Project Evaluation Summary

M1 Pacific Motorway (Varsity Lakes to Tugun)

Proponent Queensland Government
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1. Summary

Infrastructure Australia has added the **M1 Pacific Motorway (Varsity Lakes to Tugun)** project to the Infrastructure Priority List as a **Priority Project**.

The 2015 *Australian Infrastructure Audit* (the Audit) identified the lack of capacity on the road network between Brisbane and the Gold Coast as a significant problem for business, tourist and commuter travel. A program of M1 Pacific Motorway capacity improvements (Eight Mile Plains to Tugun) is listed as a High Priority Initiative on the Infrastructure Priority List.

The M1 Pacific Motorway (Varsity Lakes to Tugun) project proposes to improve a congested section of the motorway that currently carries around 90,000 vehicles per day and is projected to carry over 120,000 vehicles per day by 2036 (an increase of 1%-2% per year). The growth in traffic movements is expected to increase peak period journey times between Nerang South Interchange (Exit 73) and Terranora Creek (at Tweed Heads), with journey times increasing from around 20 minutes in off-peak periods to over 45 minutes in peak periods by 2036. These delays will affect general traffic movements and road freight. Furthermore, the congestion is affecting road safety conditions, with a high number of congestion-related accidents occurring on the motorway.

The project would provide additional capacity on the motorway by widening both directions of the road between Varsity Lakes Interchange (Exit 85) and Tugun Interchange (Exit 95) from four lanes to six lanes and upgrading the majority of interchanges. The project also proposes to implement managed motorways technology between Nerang and Tugun, and realign the motorway between Bermuda Street and Tsipura Drive (Burleigh Heads). Improving conditions on the M1 Pacific Motorway is expected to attract vehicles away from the Gold Coast Highway, creating an opportunity to enhance the streetscape in that corridor.

These works will address existing infrastructure deficiencies, address ongoing maintenance issues resulting from heavy vehicle loads and volumes, and improve flood mitigation during extreme weather events.

The benefit-cost ratio (BCR) stated by the proponent is 1.67 with a net present value (NPV) of $419.4 million, at a 7% discount rate using a P90 capital cost estimate. Infrastructure Australia identified some limitations in the cost-benefit analysis, but considers that the benefits of the project are likely to exceed its costs. Furthermore, the project has strategic merit given it will improve the reliability and capacity of the National Land Transport Network (NLTN) in South East Queensland, providing improved accessibility for regional traffic and freight.

2. Strategic context

The 2016 *Australian Infrastructure Plan* highlighted that alleviating congestion on the motorway will improve the overall efficiency of the NLTN in South East Queensland, with significant economic benefits to be delivered through reduced travel times and improved reliability for freight movements.

The M1 Pacific Motorway is the primary transport corridor linking the population centres of Brisbane, the Gold Coast, Logan and a number of surrounding regional economic clusters. These population centres are projected to accommodate more than 957,000 additional people by 2041, with the population of the Gold Coast increasing to almost 1 million people. Employment centres in Brisbane and the Gold Coast will attract workers from across South East Queensland, with many commuters relying on the M1 Pacific Motorway to access their jobs.

The Varsity Lakes to Tugun section of the motorway connects northern NSW to the Gold Coast (and then on to Brisbane). Improving the capacity of the motorway will improve connections for tourists visiting the Gold Coast and has been identified as essential to achieving the broader vision for Gold Coast's future economic development.

The motorway is part of the NLTN connection between Sydney and Brisbane and is an important link for freight, providing a connection between northern NSW and the Gold Coast, Acacia Ridge freight terminal, Brisbane CBD, the Port of Brisbane/Australia Trade Coast precinct and Brisbane Airport. The proponent has noted that heavy vehicle traffic almost doubled on the M1 Pacific Motorway between 1999 and 2011/12, while heavy vehicle movements on the New England Route reduced by around a third over the same period, suggesting that infrastructure improvements (and travel time savings) along this corridor have encouraged freight traffic to switch to the coastal corridor.

There is strategic merit in upgrading this section of the NLTN to support passenger and freight movements, and increase the capacity of this primary transport corridor between the Gold Coast and Brisbane. Improving the capacity of this corridor will also support other proposed projects, such as the potential re-purposing of the Gold Coast Highway.

