Sunshine Coast Mass Transit

DRAFT Options Analysis

APRIL 2021

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Sunshine Coast COUNCIL

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Acknowledgements
Council wishes to thank all contributors and stakeholders involved in the development of this document.

Disclaimer
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Note:
The Options Analysis was largely completed prior/during the events occurring as a result of the COVID-19 pandemic. The possible legacy effects COVID-19 may have on travel demand, public transport, mass transit and jobs and connectivity in the Sunshine Coast Region were unclear at the time of developing the Options Analysis and as a consequence have not yet been fully considered. It is acknowledged that such legacy impacts will need to be addressed in the next stage of investigation.

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Glossary

Abbreviation	Term
ABS	Australian Bureau of Statistics
AIP	Australian Infrastructure Plan
ART	Autonomous Rapid Transit
ASS	Acid Sulphate Soils
ATAP	Australian Transport Assessment and Planning
BCDF	Business Case Development Framework
BCR	Benefit-Cost Ratio
BCRG	Business Case Reference Group
BOOT	Build, Own, Operate and Transfer
BQ	Building Queensland
BRT	Bus Rapid Transit
C&D	Construction and demolition
CAGR	Compound annual growth rate
CAMCOS	Caloundra and Maroochydore Corridor Options Study
CBA	Cost Benefit Analysis
CBD	Central Business District
CDMIP	Concept Design and Impact Management Plan
CLR	Contaminated Land Register
D&C	Design and Construct
DATSIP	Department of Aboriginal and Torres Strait Islander Partnership
DBC	Detailed Business Case
DBFO	Design, Build, Finance and Operate
DCM	Design, Construct and Maintain
DCMO	Design, Construct, Maintain and Operate
DES	Department of Environment and Science
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
DNRME	Department of Natural Resources, Mines and Energy
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
ECI	Early Contractor Involvement
EMR	Environmental Management Register
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ETI	Early Tenderer Involvement
FLU	Future Land Use
GCLR	Gold Coast Light Rail
IA	Infrastructure Australia
ILM	Investment Logic Mapping
ITDP	Institute for Transportation and Development Policy
KM	Kilometres
LGA	Local Government Area
LGIP	Local Government Infrastructure Plan
LRT	Light Rail Transit
LRVs	Light Rail Vehicles
M2M	Mooloolaba to Maroochydore
MCA	Multi Criteria Assessment
MNES	Matters of National Environmental Significance

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MRI	Mooloolah River Interchange
MSES	Matters of State Environmental Significance
NCRL	North Coast Rail Line
NPV	Net Present Value
N/A	Not applicable
OA	Options Analysis
O&M	Operations and Maintenance
OCC	Operations Control Centre
PAF	Project Assessment Framework
PASS	Potential Acid Sulphate Soils
PCEM	Project Cost Estimating Manual
PDA	Priority Development Area
PPP	Private Public Partnership
PT	Public Transport
PUP	Public Utility Plant
PV	Present Value
P50	Value including contingency at the P50 confidence interval. Where risk modelling has been completed, the P50 risk-adjusted value represents the median, or most likely, cost estimate of an asset or item.
QBC	Quality Bus Corridor
QGSO	Queensland Government Statistician's Office
RNE	Register of the National Estate
ROW	Right-of-Way
SBC	Strategic Business Case
SCC	Sunshine Coast Council
SCMT	Sunshine Coast Mass Transit
SCUC	Sunshine Coast Urban Corridor
SCUH	Sunshine Coast University Hospital
SCZM	Sunshine Coast Zenith Model
SEQ	South East Queensland
SIB	Social Impact Baseline
SIE	Social Impact Evaluation
SIP	State Infrastructure Plan
SLR	Sydney Light Rail
SPP	State Planning Policy
TfNSW	Transport for NSW
TMR	Department of Transport and Main Roads
TT	Trackless Tram
VC	Volume to capacity
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled
VLC	Veitch Lister Consulting
VM Act	Vegetation Management Act (1999)
WEBs	Wider Economic Benefits
WHL	World Heritage List
wLRT	wireless Light Rail Transit
WRR Act	Waste Reduction and Recycling Act (2011)
4G	Fourth Generation

Terms of Reference

Required compliance with business case frameworks

Queensland *Business Case Development Framework*

The Building Queensland *Business Case Development Framework* ensures a consistent and rigorous approach to proposal development, enabling decision-makers to compare investment opportunities. It is applied to infrastructure projects with an estimated capital cost of delivery of $100 million or more. The framework guides business case investment proposals through three stages:

- Stage 1: Strategic Assessment – conception
- Stage 2: Options Analysis – generating and analysing options
- Stage 3: Detailed Business Case – detailed analysis of the preferred options.

Australian Government Assessment Framework

Infrastructure Australia is a federal agency that provides advice to Governments, industry and the community on the infrastructure investments and reforms that will benefit all Australians. A key advisory tool is the Infrastructure Priority List providing a list of national infrastructure priorities for consideration by the Australian Government. The *Assessment Framework* sets out the process Infrastructure Australia uses to consider initiatives and projects for inclusion on the Infrastructure Priority List. The five-stage assessment process is as follows:

1. Problem Identification and Prioritisation
2. Initiative Identification and Options Development
3. Business Case Development
4. Business Case Assessment
5. Post Completion Review.

Terms of Reference - Sunshine Coast Mass Transit Options Analysis

Queensland Government process

Sunshine Coast Council approved the Strategic Business Case for the Sunshine Coast Mass Transit Project (the Project) on 25 July 2019 when it resolved to:

> *"refer the Strategic Business Case for the Sunshine Coast Mass Transit to Building Queensland for its consideration and inclusion in the Infrastructure Pipeline, and advise Building Queensland of an intention to complete a Preliminary Business Case".*

The Project is now navigating Stage 2 of the Queensland *Business Case Development Framework* , "Options Analysis".

Australian Government process

On 25 July 2019 Sunshine Coast Council also resolved to:

> *"refer the Strategic Business Case for Sunshine Coast Mass Transit and in the form of a completed "Infrastructure Australia Stage 1 Template" to Infrastructure Australia for its consideration and inclusion in the Infrastructure Priority List, and advise Infrastructure Australia of the intention to complete a Preliminary Business Case.*
>
> *The Project is now navigating Stage 2 of the Assessment Framework, "Initiative Identification and Options Development".*

Scope of the Sunshine Coast Mass Transit Options Analysis

Project aims:

- Review and update the service need and benefits identified in the Strategic Business Case (SBC), focussing on problems and opportunities associated with transportation of people in the Sunshine Coast Region.
- Develop potential options (initiatives) to solve the problems or realise the opportunities and assess those options to select those with the highest potential value to the Sunshine Coast, Queensland and Australian communities.
- Narrow the breadth of options for improving the transportation of people by public transport in the Sunshine Coast Region by applying rigorous evaluation criteria, before assessing the viability of any remaining options.

Methodology:

- Prepare a Stage 2: Options Analysis that builds on the assessment of service need and benefits identified in the SBC already approved by Council (comparable to Stage 1: Strategic Assessment).
- Use a structured options assessment process where a longlist of options is reduced to a robust and defensible shortlist of options.
- Analyse the shortlisted options to identify preferred option/s for detailed analysis in Stage 3: Detailed Business Case.

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EXECUTIVE SUMMARY

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Executive Summary

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 national and state average population growth rates.

