

Mooloolah River Interchange

BUSINESS CASE COST BENEFIT ANALYSIS

2020



Queensland
Government

Purpose of this document

This document provides an overview of the Mooloolah River Interchange (MRI) project. The primary objective of this document is to present the key findings and outcomes of the Detailed Business Case undertaken for the project, as well as outline the economic analysis undertaken.

Status

This document was prepared based on the contents of the Mooloolah River Interchange Detailed Business Case 2020. The information presented may be subject to change as the proposal progresses through future stages of development, delivery and operations.

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Acknowledgement

TMR acknowledges the work of engineering consultant GHD in the preparation of the MRI Detailed Business Case.

Front Cover

Artist's impression of the Mooloolah River Interchange (Mooloolaba to the left).



Artist's impression: New overpass connecting Nicklin Way northbound with Brisbane Road in Mooloolaba (Mooloolaba to the right)

1. Summary information

Project name	Mooloolah River Interchange
Location	Sunshine Coast, Queensland
Proposal owner	Queensland Department of Transport and Main Roads
Proposed delivery agency	Queensland Department of Transport and Main Roads
Project inclusions	<ul style="list-style-type: none"> • New two-lane arterial road that crosses the Mooloolah River to provide a direct connection from the Sunshine Motorway to Kawana Way (and the future Kawana Motorway) • Duplication of the Sunshine Motorway from two to four lanes, between Nicklin Way and the existing Kawana Way interchange. • Free-flow connection from the Sunshine Motorway southbound to the Sunshine Motorway eastbound • Third northbound lane on the Sunshine Motorway, between the new Mooloolah River crossing and the Buderim-Mooloolaba Interchange • Direct two-lane northbound bridge connection from Nicklin Way to Brisbane Road • New east-west local road connection between Brisbane Road and Karawatha Drive/Bundilla Boulevard. • Active transport through the project area, through provision of over 7,5 km of new off-road pathways
Capital cost (P90)	\$780.7 million
Benefit cost ratio	4.01

2. Proposal overview

The Sunshine Coast is one of Australia’s most desirable places to live and work. The region continues to grow at a rapid rate, exceeding the national and state average population growth rates. The Australian Infrastructure Audit 2015 identified the Sunshine Coast as one of the top 20 regions for economic growth to the Australian economy.

A key component of the Department of Transport and Main Roads’ (TMR) long term vision for a strategic transport network response to the Sunshine Coast’s forecast growth is a continuous north–south motorway spine servicing the entire eastern Sunshine Coast from Peregian Springs in the north to the Bruce Highway at Caloundra South.

The Mooloolah River Interchange (MRI) will deliver the missing road link across the Mooloolah River which is key to establishing a future continuous north– south motorway spine. This will connect residents along the length of the Sunshine Coast with employment, health, education and activity centers, and improve road efficiency and reliability for urban freight. The project will

deliver significant local safety and capacity improvements and protect the Bruce Highway’s (M1) national freight function.

Located at the convergence of the Sunshine Motorway, Nicklin Way, Kawana Way and Brisbane Road (approximately 8 kilometres east of the Bruce Highway/Sunshine Motorway interchange) the project will enable the Queensland Government to take advantage of growth opportunities within the region and benefit road, public and active transport users through integrating infrastructure and land use planning. *Figure 1* shows the project’s location within the Sunshine Coast region.

TMR undertook detailed planning of the MRI to assess the extent to which the project will improve capacity, connectivity, resilience, accessibility and safety within the project area and also within the wider Sunshine Coast road network. The planning is to be used as the primary justification to seek multi-level government investment to proceed to the next phases of detailed design and construction.



Figure 1: MRI project area location within the Sunshine Coast region

3. Service need

The MRI, as a key component of the planned north–south motorway spine, will serve an inter and intra-regional function within the transport network and fill a much-needed gap within the Sunshine Coast road hierarchy. It will lead to improved long-term strategic functionality of the Sunshine Coast transport network and connect people to important employment, education, health and commercial destinations including the Sunshine Coast University Hospital (SCUH), the University of the Sunshine Coast (USC), the Maroochydore City Centre Priority Development Area (PDA), the Sunshine Coast Airport (which operates domestic and international flights), as well as other employment, recreation and activity centres.

The project will reduce congestion and delays on the local transport network and reduce use of the Bruce Highway for local trips. Without intervention, these are forecast to continue to increase significantly over the next 10 years due to continuing regional growth.