3. Problem description

Congestion on the M1 Pacific Motorway is a nationally significant problem because it impacts on both the capacity and reliability of the NLTN. Infrastructure Australia has identified M1 Pacific Motorway capacity issues between Eight Mile Plains and Tugun as a High Priority Initiative. The proposed project is a component of this Initiative.

The Varsity Lakes to Tugun section of the corridor currently carries 90,000 vehicles per day, exceeding the design capacity for the four-lane motorway, and is forecast to grow to in excess of 100,000 vehicles by 2026 following the completion of upgrades to the M1 Pacific Motorway in northern NSW, and 120,000 vehicles per day by 2036.

The limited capacity of the motorway impacts on the travel times of a variety of road users who rely on the motorway each day, including local residents, long-distance travellers, commercial vehicles, buses, tour operators and international and domestic tourists. The corridor currently experiences extended periods of peak congestion, particularly during the morning, reducing the reliability of freight vehicles and lengthening the travel times for the growing number of commuters travelling to the Gold Coast and Brisbane from northern NSW.

The road surface of the Varsity Lakes to Tugun section currently requires significant annual expenditure to maintain service standards. The condition of the roads is likely to worsen without intervention due to the forecast growth in traffic demand, particular for heavy vehicles.

In addition to improving capacity, the project aims to address a number of road design issues related to horizontal/vertical alignment, flood immunity and merging. The project would allow the repurposing of the nearby Gold Coast Highway from an arterial road to a boulevard function to improve active transport connections, and support the transition of the Gold Coast to a multi-centred city.

4. Proposal

Key features of the project as proposed in the submitted business case include:

- full construction of six lanes (three lanes in each direction) on the M1 Motorway between Varsity Lakes and Tugun, including auxiliary lanes between the majority of interchanges
- overall improved geometric alignments, sight distances and ramp lengths
- motorway realignment of tight horizontal curves between Burleigh and Tallebudgera
- upgrade of Varsity Lakes, Burleigh, Tallebudgera and Palm Beach interchanges, including replacement of the Reedy Creek flyover and a new flyover at Bermuda Street
- relocation of Sarawak Avenue exit ramp through the provision of a southbound collector road between Palm Beach Avenue and Sarawak Avenue
- new bridge overpass at Nineteenth Avenue to accommodate future heavy rail requirements
- entry ramp upgrades between Nerang and Tugun to provide improved ramp storage for ramp metering
- managed motorways between Nerang and Tugun, including ramp metering, variable speed limit (VSL) and variable message signs
- new service road between Tallebudgera and Palm Beach interchanges, including a crossing of Tallebudgera Creek and a connection to Tsipura Drive
- cycle facilities at interchanges and along service roads to improve cycle connectivity
- two fauna crossings.

The proponent states the project, once delivered, will be sufficient to satisfy traffic demand until at least 2041. This additional capacity is expected to attract vehicles away from the Gold Coast Highway, the main alternative route, with up to 13,000 fewer vehicles using that route each day. The project will also divert traffic from much of the surrounding arterial network, thereby relieving congestion on local roads.

The project aims to improve the capacity, reliability and safety of the motorway. Therefore, it aligns with several policy papers released by the Queensland Government, including *Our Future State: Advancing Queensland's Priorities (2018)*, *ShapingSEQ – South East Queensland Regional Plan (2017)* and *Queensland Plan (2014)*. The project also aligns with Infrastructure Australia's recommendations to make better use of existing assets and to optimise infrastructure using technology.

5. Options identification and assessment

The base case is a 'do minimum' scenario, including committed and funded projects. The proponent has confirmed that the base case also includes unfunded projects. These projects are not expected to have a material effect on the benefits of the proposed project. The base case also includes ramp metering and ramp consolidation.

