private financing and user charging is not suited to a road project of this nature. This is due to the scope and cost, the associated risk and the lack of an effective charging mechanism available to fund the project. Infrastructure Australia encourages proponents to consider network-based road user charging as part of the funding options assessment.

²Western Sydney Infrastructure Plan announcement - Joint Statement by Tony Abbott and Warren Truss, 15 April 2014