The existing road layout in the project area, including lane drops, speed limit changes, merges, weaves and multiple on and off-ramps, results in the potential for driver confusion, numerous conflict points and congestion. Addressing these issues and reducing crash risk, through separating or removing conflicting lane merges and weaves, providing a consistent speed environment and providing greater directional legibility, was a critical focus of the planning.

The MRI project will deliver necessary connectivity between the Sunshine Motorway and Kawana Way (and the future north–south motorway).

Key issues to be addressed by the MRI project include:

- significant congestion within the central Sunshine Coast road network
- existing safety, efficiency and resilience issues within and adjacent to the project area
- urban development and economic growth targets are unlikely to be achieved limiting population and economic growth
- access to services and social amenity on the Sunshine Coast will be adversely and significantly impacted and will affect Queensland Government, Sunshine Coast Council (SCC) and private sector intentions and investments, including addressing growing demand associated with the SCUH, USC, Kawana Town Centre and the new Maroochydore City Centre.



Artist's impression: Sunshine Motorway leading to the Mooloolah River Interchange (looking south towards Birtinya)

4. Project history and development

The MRI concept was first considered as an initiative to respond to growing demand on the Sunshine Coast transport network in 2004. The MRI progressed as a component of Sunshine Coast strategic planning studies including the Multi-Modal Transport Corridor (MMTC) study in 2007, and the Sunshine Coast Transport Project (SCTP) from 2010 to 2012.

The MRI was initiated as an individual project in 2013 to investigate a new road crossing over the Mooloolah River and also potential improvements in the existing Sunshine Motorway/Nicklin Way interchange. This planning study

considered a wide range of interchange treatments to address the long-term transport needs of the local area.

In 2015, a Preliminary Business Case (PBC) was completed which was approved by TMR in November of that year. The PBC identified a preferred option that consisted of two broad stages, the first of which has now been progressed in this business case, and an ultimate stage which includes duplication of the river crossing and other improvements to further increase the capacity in the road network and ensure any infrastructure built now will meet demand well into the future.

This business case refined the layout to provide enhanced connectivity, confirmed compatibility with the future construction of the Caboolture to Maroochydore Corridor Study (CAMCOS) rail component within the MRI project area, undertook additional environmental and cultural heritage assessments and updated the project estimate and economics assessment.

Figure 2 provides an overview of the MRI project development lifecycle.