The business case considered one of the best performing preliminary options (Project Option 2) and a managed motorways technology focussed option (Project Option 1) against the base case. Project Option 1 was not shortlisted through the options assessment process:

- Project Option 1 proposes the implementation of managed motorways technology (i.e. variable speed-controlled sections of the motorway) between Nerang and Tugun along with replacing ageing pavement and strengthening existing embankments. The option does not increase the capacity of the motorway by adding additional lanes and does not alter motorway alignments or change ramp lengths.
- Project Option 2 proposes widening the motorway to six lanes between Varsity Lakes and Tugun, with new auxiliary and service roads to better manage traffic flow, and improvements to the horizontal/vertical alignment of the corridor. This option also includes managed motorways technology between Nerang and Tugun (as per Project Option 1).

Infrastructure Australia recommends that the best performing options be identified through increasingly quantitative assessment tools during the shortlisting process. This is to ensure that the best performing options are assessed in the business case. Notwithstanding the shortlisting issue above, the proponent considered a wide range of sub-options in the appraisal to arrive at the preferred option, including various ramp and interchange configurations.

The two options were evaluated incremental to the base case, with the proponent estimating that the BCR for the two project options is similar, but with a higher NPV for Project Option 2. The proponent has selected Project Option 2 as the preferred option.

6. Economic, social and environmental evaluation

The proponent's economic evaluation of the proposed project shows a NPV of $419.4 million and a BCR of 1.67 at a 7% real discount rate using P90 capital costs. The central case for the economic appraisal excluded wider economic benefits (WEBs) and travel reliability benefits.

Infrastructure Australia's analysis found that the assumptions and methodology used by the proponent in the economic evaluation are generally consistent with the Infrastructure Australia Assessment Framework.

Transport demand and traffic analysis was performed using two models: a strategic transport model to estimate regional network-wide demand changes; and a mesoscopic traffic model to estimate the local traffic performance of the proposed design. This approach is appropriate for estimating the impacts of a motorway upgrade project.

The proponent has adopted a 'blended' trip matrix approach for estimating project benefits, where the project benefits are assumed to transition from a fixed trip matrix (a basic approach that only allows for people to change route) to a more standard variable trip matrix (which allows for changes in route, mode and destination) over 10 years. This has led to a marginally higher benefit compared with the variable trip matrix approach recommended in the *Infrastructure Australia Assessment Framework*. Furthermore, the use of a 'blended' matrix approach for this project differs from the approach used for the M1 Pacific Motorway (Eight Mile Plains to Daisy Hill) project, submitted to Infrastructure Australia for evaluation at the same time.

The variable trip matrix approach allowed for some, but not all, of the induced demand effects identified in the Australian Transport Assessment and Planning (ATAP) guidelines. Specifically, the model did not allow for people making additional trips or changing the time that they travel.

The proponent's demand modelling peer review report notes a moderate risk that congestion is potentially overestimated in the base case because of assumptions regarding people's choice of departure times or their decisions to travel on alternative routes. Notwithstanding this issue, the proponent's sensitivity analysis suggests that the project remains viable under a worst-case scenario (-20% benefits and +20% costs).

Reducing congestion on the motorway is projected to deliver over two-thirds of the economic benefits, namely travel time savings for car users, light vehicles and heavy vehicles. The balance of the benefits relates to fuel consumption savings and public transport user benefits.

During the evaluation, Infrastructure Australia noted the following limitations in the analysis:

- Fuel consumption benefits appear high for the project, compared with standard methods of calculation.
- Vehicle operating costs (excluding fuel) for the project appear high. These costs represent the estimated increase in maintenance, repairs and depreciation costs for vehicles following the delivery of the project. The proponent's modelling indicates that any fuel efficiency gains to all users from less stop-start driving are offset by these extra costs.
- Construction disbenefits have not been considered for the project, even though there are likely to be speed restrictions in place for the duration of the construction timeframe.

After allowing for adjustments to the benefits to reflect these issues, Infrastructure Australia expects that the benefits of the proposed project will exceed the project costs.