Over the past 20 years, the population of the Sunshine Coast has grown strongly by 125,500 people at an average of 2.6 per cent per year. By comparison, Queensland's population grew at an average of two per cent per year in the same period. Projections of future population for the Sunshine Coast Region made by the Queensland Government Statistician's Office (QGSO) will see an increase from 303,389 in 2016 to 518,004 in 2041. This represents an increase of 214,615 people (or 71 per cent) over the 25-year period.

The region is heavily dependent on car transport and continues to rapidly expand its urban boundaries. It faces major challenges in managing growth over the next three decades. Population growth and increasing congestion will continue to put pressure on housing, transport, lifestyle, employment, social infrastructure and the environment.

There is a real risk of a vicious circle developing, as shown in Figure 1, degrading the very qualities of the region that make it an attractive place to live and visit. Sunshine Coast Council has a vision for the Sunshine Coast to be Australia's most sustainable region: Healthy. Smart. Creative.

To achieve this vision and respond to the forecast population growth, a step change in public transport is required to set the region on a path to sustainable transport and urban development.

To support the development of an integrated urban public transport solution for the Sunshine Coast, the Sunshine Coast Mass Transit (SCMT) Options Analysis assesses the region's land use, transport, liveability and environmental sustainability challenges, considers options to address the challenges and defines the priority for more detailed investigations. It builds on work already completed in the SBC in July 2019[1].

Figure 1 – Risk of a vicious circle

Mass transit is a system of public transport that concentrates on moving large numbers of people over a fixed route or network. Mass transit includes:

- Buses (including articulated and double decker buses)
- Trams or light rail vehicles
- Passenger trains

[1] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case

The challenge of sustainable population growth

To accommodate the forecast population growth of 214,615 people in the Sunshine Coast Region, the South East Queensland (SEQ) Regional Plan (*ShapingSEQ)* identifies a need for at least 87,000 new residential dwellings between 2016 and 2041. Recent projections by QGSO suggest 92,000 dwellings will be required. Owing to existing urban settlement patterns and geographic constraints, the Sunshine Coast is facing a major challenge to accommodate the forecast growth in population and additional dwellings.

If the Sunshine Coast responds to population growth primarily through urban expansion, this will likely result in urban encroachment on the region's natural resources including environmentally significant land, highly constrained land, rural areas and agricultural areas. The expanded urban environment will also require significant investment in the provision of infrastructure and services over a larger geographic area.

New communities located outside existing urban areas are also difficult to service with effective public transport and often do not meet residents' needs for employment, recreation, shopping and education. Residents of new communities tend to rely mostly on car transport for trips outside the immediate local area. This will generate higher levels of vehicle travel with commensurate high needs for new roads and car parking to enable residents to access the established major activity centres and coastal attractions.

To reduce these undesirable effects, both Sunshine Coast Council and the Queensland Government have recognised there must be a strong focus on accommodating a majority of future population growth through urban consolidation within the Existing Urban Area (Figure 2 below). According to *ShapingSEQ*, to accommodate the forecast growth for the Sunshine Coast, 62 per cent of new dwellings should be delivered through urban consolidation[2]. According to *ShapingSEQ*, this translates to an estimated 53,700 new dwellings to be located within the existing urban area of the region over the 25 years between 2016 and 2041[3].

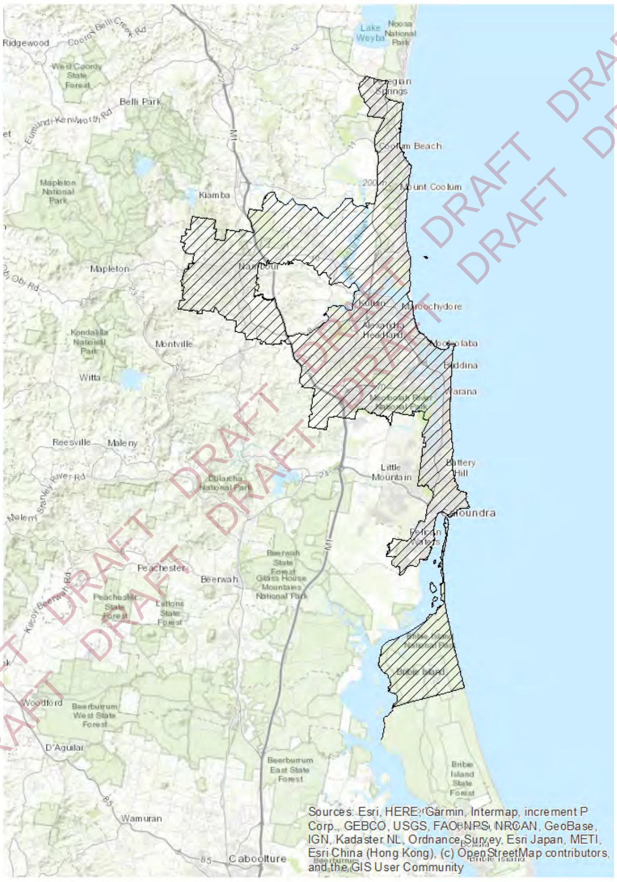

Figure 2 – Existing Urban Areas

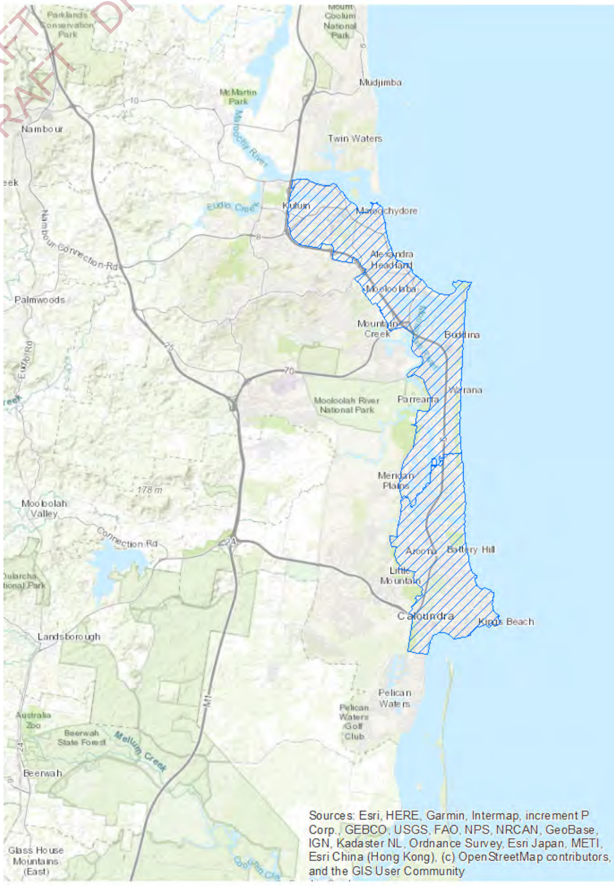

Figure 3 – Sunshine Coast Urban Corridor

[2] Queensland Government (2017). *ShapingSEQ*, p120
[3] Queensland Government (2017). *ShapingSEQ*, p120

Sunshine Coast Urban Corridor

Consistent with *ShapingSEQ*, Council's policy objective is to progress a comprehensive agenda to accommodate the majority of forecast population growth through urban consolidation within the existing urban area. The greatest opportunity to achieve sustainable urban consolidation occurs within the 24-kilometre urban coastal corridor between Maroochydore and Caloundra, known as the Sunshine Coast Urban Corridor (Figure 3 above). Consistent with relevant Queensland Government and Council policies and plans, the Sunshine Coast Urban Corridor can enable more sustainable and affordable housing choices, closer to major employment and recreational centres. This consolidation of travel demand can in turn support more effective public and active transport services, creating a self-reinforcing circle whereby public transport services can be further improved to attract more patrons.