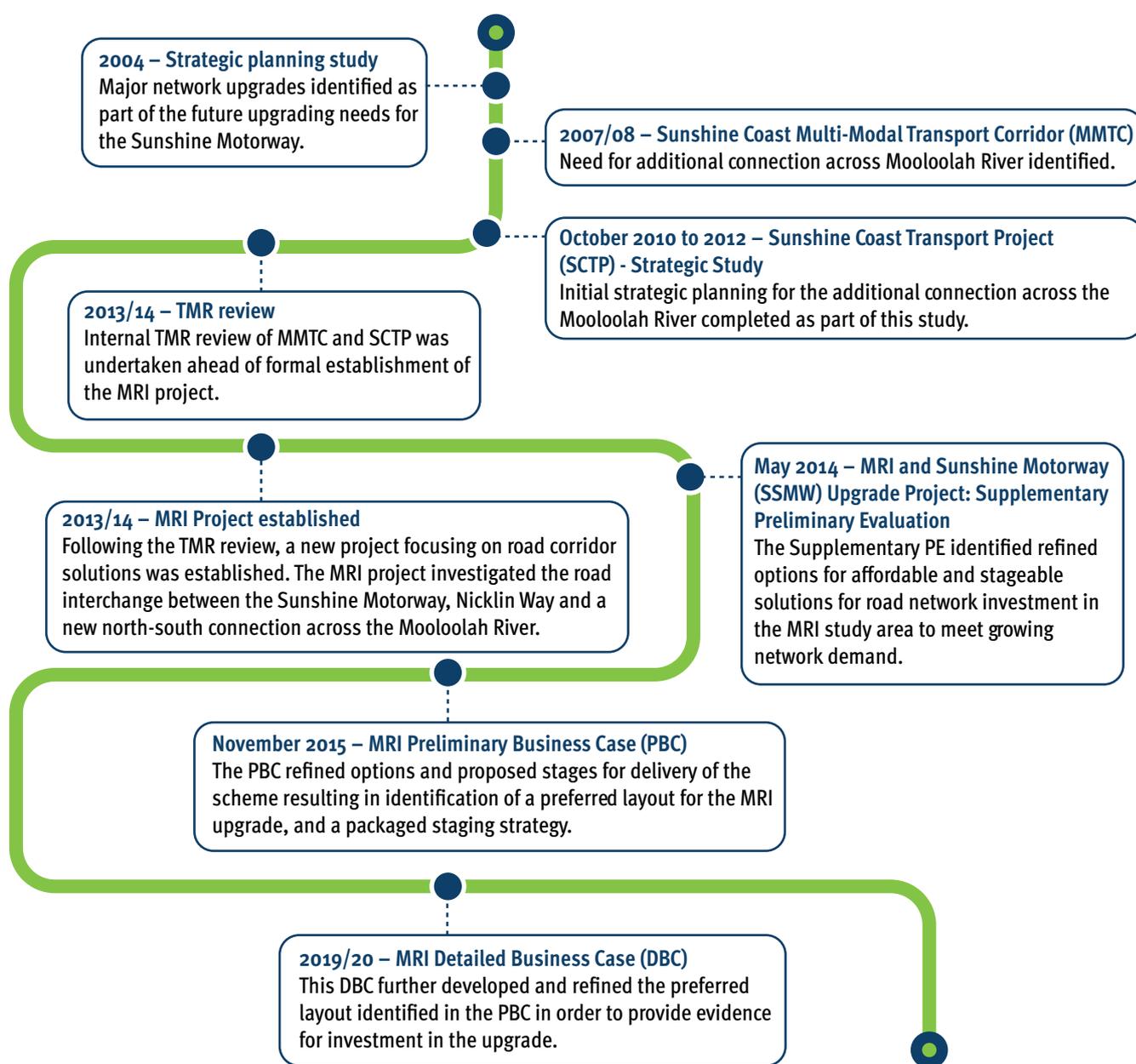


Figure 2: MRI project development lifecycle



Sunshine Motorway looking west towards the Bundilla Boulevard exit. Traffic weaving in this section is a cause of regular significant congestion and delay.

5. Base case

The base case provides the basis upon which the MRI project has been assessed in the economic analysis and has been developed in accordance with Infrastructure Australia (IA) guidelines. It uses a combination of currently committed and funded works, and standard maintenance and minor rehabilitation works and includes all expected impacts, costs and benefits of the situation that would exist without the project.

The base case network deficiencies include the key direct connection of the Sunshine Motorway to Kawana Way (and the future north– south motorway spine), across the Mooloolah River. The current lack of connectivity means that the Sunshine Motorway/Nicklin Way route and the Bruce Highway provide the only direct major north– south routes for inter and intra-regional travel on the Sunshine Coast. Along with this lack of connectivity, other issues include congestion, lack of capacity and crash-risk associated with the existing interchange configuration.

In addition to the wider network connectivity issues, there is limited integration of the existing local transport network with land use adjacent to the project area, with local traffic in Mountain Creek, Brightwater, Parrearra and Minyama restricted to using the Sunshine Motorway and Kawana Way for local access trips.

Both the Sunshine Motorway and Kawana Way are forecast to be operating at capacity by 2026, resulting in increased travel times for local trips and longer distance trips which must pass through this location.

Transport modelling indicates that congestion is expected to worsen beyond 2026 without the project. For example, in the AM peak the Sunshine Motorway heading westbound (from north and east) will experience increasing congestion with average speeds of less than 40 km/h in 2026, worsening to less than 20 km/h in 2041. Several key intersections will have long delays in 2026, worsening by 2041.

Without the project, intra-regional and inter-urban movements, particularly north-south trips, will be constrained in the future as increasing travel times restrict access to key activity centres and other employment, health, education and recreation destinations, which will negatively impact the region's economy and productivity.

6. The MRI project

The MRI project comprises a major upgrade to the existing interchange, to establish the road hierarchy of the Sunshine Motorway as a regional distributor connecting to the national Bruce Highway, and to provide a direct and efficient link between the Sunshine Motorway and Kawana Way (and the future north-south motorway spine).

The MRI, as a component of the north-south motorway spine, will significantly improve travel times and reliability through the delivery of the new direct river crossing from the Sunshine Motorway to Kawana Way and reduce local trips non the Bruce Highway and free up other major roads such as Nicklin Way and Kawana Way for improved public transport. The MRI will also reduce local trips on the Sunshine Motorway with improved access to the Mountain Creek, Brightwater, Parrearra and Minyama areas via the Karawatha Drive connection road.