Benefits and costs breakdown

Proponent's stated benefits and costs		Present value ($m, 2018) @ 7% real discount rate	% of total
Car users		**927.4**	**88%**
Travel time savings | Personal		613.3	59%
Travel time savings | Business		120.2	11%
Fuel consumption benefits		193.9	18%
Light Goods Vehicles		**43.8**	**4%**
Travel time savings		35.1	3%
Fuel consumption benefits		8.7	1%
Heavy Goods Vehicles		**105.0**	**10%**
Travel time savings		78.7	8%
Fuel consumption benefits		26.2	3%
Public Transport User Benefits		**41.9**	**4%**
Trip time savings | Personal		33.3	3%
Trip time savings | Business		12.3	1%
Station amenity improvements | Personal		-1.3	0%
Station amenity improvements | Business		-2.5	0%
Savings in public transport fares		0.1	0%
Consumer Surplus as reflected in		**-12.3**	**-1%**
Additional government revenue from excise and GST on fuel		-12.1	-1%
Additional public transport fare revenue collected		-0.2	0%
Unperceived Impacts of Changes in User Behaviour		**-61.7**	**-6%**
Changes in vehicle operating costs (excl. fuel) | car		-70.6	-7%
Changes in vehicle operating costs (excl. fuel) | LGV		-1.3	0%
Changes in vehicle operating costs (excl. fuel) | HGV		12.0	1%
Crash cost savings		-1.7	0%
Total Benefits[1]		**$1,048.8**	**100%**
Costs			
Capital costs (P90)		$615.4	98%
Operating costs		$13.6	2%
Total Costs[1]		**$629.0**	**100%**
Core results	**Net benefits - net present value (NPV)[2]**	**$419.4**	n/a
	Benefit–cost ratio (BCR) [3]	**1.67**	n/a

Source: Proponent's Business Case Submission (Stage 4 Template)

Notes:

(1) Totals may not sum due to rounding.

(2) The net present value is calculated as the present value of total benefits less the present value of total costs.

(3) The benefit cost ratio is calculated as the present value of total benefits divided by the present value of total costs.

A breakdown of the proponent's reported capital costs and funding is presented in the table below.

Capital costs and funding

Total capital cost (P90, nominal, undiscounted)	$1,016.5 million
Proponent's proposed Australian Government funding contribution	$508.3 million (50:50 Australian Government to State Government split)
Other funding (source / amount / cash flow) (nominal, undiscounted)	$508.3 million from the Queensland Government

7. Deliverability

The proponent states that the project is anticipated to take five years to complete and will be delivered through multiple works packages, including an early works package, a managed motorways package, and three construction contracts to be progressively delivered between Varsity Lakes Interchange (Exit 85) and Tugun Interchange (Exit 95). The decision to deliver the project using three construction contracts was made after the completion of the business case, which referred to four construction packages, to minimise package interface risks.

The construction schedule has been developed to take advantage of resources mobilised to construct the nearby M1 Pacific Motorway (Mudgeeraba to Varsity Lakes) project, which the Department of Transport and Main Roads expects to be completed in mid-2020.

The three construction packages are proposed to be delivered as Construct Only contracts, allowing the proponent to address known geotechnical, environmental and preconstruction risks during the detailed design phase. These project risks appear reasonable for a project of this nature. In selecting the Construct Only contract approach, the proponent considered a range of other procurement approaches, including Alliance and Public Private Partnership models.

The project will be delivered by the Queensland Government, in consultation with the City of Gold Coast Council which is the owner and operator of several road connections impacted by the project. This consultation process will be critical to the success of the project as it is delivered alongside other nearby upgrades of the motorway and surrounding roads.

The cost estimate peer review report concluded that no significant omissions were identified in the cost estimate, that the cost estimate had been prepared in accordance with the relevant cost estimating manual and that unit item costs within the capital cost estimate were generally reflective of efficient prices for Queensland road construction.

As part of best practice project development, Infrastructure Australia recommends a Post Completion Review of the project be conducted to accurately gauge whether it delivered the expected levels of service, and to identify any lessons that could be used to inform future projects. This will be particularly important for this project, given that it is part of a broader program of works on the M1 Pacific Motorway.

The business case includes a strategic benefits realisation plan that recommends the outcome of the Reference Project's benefits evaluation be presented to the proponent at project closure, but does not include a full Post Completion Review Plan.

The proponent has considered a range of funding approaches, including road user charges. The proponent considered the application of a toll on this section of the M1 Pacific Motorway to be inappropriate as the M1 Pacific Motorway is part of the NLTN and there is no practical alternative route.