Consolidating a greater proportion of dwellling and employment growth within the Sunshine Coast Urban Corridor will:

- Ensure a more cost-effective and sustainable solution to transport infrastructure provision
- Catalyse the opportunity to support substantial and appropriate economic growth
- Increase the value of any suitable land for urban purposes along the SCMT corridor so more people can live close to public transport
- Enable greater and more affordable access to the lifestyle advantages offered closer to the coastline.

The need for action

Confirming and articulating the problems and opportunities faced by the Sunshine Coast Region is critical to understanding the need for action. Developing a sound understanding of the extent, scale, cause and effect of the service needs provides a strong basis for developing intervention options, and ultimately investing in a preferred Project solution.

The problems to be addressed by the SCMT Project are outlined in Figure 4. These have been updated from the SBC as per Building Queensland's recommended approach to business case development.

Responding to these problems can deliver a range of regional benefits that may only be achieved through an integrated approach to land use planning and economic and community development, undertaken in conjunction with the delivery of an efficient transport network.

Figure 4 – Service needs of the Project

Problem 1 – An accelerating trend towards urban expansion

The Sunshine Coast has experienced significant increases in urban expansion which is impacting the region's ability to sustainably accommodate population growth. As illustrated in Figure 5, this will require an increase of at least 87,000 dwellings from 2016 to 2041[4]. Recent projections by the Queensland Government suggest this number will be 92,000.

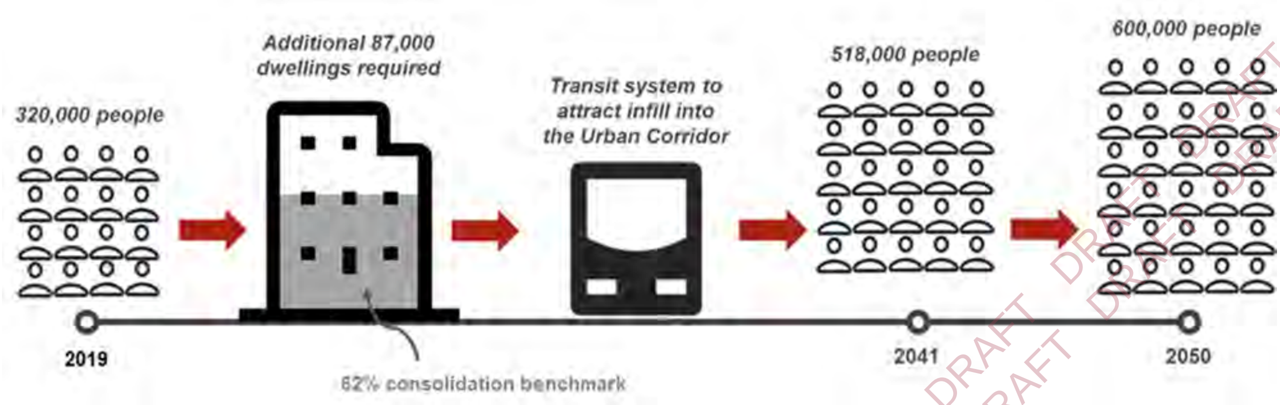

Figure 5 – Population growth and urban consolidation benchmarks

At least an additional 53,700 consolidation dwellings are required within the region by 2041 to achieve the *ShapingSEQ* consolidation benchmark of 62 per cent. This equates to approximately 2,240 additional dwellings in the existing urban area each year from 2017 to 2041.

Based on current trends, it is estimated only about 40 per cent of the required 53,700 dwellings will be taken up without intervention to provide infrastructure and review the land use planning arrangements for the Sunshine Coast Urban Corridor to encourage and support further urban consolidation. Without intervention, the *ShapingSEQ* benchmarks are unlikely to be achieved and the increased demand for housing will most likely need to be met by further greenfield developments (urban expansion), thereby failing to support a sustainable approach to transport and urban development.

Without the unlocking and servicing of areas suited to providing a range of housing choices within the existing urban areas, including the Sunshine Coast Urban Corridor, the process of urban expansion will continue to accelerate. This acceleration will result in the following undesirable outcomes:

- *Non-urban land consumption* –increasing development pressure will lead to less non-urban land being available for productive uses such as agriculture, recreational and environmental uses.
- *Infrastructure connection costs* – particularly with respect to transport and utilities infrastructure, but also in terms of social infrastructure service provision. The Property Council of Australia suggests greenfield development increases infrastructure costs by $95,000 per dwelling over urban consolidation dwellings. This equates to an extra cost to the community of almost $95 million for every 1,000 additional greenfield houses built[5].
- *Transport congestion and environmental costs* – as urban expansion residents are typically remote from jobs and services, resultant lengthy commute times and distances cause significant economic, social and environmental costs.
- *Labour force productivity costs* – as agglomeration economies and human capital benefits are impeded by spatial dislocation and congestion.
- *Reduced housing choice* – as constrained urban consolidation housing options fail to match the market requirement for quality owner-occupied housing, prospective residents are forced to choose housing in new expansion areas remote from coastal employment and attractions.

[4] Queensland Government (2017). *ShapingSEQ*, p120

[5] Property Council of Australia (2016). *Infill Projects could save Perth billions.* Accessed at: https://www.propertycouncil.com.au/Web/News/Articles/News_listing/Web/Content/News/National/2016/Infill_could_save_Perth_billions.aspx

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Problem 2 – High dependency on private car transport

The region's transport system is heavily dependent on car use. In the 2016 census, 68 per cent of working residents in the region drove themselves to work and a further 25 per cent were passengers in a car, while less than four per cent of journeys to work were taken on public transport[6]. The remaining trips (mode share of approximately three per cent) were via active transport (i.e. walking, cycling etc.)[7].

The region's current public transport network is mostly focussed on providing a safety net for those who are unable to access car transport. There is only one bus route (the 600 route) between Caloundra and Maroochydore that meets TransLink's "turn-up-and-go" patronage attracting frequency (with headways of 15 minutes in peak periods). The network includes several services with headways exceeding one hour and some which do not operate on weekends. TransLink also faces the challenge of providing timely public transport services to emerging communities in urban expansion areas, where demand is typically very low[8].

Lack of effective public transport will continue to exacerbate car dependency. Dispersed urban settlements and inadequate public transport service levels within the region will also reinforce the region's car dependency which will result in increased congestion and demands for new roads.

Problem 3 – Growing levels of road congestion

The Sunshine Coast's growing population and economic development will inevitably translate to increasing travel demand.

Congestion in the region's coastal precincts has the potential to constrain employment growth, hamper productivity improvements, adversely impact lifestyle and amenity and constrain the process of urban consolidation.

Traffic congestion in key tourism locations on the Sunshine Coast is already exacerbated by day trippers and overnight visitors during peak holiday seasons. As an popular tourist destination, the region needs to cater for significant volumes of visitor travel. In 2018/19, visitors to the Sunshine Coast Region comprised:

- 1.7 million international visitor nights
- 7.7 million domestic visitor nights
- 4.3 million day visits[9].