The project will also provide new opportunities for public transport connections, and support CAMCOS and Sunshine Coast Mass Transit projects (subject to separate planning studies).

The project supports active transport through provision of over 7.5 kilometres of new off-road pathways which directly connect to existing active transport facilities on Nicklin Way, Kawana Way and paths adjacent to the Sunshine Motorway. This proposed pathway network will deliver highly attractive opportunities for commuter and recreational bike riding and facilitates mode-shift through the provision of new bicycle and pedestrian routes, resulting improvements to travel times and accessibility.

Key features of the reference project include:

- a new two-lane arterial road that crosses the Mooloolah River to provide a direct connection from the Sunshine Motorway to Kawana Way (and the future north-south motorway spine)
- duplication of the Sunshine Motorway from two to four lanes, between Nicklin Way and the existing Kawana Way interchange
- free-flow connections from the Sunshine Motorway southbound to the Sunshine Motorway eastbound
- a third northbound lane on the Sunshine Motorway, between the new Mooloolah River crossing and the Buderim-Mooloolaba Interchange
- direct, two-lane northbound bridge connection from Nicklin Way to Brisbane Road
- new east-west local road connection between Brisbane Road and Karawatha Drive/Bundilla Boulevard
- significant active transport facilities through the project area, including the provision of over 7.5 km of new off-road pathways.

Throughout the development of the business case, opportunities to rationalise the CAMCOS and MRI corridors were explored. The resulting MRI design provides for the current protected CAMCOS corridor and also provides for an alternative, more cost-effective alignment to be considered in the future.



Artist's impression of the Mooloolah River Interchange (Mooloolaba to the left).

7. Project cost estimate

A risk-adjusted project cost estimate was developed based on construction materials rates (July 2020), quantities determined through the concept design and delivery of the project as a single construction project over a 48-month period. A breakdown of project cost estimates is shown in Table 1, with the base date for the estimate in July 2020.

Table 1: Project cost estimate breakdown (July 2020)

Project Cost Estimate (P90)	
Project phase	Cost (\$ Millions) ¹
Concept phase (planning)	7.5
Development phase (detailed design)	84.8
Implementation phase (construction)	450.5
Finalisation Phase	0.3
Contingency allowance	169.3
Escalation (allowance for yearly cost increases)	68.2
Total	780.7

Significant costs associated with the delivery of the MRI project include:

- Bridges (27.2%)
- Bulk earthworks (20.0%)
- Pavements (8.2%)
- Drainage, protection works and retaining walls (6.8%)
- Road furniture (signs etc.) (4.3%)
- Traffic control during construction (3.3%)
- Environmental management during construction (2.4%)
- Lighting (1%)

8. Economic assessment

The economic impacts for the project utilised cost benefit analysis (CBA) to assess the incremental economic benefits and costs of the project to society. The CBA assessed a range of benefits through changing travel behaviour in the Sunshine Coast region. The economic appraisal drew on the forecast travel demands to estimate a range of project costs and benefits, over a 30-year appraisal period. To quantify these impacts, the appraisal assessed two categories of benefits to cover the range of potential benefits summarised in *Figure 3*.

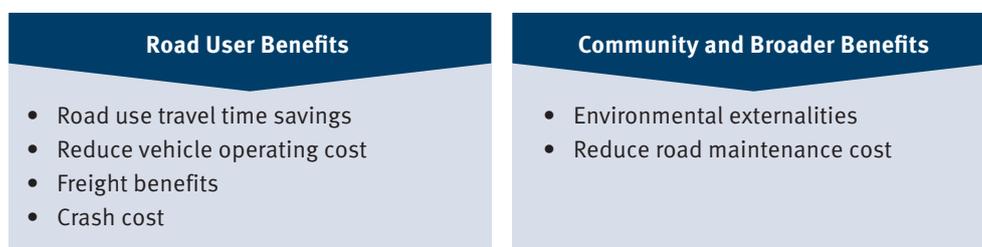


Figure 3: Project economic benefits

1. All costs are rounded to the nearest \$100,000

9. Travel demand forecasts

Detailed transport modelling was undertaken to assess the performance of the transport network with and without the MRI project. The MRI project was tested to demonstrate the strategic transport benefits associated with the design, along with improved safety performance. The transport modelling is based on a three-tier approach:

- Tier 1** Strategic demand modelling was used as the basis for trip generation, distribution and mode choice, taking into account future development patterns and population forecasts.
- Tier 2** Regional mesoscopic modelling provided a more detailed representation of route choice compared to the Tier 1 models.
- Tier 3** Microscopic modelling (project area) provided a detailed traffic simulation of complex interactions between vehicles and evaluated network dynamics, blocking back, merging, weaving, detailed travel times and interactions between vehicles, traffic control process and network geometry. This level of transport modelling provided a highly detailed assessment of the performance of the study network.

The transport modelling was undertaken for a range of design horizons (2026, 2031 and 2041) including a base case network, a project network (which includes the MRI project only) and a sensitivity network (at 2041 only). The sensitivity network includes additional features to simulate possible, future transport upgrades such as an upgrade to the Buderim-Mooloolaba Interchange and a north– south motorway spine south of the MRI, with a connection to the Bruce Highway at the Roys Road interchange.

Transport modelling demonstrates a general trend of a reduction in hours travelled (Vehicle Hours Travelled or VHT) and an increase in the kilometres travelled (Vehicle Kilometres Travelled or VKT) which confirms that the project will deliver significant network benefits. The reduction in VHT indicates generally faster network travel times associated with the project, while the increase in VKT indicates that more trips are using the more efficient motorway and major roads rather than the local road network.

The transport modelling indicated that delivery of the MRI will result in:

- an average of 9% decrease in VHT in 2026 and 4.4% in 2041
- an average of 3.5% increase in VKT in 2026 and 4.2% in 2041
- an average of between 12-16% improvement of average travel speed across the region in the 2026 peak periods, and between 7-11% improvement in 2041.

Delivery of the MRI project is expected to significantly improve the efficiency and performance of the Sunshine Coast's road network with a significant shift of local traffic movements away from the Bruce Highway and the already congested local and sub-arterial links, onto the Sunshine Motorway and connecting road links to the south.

10. Cost benefit analysis results

The summary results of the detailed cost benefit analysis for the project are presented in Table 2 for a P50 level of risk (discounted at 7 per cent over a 30-year appraisal period). Key economic decision criteria are presented along with the disaggregated cost and benefit categories assessed as part of the business case. All decision criteria demonstrate an economic return for the community in excess of the net whole-of-life costs for the project.

Table 2: Summary of economic appraisal results

COST BENEFIT ANALYSIS RESULTS (P50)	Present Value (\$ Millions)
Discounted Project Costs²	
Capital costs	582.35
Operational and maintenance costs	41.16
Total costs	623.51
Project Benefits	
Road user travel time savings	2,627.39
Reduced vehicle operating costs	251.75
Freight benefits	24.99
Crash cost savings	-171.42 ³
Environmental cost savings	-287.95 ⁴
Fuel greenhouse gas savings	55.26
Total benefits	2,500.02
Results	
Total Project Costs	-623.51
Total Project Benefits	2,500.02
Net Present Value (NPV)	1,876.51
Benefit Cost Ratio (BCR)	4.01

The benefits of the project are estimated to significantly exceed the costs, giving the project a Net Present Value (NPV) of \$1,876.51 million and a benefit to cost ratio (BCR) of 4.01. In other words, the project will deliver just over \$4 of benefit for every \$1 of cost and represents an excellent level of return on investment. The benefits are primarily realised due to travel time savings across the network, with additional net benefits in vehicle operating costs, fuel, greenhouse gas savings and freight savings.

2. The project costs listed represent risk adjusted costs for design and construction, land acquisition, and client costs of the MRI project. Prior to inclusion in the economic appraisal, some adjustments were undertaken to align the cost estimates with the real, discounted values of the economic benefits. This includes the exclusion of sunk costs incurred before the appraisal start date and waste levy costs that are considered a transfer rather than an economic cost.
3. The MRI project will lead to safety improvements across the MRI project area; however, this is not able to be robustly and confidently monetised through the economic appraisal. Due to the uncertainty surrounding the estimation of safety improvements directly attributable to the MRI project, a standard rate of kilometre travelled has been adopted. This does not capture the full benefits associated with the safety improvements delivered as part of the MRI project and therefore represents an overestimate of the likely safety disbenefits.
4. The environmental impacts of fuel usage have been calculated based on the distance and speeds travelled on a link by link basis. However, other environmental externalities have been estimated based solely on distance, which is likely to overestimate the environmental disbenefits.