Congestion is forecast to increase significantly by 2041 as an increasing number of residents and tourists compete for road space particularly in Caloundra, Kawana, Mooloolaba and Maroochydore. The recent expansion of the Sunshine Coast Airport, along with development of the region's major tourist attractions add to the accessibility and visitor appeal of the region. While major gateways such as the Sunshine Coast Airport and the Bruce Highway facilitate access to the region, once they arrive visitors need reliable access to key local destinations and services. A region heavily congested with vehicle traffic will detract from its popularity as a tourism destination, resulting in adverse economic impacts.

As the region grows, demand on the road network will continue to rise and, without intervention, there is a risk that congestion will progressively become unmanageable and impact the qualities that attract residents and visitors to the region.

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[6] Integrated Transport Strategy, 2018, Sunshine Coast Council, p24
[7] Integrated Transport Strategy, 2018, Sunshine Coast Council, p22
[8] Integrated Transport Strategy, 2018, Sunshine Coast Council, p22
[9] Economy.id (2019). Sunshine Coast Council economic profile. Accessed at: https://economy.id.com.au/sunshine-coast/tourism-visitor-summary

Problem 4 – Liveability and environmental sustainability challenges

Increased levels of urban expansion and reduced levels of employment self-containment will lead to an increase in long distance commuting and its associated economic, social and environmental impacts. Council's vision is to be *'Australia's most sustainable region: Healthy. Smart. Creative'* which includes protecting liveability and the natural environment.

The region's industry base is expanding and becoming more diverse, with approximately 31,000 local businesses providing over 149,000 jobs, and more than 23,000 jobs created in the past five years in high-value industries. The need to pursue the development and growth of high-value industries to maintain high levels of employment self-containment is critical.

The Sunshine Coast Urban Corridor already has high levels of employment self-containment. Over 50 per cent of Maroochydore residents work within the Maroochydore region, with a further 17 per cent travelling to Kawana for work, and 21 per cent travelling to other areas within the Sunshine Coast Region. However, connectivity between key employment, tourism and health centres via public transport is limited. Transport connectivity is important to attracting new businesses and employees as easy access to employment via efficient transport options will improve the attractiveness of the Sunshine Coast as a place to live and work.

The trend towards urban expansion is impacting the natural environment as additional land is required to support dwelling growth. Urban expansion also results in an overall increase in the number of vehicle kilometres travelled on the transport network.

If Council is to achieve its objective to be Australia's most sustainable region, there is a need to reverse the current trend towards urban expansion. Growth oriented towards urban consolidation is likely to result in lower use of cars and a shift to public and active transport. This will reduce the air pollution and greenhouse gas emissions associated with an increase in car use. Additionally, increased urban consolidation reduces the pressure on the natural environment as there is a reduction in the amount of rural, natural and landscape areas being converted to urban purposes.

Cost and risks of not responding to the problems

The urgency for a mass transit system within the Sunshine Coast Region, in particular the Sunshine Coast Urban Corridor, is driven by the current and forecast transport and land use problems within the region.

During the SBC stage of the Project, transport and economic modelling were undertaken to quantify and monetise identified problems. It was estimated congestion along key arterial routes within the region currently costs over $500 million per annum. This is forecast to grow and cost the regional economy $3 billion per annum (nominal cost) by 2041.

Without intervention, the annual cost of congestion in the Sunshine Coast Urban Corridor could almost treble by 2041. The cost of congestion is:

- $350 million per annum for the Sunshine Coast Urban Corridor from Maroochydore to Caloundra, rising to $2.2 billion in 2041 (nominal cost)
- $160 million per annum for the Sunshine Coast Urban Corridor from Maroochydore to the Sunshine Coast University Hospital (SCUH) precinct, rising to $1 billion in 2041 (nominal cost).

Without intervention to support higher levels of urban containment, economic, social and environmental impacts will increase significantly over the next 20 years to 2041.

Service needs to address the four key problems

The service needs for the Project options analysis stage are identified as:

1. Transform suitable parts of existing urban areas into lifestyle communities, clustered around mass transit and closer to jobs and attractions.
2. Develop an efficient mass transit system connecting population and employment centres that is accessible and offers a viable alternative to using cars.
3. Move more people in less vehicles through efficient mass transit that is easily accessed by active transport.
4. Maintain and enhance the sustainability, liveability and environmental quality of the region as it continues to experience rapid growth. This will be achieved by reducing urban expansion, the amount of energy used to complete journeys and emissions released by transport in the region.

Responding to the problems

Transport systems shape cities, build economies, and help determine lifestyles. There is an indivisible link between the type of transport system provided and the form of urban development it can serve:

- Car-based communities tend to be set out on a large scale and are necessarily remote from attractions and jobs in other parts of the region. Public transport to these areas, if provided, will be limited to a basic level of level of service that spreads its scarce resources over a larger area.
- Communities that rely more on public transport and active transport are necessarily compact, allowing public transport resources to provide a good level of service to a concentrated passenger market.

At the highest level, the choices faced by the region as it grows, are simple:

1. Continue a business-as-usual approach, providing a major urban freeway network and increased car parking to match urban expansion and growth in demand for private vehicle travel; or
2. Adopt a strategy that can limit the expansion of car-based urban expansion and concentrate people and jobs around a significantly improved public and active transport system.

All the planning and strategy development undertaken over the past decade by Sunshine Coast Council and the Queensland Government has determined the second choice is the only viable approach.

Adopting a business-as-usual approach will constrain the region to a future where roads, car parking and traffic dominate the urban landscape, and where those who cannot access private motor transport experience considerable disadvantage. This alternative will see many existing urban areas become places catering more for cars and less for people, with their amenity and attractiveness irreparably compromised.

At the centre of the response to the problems identified in this Options Analysis is the delivery of an integrated public transport system across the region. This includes a mass transit system to carry people on the most important movement corridors.

Any public transport solution for the Sunshine Coast Region will need to be delivered by the Queensland Government and funded primarily by the Queensland and Australian Governments. However, Council has undertaken the initial planning and business case work recognising the need to advocate for the sustainable future of the region.

As part of this Options Analysis, a master plan for an integrated public transport system serving the entire region and connecting it to the rest of SEQ has been developed. This is shown in Figure 6. This plan is consistent with the Sunshine Coast Integrated Transport Strategy, *ShapingSEQ* and the Queensland Government's North Coast Regional Transport Plan. It includes improvements to the bus network and Park 'n' Ride facilities, linking the less densely populated parts of the region to the mass transit system.

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Figure 6 – Optimised mass transit master plan for the Sunshine Coast

A regional mass transit system has to be delivered in stages. The Options Analysis has confirmed the findings of the SBC based on the need to service the largest travel markets first, and to arrest the rapid growth of urban expansion by supporting the urban consolidation policies already endorsed in existing planning strategies. This staging plan is shown in Figure 7.

The first stage of the public transport solution will be a local mass transit system in the northern part of the Sunshine Coast Urban Corridor, extending 13.6 kilometres from Maroochydore to the SCUH at Birtinya town centre. Future stages include expansion of this local mass transit system to Caloundra and linking it to the regional public transport system at Beerwah.

However full seamless integration with the development of a mass transit system (most likely regional rail) in the Caboolture and Maroochydore Corridor Options Study (CAMCOS) corridor to Beerwah, connecting the region to the rest of SEQ is vital. The Department of Transport Main Roads (TMR) will investigate this as part of the implementation of its North Coast Regional Transport Plan. Nothing in this Options Analysis should be construed to imply a project to connect to the North Coast Rail Line at Beerwah is not required, and it should remain a very high priority in the region's transport investment program.