11. Sensitivity analysis

Scenario and sensitivity analyses were undertaken on the discount rate, costs and benefits to test the robustness of the evaluation results. The analysis showed that the NPV remains highly positive, and the BCR is robust in all sensitivities and scenarios tested.

The sensitivity tests completed for the project included:

Table 3: Sensitivity tests

SCENARIO	NPV (\$ Millions)	BCR
Road maintenance		
Excluded	1,876.51	4.01
Included	1,751.52	3.81
Discount rates		
7%	1,876.51	4.01
4%	3,547.10	5.98
10%	1,022.64	2.83
Cost sensitivity		
100%	1,876.51	4.01
80%	2,001.21	5.01
120%	1,751.81	3.34
Benefit sensitivity		
100%	1,876.51	4.01
80%	1,376.50	3.21
120%	2,376.51	4.81

5. Road maintenance includes all maintenance costs that would have otherwise been expended in the project area if the MRI project doesn't proceed.

12. Wider economic impacts

With significant population and economic growth expected in the Sunshine Coast region, investment in the MRI and wider north– south motorway is necessary to provide capacity to support significant population growth in the region, including associated increased demand on the road network, and the need to connect the community with employment. The MRI is critical to reduce the reliance on the Bruce Highway for local trips and to improve local connectivity, efficiency, safety and access to public and active transport options while reducing or eliminating existing capacity constraints and congestion.

Delivery of the project is a key first step in improving the north– south connectivity of the Sunshine Coast transport network to assist in achieving these outcomes. Intra-regional and inter-urban movements, particularly

north-south trips, which would otherwise be constrained in the future will benefit from the project as reducing travel times boosts accessibility to key activity centres and other employment, health, education and recreational destinations, further supporting the region's economy and productivity.

In addition to the positive economic outcomes of the project as shown by the BCR, the construction of the project is estimated to generate an average of 389 full-time equivalent (FTE) jobs across the estimated five-year construction period.

13. Social impacts

A social impact evaluation was undertaken to assess the project's social, economic, and environmental impacts and to identify options to take advantage of positive impacts, and to avoid, manage, mitigate, or offset negative impacts. By addressing the congestion and urban growth issues, the delivery of the MRI is expected to provide significant social value benefits to the region, in alignment with the project objectives.

The most significant social benefits expected are:

- reduced traffic congestion and improved transport connectivity
- increased economic efficiency for the local economy contributing to the South East Queensland regional economy
- improved accessibility and mobility for urban freight and business travel
- reduced weaving maneuvers, resulting in improved road safety in the project area and its road approaches for commuting residents and visitors
- improved response times of emergency services, resulting in improved health outcomes
- improved safety, travel time reliability, and better access/connectivity to public and active transport
- supporting options for enhanced public transport by creating a faster and more attractive alternative route and freeing up capacity on parallel routes such as Nicklin Way
- improved access for local communities, and enhanced connectivity to employment opportunities, commercial and retail outlets, educational institutions (USC), health facilities (SCUH) and social services.

Strategies, such as promotion of active transport and early engagement with residents and business owners prior to opening of the project are identified to further enhance already strong positive social impacts of the project.

Several environmental studies have been undertaken to consolidate previous assessments and reduce potential impacts. TMR recognises the community importance of the environment in this location and in addition to the statutory approvals and permits required during the detailed design and construction phases, the business case identified further investigations needed to ensure disturbance is minimised and the environment is protected during the construction and operation of the MRI.

Significant cultural Heritage investigations were undertaken as part of the business case and a Cultural Heritage Field Assessment Report was completed. TMR have commenced an additional Cultural Heritage Study of the project area in conjunction with Kabi Kabi First Nation Traditional Owners Native Title Claim Group (Kabi Kabi). This study will inform the Cultural Heritage Management Plan and identify further mitigation and monitoring requirements for construction.