Figure 7 – Geographic breakdown and focus areas for a SCMT solution

Options development

Options for Priority Area 1 in the Sunshine Coast Urban Corridor from Maroochydore to the SCUH were developed though previous inputs (such as the SBC) and recent stakeholder views and emerging trends.

To achieve the objective of changing travel behaviour and attracting passengers out of cars, public transport options needed to be reliable and efficient, and not be delayed in congestion with other general traffic.

A primary element affecting this is the Right-of-Way (ROW) enjoyed by the public transport services. Industry standard terminology for the varying levels of ROW are:

- Category A – the best standard, with full separation from other traffic both horizontally and vertically. The vehicles usually only need to stop to serve passengers, are not affected by congestion and can offer a reliable and efficient travel time.
- Category B – a good standard. Separated from all other traffic horizontally but intersecting at-grade with cross traffic. If there are not too many vehicles using the ROW, traffic signal phasing to suit the vehicle can be advanced and the vehicle also proceeds smoothly through intersections. The service is reliable and travel time competitive with driving.
- Category C – the lowest standard. The vehicle generally only runs at the same speed as other traffic, and because it needs to stop to serve passengers, it will be uncompetitive with private car travel. Bus

lanes, though offering some priority, must carry other traffic and for variety of reasons, are regarded as Category C standard.

No Category A option was considered viable in the SCMT corridor as it would result in an elevated structure which would significantly diminish the visual amenity of the area. An underground sub-way option would be prohibitively expensive and is not suited to a regional location.

The development of feasible options for the Options Analysis was undertaken by the Project Team, considering the technologies and initiatives that could feasibly be delivered to realise the benefits sought from the Project, with a focus on the identified Sunshine Coast Urban Corridor. The options considered in the Options Analysis options assessment were:

- Region-wide bus service enhancements (no infrastructure)
- Region-wide bus network upgrades (with targeted bus infrastructure improvements)
- Road network upgrades in the Sunshine Coast Urban Corridor
- QBC – articulated bus (targeting zero emissions technology)[10] in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor
- BRT (BRT, bronze standard[11]), double-articulated bus, wireless with on-board stored energy in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor
- LRT with overhead power in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor.
- wLRT, wireless with stored on-board stored energy in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor
- TT, wireless with on-board stored energy in Priority Area 1.

These options reflect a range of transit solutions, technology options and levels of capital investment to understand the incremental benefit that could be realised from various levels of intervention to improve mass transit increasing level of investment and intervention in the Sunshine Coast Urban Corridor.

Options assessment

The longlist of options for mass transit in Priority Area 1 of the Sunshine Coast Urban Corridor from Maroochydore to the SCUH where assessed to determine a shortlist of Reference Projects to carry through the economic, social, environmental and financial assessments. To assess the ability of the longlist of options to provide quality public transport, a qualitative assessment was made based on distinguishing between each options' ability to attract passengers out of cars and maintain efficient operations.

The attributes evaluated for each option were:

- Legibility of the system to users
- Reliability of service and the total travel time
- Ride quality
- Minimising travel time with reliable running times
- Minimising lost time (layover) time between services
- Ensuring the vehicles have sufficient peak passenger capacity.

The results of the qualitative assessment of quality public transport attributes are shown in Table 1 below.

[10] If these are available to operate commercially at the commencement of the project operating stage
[11] Categorised by its design features as per the Institute for Transportation and Development Policy - BRT Standard.

Table 1 – Qualitative MCA comparison of options against certain attributes of quality public transport

Attribute	Region-wide bus upgrade Category C	Region-wide bus upgrade + infrastructure Category C	Road network upgrade Category C	Quality Bus Corridor (QBC) Category C	Bus Rapid Transit (BRT) Category B	LRT Category B	wLRT Category B	Trackless tram (TT) Category B
Legibility of the system to users	3	4	3	7	10	10	10	10
Reliability of service and the total travel time	3	4	3	7	9	10	10	9
Ride quality	3	3	3	3	8	10	10	9
Minimising travel time with reliable, running times	3	4	3	6	9	10	10	9
Minimising lost time (layover) between services	3	3	2	9	7	10	7	7
Ensuring the vehicles have sufficient peak passenger capacity	5	5	4	6	7	10	10	8

To provide a quantitative assessment, eight options for local mass transit in Stage 1 were assessed against a range of criteria chosen to link directly to the service need requirements and Project objectives developed in the SBC. Scoring was undertaken based on the quantified performance of each option, using outputs from the transport model, first principles cost estimates and expert assessments of urban change. Scores are shown in Table 2.

Table 2 – Results of weighted scoring under the quantified MCA

Criteria	Bus service Category C	Bus network Category C	Road network Category C	QBC Category C	TT Category B	BRT Category B	wLRT Category B	LRT Category B
Transport outcomes	7.2	7.5	5.4	8.4	9.6	9.6	9.7	9.9
Land use outcomes	0.0	0.2	0.0	0.5	5.6	5.6	10.0	10.0
Sustainability	3.3	3.8	0.0	5.0	9.9	9.9	10.0	10.0
Cost	8.1	6.3	10.0	4.6	2.0	2.0	1.8	1.8
Progress to next stage	**no**	**no**	**no**	**yes**	**yes**	**yes**	**yes**	**yes**

TT, BRT, wLRT and LRT all realise similar transport and sustainability outcomes. However, based on empirical evidence, wLRT and LRT promote stronger land use outcomes in terms of take-up compared to all other options. However, this needs to be investigated further during the DBC as recent literature suggests BRT/TT options could also trigger stronger land use responses[12]. After the Category B mass transit options (TT, BRT, wLRT and LRT) the QBC option was the next highest scoring option due to its relatively strong transport and sustainability outcomes. However, it has very limited potential to influence land use outcomes.

[12] Transport and Infrastructure Council | Australian Transport Assessment and Planning Guidelines (ATAP). 2021. Draft BRT and LRT Assessment and Cost-benefit Analysis. Public Consultation Draft

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Combining outcomes of both the qualitative and quantitative MCAs, the options shortlisted and recommended for progression to economic analysis and more detailed assessment through development of a cost benefit analysis (CBA) are:

- BRT – wireless with on-board stored energy
- TT – wireless with on-board stored energy
- LRT – overhead reticulated power
- wLRT – wireless with on-board stored energy
- QBC – articulated bus (targeting zero emissions technology).

Demographic scenarios used in the Options Analysis

Quantified assessments of shortlisted options were undertaken as part of this Options Analysis. A strategic transport model was developed to provide a large range of parameters relating to transport costs and benefits. These transport modelling outputs will be utilised in the business case assessment process including the development of detailed economic benefit-cost ratios (BCRs).

To achieve the necessary rigour, the transport model runs a series of "cases", constructed from both demographic and transport system scenarios.

The demographic scenarios used two approaches that enable a comparison of all options:

1. Official Queensland Government projections relating to urban settlement patterns and the location of employment (i.e. the demographics and city form are fixed by previous analysis outside of the mass transit business case process); and
2. Testing the effects of a strategic transport investment in relation to land use change (i.e. the demographics and city form are free to vary depending on the transport accessibility of the land in the catchment of the infrastructure).

The first approach utilised the population projections for the Sunshine Coast produced by the QGSO in 2018.