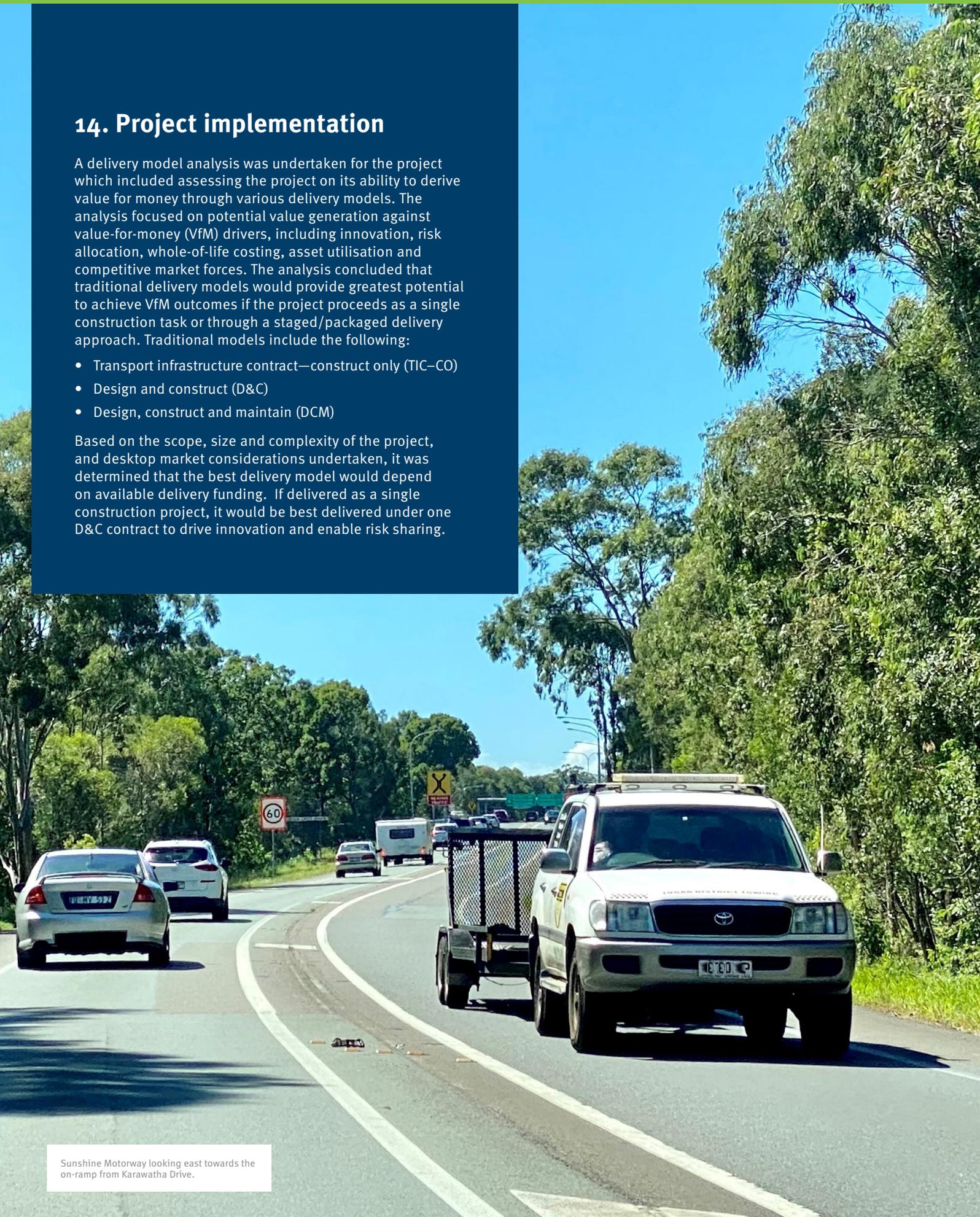
Mitigation strategies for other impacts, such as minimising property resumptions, and installing noise attenuation have been identified to manage potential negative social impacts resulting from the project. These enhancement and mitigation strategies will continue to be considered and developed in the detailed design phase of the project.

14. Project implementation

A delivery model analysis was undertaken for the project which included assessing the project on its ability to derive value for money through various delivery models. The analysis focused on potential value generation against value-for-money (VfM) drivers, including innovation, risk allocation, whole-of-life costing, asset utilisation and competitive market forces. The analysis concluded that traditional delivery models would provide greatest potential to achieve VfM outcomes if the project proceeds as a single construction task or through a staged/package delivery approach. Traditional models include the following:

- Transport infrastructure contract—construct only (TIC—CO)
- Design and construct (D&C)
- Design, construct and maintain (DCM)

Based on the scope, size and complexity of the project, and desktop market considerations undertaken, it was determined that the best delivery model would depend on available delivery funding. If delivered as a single construction project, it would be best delivered under one D&C contract to drive innovation and enable risk sharing.