The second approach, produced two theoretical Intervention land use scenarios to test the effect of mass transit investment on land use outcomes:

3. An LRT scenario (noting that wLRT is also aligned to this scenario)
4. A BRT scenario (noting that TT is also aligned to this scenario).

These theoretical Intervention scenarios relied on an evidence-based assessment of the potential for land use change based on increased take up of dwelling and employment opportunities in the SCMT corridor. However, these theoretical scenarios do not constitute town planning proposals and will require further consideration and community engagement in the future if the Project proceeds.

The Intervention scenarios were compared to a No-Intervention (trend) land use scenario based on a likely settlement pattern without providing mass transit to support land use change and urban consolidation.

Reference Projects

The route for Stage 1 of the Project is from Maroochydore central business district (CBD) to SCUH. The LRT, wLRT, TT and BRT Projects adopted a separate ROW for the mass transit and are closely aligned in terms of route, alignment and service type. The QBC Reference Project generally adopted the same route but a lower level of infrastructure investment based primarily on kerbside bus lanes.

The Stage 1 mass transit system is proposed to be supported by region-wide upgrades of the bus network. A Park 'n' Ride facility with up to 1,000 spaces and a bus transfer facility is also proposed to be located adjacent to the Bundilla Station, intersecting with the Sunshine Motorway. It is assumed by 2041, parking charges will be applied in Maroochydore and Mooloolaba and based on current charges, applied in Caloundra and Birtinya, escalated for inflation.

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Reference Project – QBC

This option involves the development of a high-quality bus corridor and service, including a significant level of capital investment and corridor level treatments focused on increasing public transport priority and attracting passengers out of cars. The key features of this option include:

- Branded buses – approximately 20 higher specification branded vehicles, articulated or double decker buses 12 to 18 metres long
- Kerbside bus lanes, as determined by TMR through its CoastConnect project finalised in 2011. As per CoastConnect, the QBC bus lanes will be limited mostly to Nicklin Way, Main Drive and Lake Kawana Boulevard. Buses will operate mostly in mixed traffic for the remainder of the route.
- High frequency bus services with frequency of eight services per hour and headways of 7.5 minutes
- Quality bus stops, all with shelters, along the corridor
- Park 'n' Ride at and bus transfer at Bundilla
- Increase in bus kilometres and enhanced network connectivity
- It is assumed that by 2041 parking charges will be applied in Maroochydore and Mooloolaba and based on current charges, applied in Caloundra and Birtinya, escalated for inflation.

The bus network upgrades supporting the QBC are proposed to be amended to allow for buses emanating from outside of the local mass transit catchment to operate in the bus lanes and carry passengers to the major centres, thereby reducing the need for transfers from the local buses to the QBC spine services.

Reference Project - TT

A trackless tram is an emerging technology solution that is a rubber tyred vehicle, longer than a bus and that may provide a smoother ride. As with all mass transit technologies, TT could, in the future, be autonomously guided via measures including optical video, magnetic beacons or radio service guidance system.

The best-known form of TT is the Autonomous Rapid Transit[13] which is currently operating on a 17 kilometre line that has recently been opened for revenue service in Yibin in the south-eastern part of Sichuan province, China. These are fully electric and rely totally on energy stored on board through batteries.

The TT option evaluated here reflects the Yibin vehicle, running on a busway with a high specification major infrastructure intervention.

Features of the design include:

- Identical alignment to the LRT, wLRT and BRT alignment across the corridor with aligned station locations and function
- 14 modern battery electric TT vehicles, each being 32 metres long

Reference Project – BRT

The Reference Project – BRT was designed to create a permanent dedicated high-quality public transport spine in the corridor. The solution includes high-quality, rubber-tyred vehicles and formal stations. It resembles a LRT system in terms of priority, legibility and accessibility. The BRT option is made up mostly of a dedicated ROW centre-running corridor with a width varying from 8.2 metres to 11.2 metres. The solution includes high-quality vehicles and stations with features to qualify as a 'Bronze BRT', as described by the international Bus Rapid Transit Standard. The 'Bronze BRT' provides a broadly equivalent service level standard as LRT, with dedicated running and signal priority. Higher standards (i.e. Gold and Silver) generally aim to allow BRT to compete with very high-capacity passenger transport modes like metro rail. Adopting a Gold or Silver standard BRT will add significant costs which were assessed by technical experts to unfairly penalise the BRT option, when compared to LRT.

The BRT ROW will be made up of multi-layered pavement running way, concrete stations and approaches. The 16 BRT station locations and functions are similar to the LRT option, with tap-on at platform facilities. Unlike the LRT, all stations for the BRT are side platforms due to available BRT vehicles only having doors

[13] The ART is a proprietary product of the Chinese rail company CRRC. It is understood to offer a smoother ride than a conventional bus due to the application of air ride suspension and an axle configuration that mimics rail bogies.

on one side of the vehicle. The BRT vehicle itself will be an electric vehicle, similar to the proposed Brisbane Metro bi-articulated vehicles which measure 24.5 metres long and can carry between 130 and 150 passengers in normal revenue service.

Figure 8 depicts an impression of vehicles and a station under the BRT Reference Project.

Figure 8 – BRT impression

From an operational perspective, the BRT service frequency has been assumed to be identical to LRT at eight services per hour during the day.

Standard route buses will not use the mass transit busway. The system will use its own special modern, extra-long, electrically powered vehicles running at headways as low as 7.5 minutes. Bus passengers will easily be able to transfer to the BRT vehicles at key locations through a direct, cross platform arrangement. There will be no fare penalty for transferring, and with low headways the wait time will be minimal.

Reference Project – LRT

The LRT Reference Project was designed having regard to the Gold Coast, Newcastle and Canberra light rail systems. The scope of the LRT Reference Project includes the provision of high-quality vehicles, stations and light rail trackage provided through an embedded railway track. There is a dedicated ROW based on a minimum corridor width of eight metres, mostly in the centre of existing roads. The system includes 16 stations, 11 of which have a single island platform and the remaining five having two side platforms. As with most other LRT systems, the LRT Reference Project is assumed to utilise electric traction power delivered through overhead line equipment. Some LRT systems, including Newcastle in New South Wales, utilise battery powered trams with flash-charging at stations, and this may prove to be an economic proposition for the Sunshine Coast in the future. The LRT and its technical assumptions will be reviewed and refined in subsequent stages of the Project.

From an operational perspective, the LRT service frequency was assumed as eight services per hour at 7.5-minute headways and a 30-minute journey time for Stage 1. All LRT vehicles will be given a level of priority at traffic signals to enable quicker journey times[14]. The LRT expected capacity is 80 seated and 220 standing for a total capacity of 300.

Standard route buses will not use the LRT ROW however bus passengers will easily be able to transfer to the LRT vehicles at key locations through a direct, cross platform arrangement. There will be no fare penalty for transferring, and with low headways, the wait time will be minimal.

[14] Based on precedent project experience with the GCLR which operates in a similar right-of-way, with signals also managed by TMR's STREAMS signal management system.

Figure 9 depicts an impression of vehicles and a station on Nicklin Way under the LRT Reference Project.

Figure 9 – LRT impression – Nicklin Way

Reference Project – wLRT

The most common LRT systems around the world use reticulated electricity delivered through 750 v DC overhead power lines.

With the improvement of battery technology, a number of LRT systems are relying on use of batteries for on-board stored energy rather than having overhead power lines. The batteries are flash-charged through overhead pantographs at stations and at the end of each run, and deep-charged at depots overnight. This option was evaluated as “wLRT”. It addresses concerns associated with the visual amenity of the overhead wires, and may prove feasible in the case of a Sunshine Coast system. The Project team liaised with Canberra and Newcastle light rail counterparts to understand the cost and effectiveness of wireless technology as an on-board stored energy solution.

Variants using hydrogen fuel cells to power LRT are also being tested overseas. As with all hydrogen powered technology, an issue to be overcome is the availability of “green” hydrogen, produced without burning fossil fuels. Hydrogen fuel cell for all vehicles, including LRT, may become feasible for future stages of the Project.

Transport outcomes

The strategic transport assessment is built on the Project’s service needs to identify five strategic transport drivers to assess the transport outcomes of the shortlisted mass transit options (LRT, wLRT, BRT, TT and QBC). The strategic transport drivers are:

1. Improved passenger transport options that increase public transport patronage
2. Increased accessibility to key destinations by public transport
3. A transport system that increases access to employment by public transport and facilitates journey to work self-containment
4. A mass transit system that reduces reliance on cars and reduces transport costs for users
5. Increased residential and employment densities within centres, and adjacent to high-frequency public transport routes.

As detailed in Figure 10, the 2041 forecasts indicate that over 60,000 boardings per day are made by the Category B options within the Sunshine Coast local Government area (LGA). In comparison, the QBC option sees only marginal increases in the total number of trips made each day on the Sunshine Coast, despite the redesign of the supporting bus network to make best use of the bus priority infrastructure and reducing the need to transfer between services.

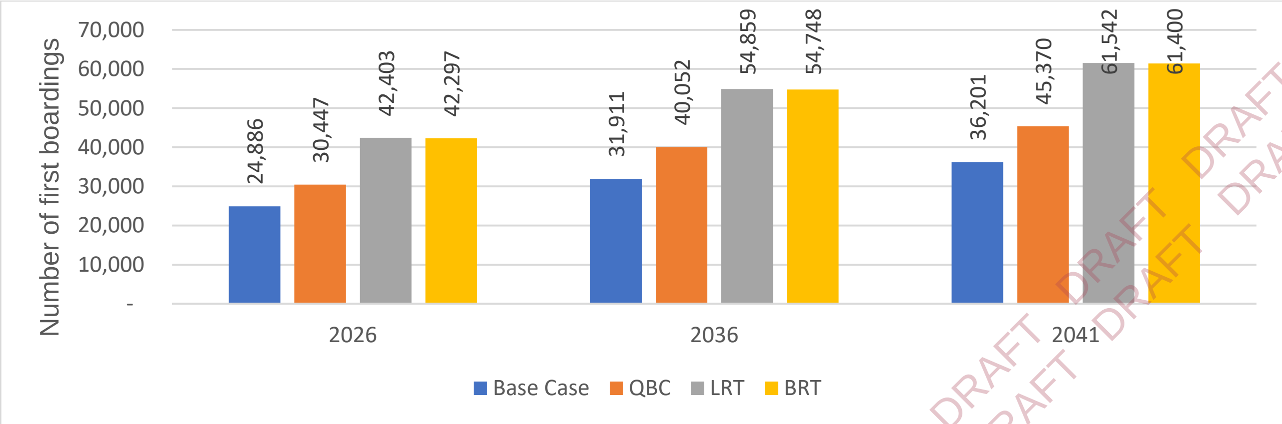

Figure 10 – Number of daily public transport trips from origins within the Sunshine Coast LGA; Base Case vs Category B Mass Transit[15] vs QBC

As shown in Figure 11, the Category B Mass Transit project options (LRT and BRT) result in a higher public transport mode share for all trips within the Sunshine Coast LGA when compared to the QBC option. Both the LRT and BRT options show up to 2.32 per cent public transport mode share in 2041, compared to 1.18 per cent under the Base Case. This represents a doubling of public transport mode share to approximately 49,000 trips per day under the Category B Mass Transit scenario compared to approximately 25,000 trips under the Base Case, with approximately 15,000 fewer car trips. Public transport mode share in the QBC option shows only a slight increase, reaching just 1.57 per cent in 2041.

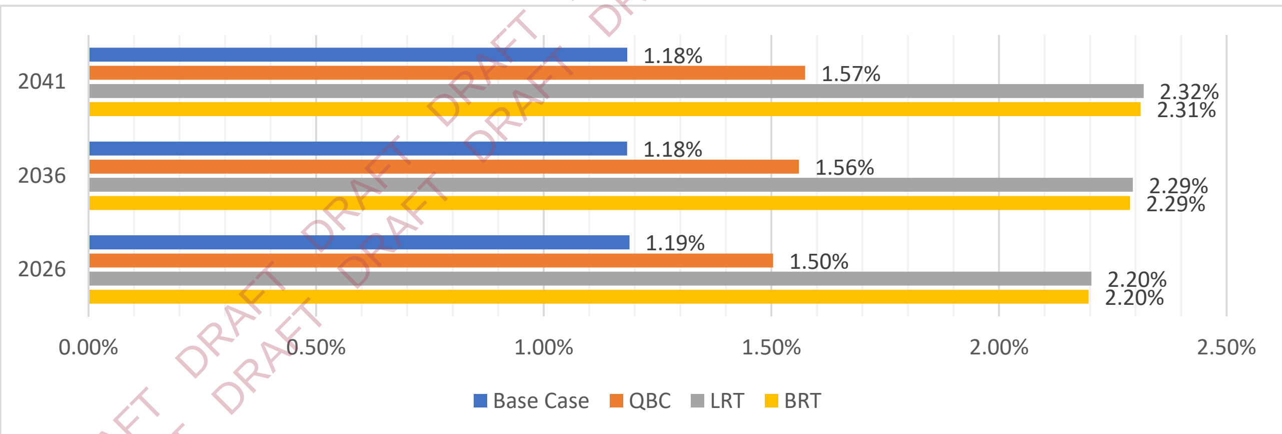

Figure 11 – Public transport mode share for all trips within the Sunshine Coast LGA

Preliminary financial analysis

A financial model was developed to determine the construction, mobilisation and operating period costs and present cash flows to the end of the analysis period for each option. Revenue has been used to offset operating costs to present the net cash flows. This approach reflects a typical discounted cash flow analysis methodology for the assessment of infrastructure projects.

Construction and operating costs and a comparison of the whole of life costs for all options are shown in Table 3 and Table 4.

Table 3 – P50 risk adjusted capital costs for the shortlisted options

[15] Modelled as LRT and BRT only. Trackless Tram is assumed to be the same as BRT in this strategic analysis

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Construction costs	QBC ($000)	TT ($000)	BRT ($000)	wLRT ($000)	LRT ($000)
Nominal $'000	493,070	1,540,454	1,524,808	1,783,806	1,816,668
Present value $'000	426,701	1,343,899	1,331,623	1,546,795	1,574,456

Table 4 – Comparison of the Net Present Value (NPV) of all options

	NPV ($000)				
Cost item	**QBC**	**TT**	**BRT**	**wLRT**	**LRT**
Construction Costs ($000)	(426,701)	(1,343,899)	(1,331,623)	(1,546,795)	(1,574,456)
Operating Costs ($000)	(700,361)	(1,578,139)	(1,578,139)	(1,634,013)	(1,634,013)
Farebox Revenue ($000)	245,639	529,939	529,939	539,027	539,027
Net Project Value ($000)	**(881,423)**	**(2,392,098)**	**(2,379,823)**	**(2,641,781)**	**(2,669,441)**

This preliminary financial assessment analysed the capital and operating expenditure required and revenue acquired for the five Reference Projects – QBC, TT, BRT, wLRT and LRT. All five Reference Projects will require significant funding during the delivery stage to accommodate the infrastructure development required. The LRT option, as the most capital intensive, requires the highest investment during project delivery and the operational stage. As with all public transport projects, none of the options generate sufficient farebox revenue during the appraisal period to recover capital or operating costs. A further detailed cost estimate will be required for the preferred Reference Project(s) during the Detailed Business Case stage.