Sunshine Motorway looking east towards the on-ramp from Karawatha Drive.

15. Staged implementation

Recognising that funding to deliver the MRI as a single construction project may be limited, an option to deliver the MRI as a series of up to five separate work packages via traditional TIC-CO contracts was also developed. This form of delivery would allow TMR to manage the staging tasks and risks in accordance with available funding streams.

Figure 4 shows the recommended delivery package sequencing for the project.

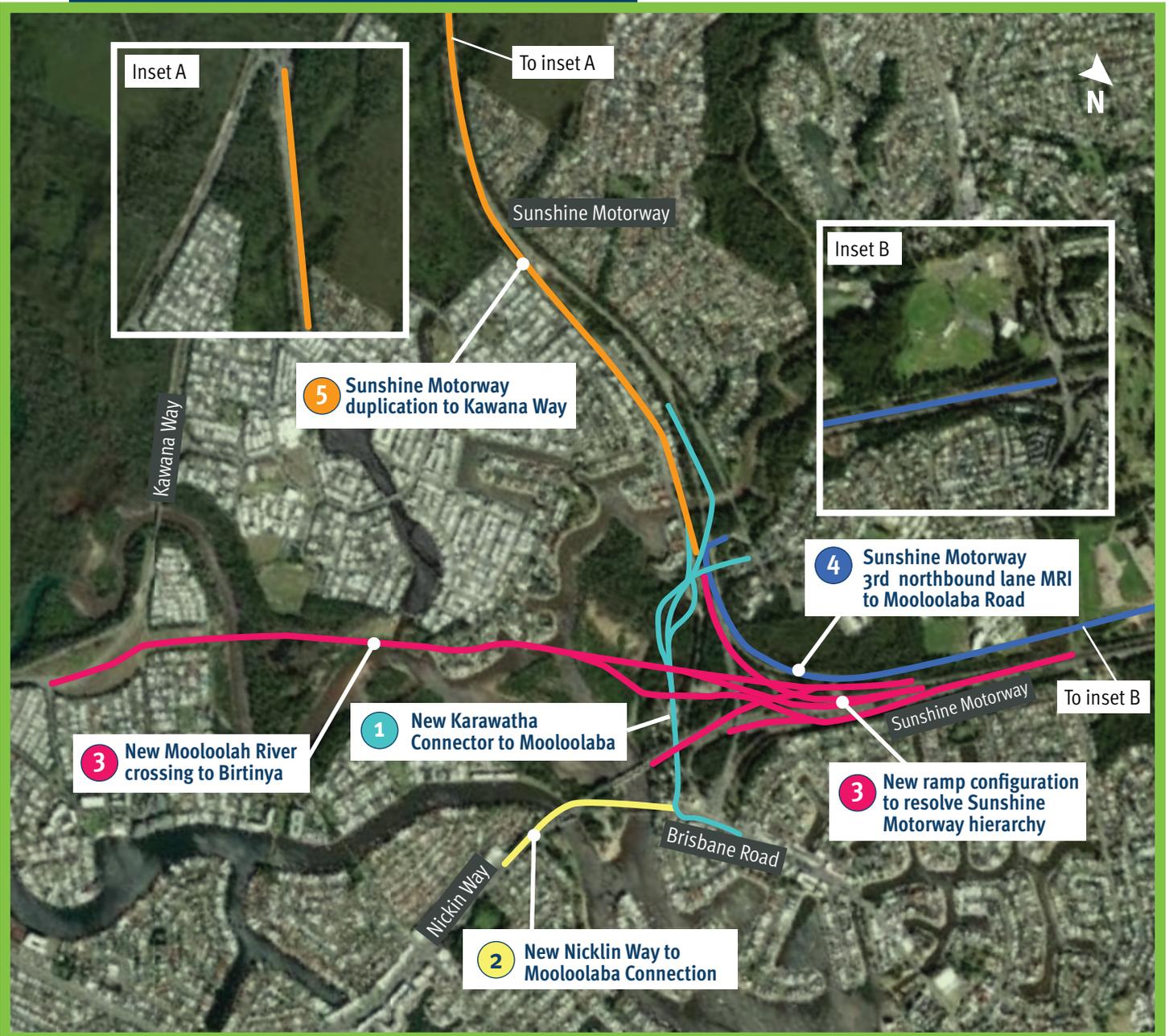


Figure 4: Recommended delivery package sequencing for the project

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