Preliminary economic benefits

The economic analysis uses a CBA framework that applies a discounted cashflow technique to the benefits and costs of the Project. The economic appraisal framework for the Project assessed a broad range of benefits the Project will generate through influencing land use change, employment outcomes and travel behaviour in the Sunshine Coast Region. To quantify these impacts, the appraisal quantified three broad categories of benefits, as summarised in Figure 12.

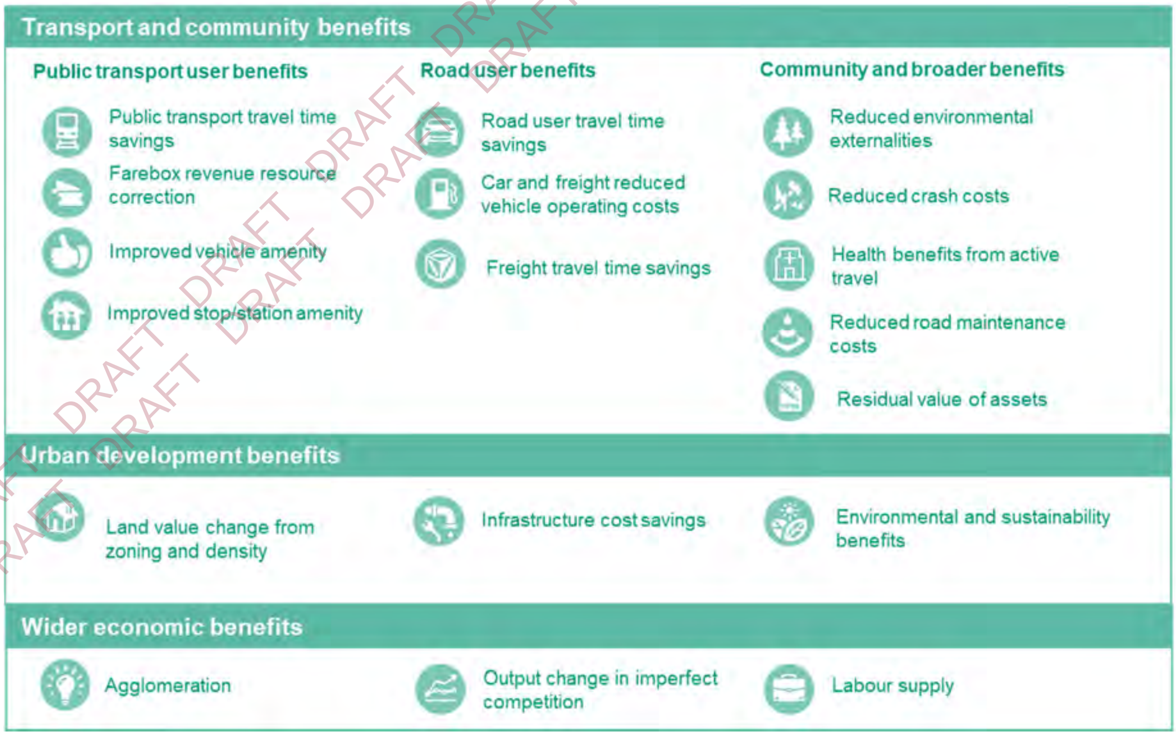

Figure 12 – Benefits appraised in the SCMT Options Analysis

Reflecting that mass transit in this corridor offers the potential to not only improve accessibility, amenity, environmental and safety outcomes but also offers a high-capacity solution to support land use change, the economic appraisal framework can be developed to assess two rounds of benefits:

- The first round (benefits without land use change) isolates the transport and wider economic benefits of the Project that are independent of land use change.
- The second round (benefits with land use change) assesses the benefits of the Project inclusive of land use changes that reflect the effects of realising land use outcomes and increased economic activity.

A number of demographic scenarios for 2026, 2036 and 2041 were applied in the economic assessment to test the potential urban change benefits of the investment in a major mass transit project. These demographic scenarios establish how projected population and employment growth may vary depending on the type of intervention being tested. These each comprise:

- a “no intervention” (trend) demographic scenario (without-Project)
- an “intervention” demographic scenario (with-Project)

This split between demographic scenarios occurring without and with the Project allowed the testing of both first and second round benefits. The results of the economic assessment using both first and second round benefits are summarised in Table 5.

Table 5 – Summary of economic assessments of shortlisted options

Appraisal outcomes	LRT	wLRT	BRT	TT	QBC
BCR (No land use change)	0.4	0.4	0.4	0.4	0.7
BCR (With land use change)	1.2	1.2	0.7	0.7	0.7
BCR (With land use change considering further consideration of BRT/TT effects)	1-1.2	1-1.2	0.7-0.9	0.7-0.9	0.7

The economic analysis suggested that:

- Investment in mass transit in the Sunshine Coast offers the potential to generate improved transport and amenity outcomes for public transport users, as well as reduced road congestion
- LRT/wLRT has the greatest potential to support land use change given the take-up it supports. Depending on the level of land use change that occurs, it could realise the highest BCR. However, BRT/TT appear able to achieve higher economic outcomes on the basis that they offer a similar level of transport quality and capacity. This should be the subject to further consideration in the Detailed Business Case.

Based on these results, it is considered that there is sufficient justification for further consideration of mass transit to deliver increased public transport mode share together with improved land use outcomes on the Sunshine Coast, and to achieve the Council’s and Queensland Government’s strategic objectives and maintain the lifestyle and amenity attraction of the Sunshine Coast.

As identified in the land use analysis, there is a current lack of clear evidence as to the potential ability of BRT/TT to increase land use take-up. This is reflected in the economic analysis which reveals a lower BCR for the BRT/TT options relative to LRT. Additionally, all the Category B mass transit options (LRT, wLRT, BRT and TT) have low first round BCRs based on their current specification. Through the economic analysis a number of further areas of exploration have been identified.

Key findings

Need for the Project

- The Sunshine Coast Region's population is projected to continue to grow strongly, reaching 518,000 in 2041. This means there will inevitably be the need for the provision of major new public infrastructure, including new transport facilities.
- Without intervention, population growth and increasing congestion will continue to put pressure on housing, transport, lifestyle, employment, social infrastructure, and the environment.
- At the highest level, the choices faced by the region as it grows, are simple:
  - Continue a business-as-usual approach, providing a major urban freeway network and increased car parking to match urban expansion and growth in demand for private vehicle travel; or
  - Adopt a strategy that can limit the expansion of car-based urban expansion and concentrate people and jobs around a significantly improved public and active transport system.
- All the planning and strategy development undertaken over the past decade by Sunshine Coast Council and the Queensland Government favours the second strategy as the only viable approach.
- Adopting a business-as-usual approach will constrain the region to a future where roads, car parking and traffic dominate the urban landscape, and where those who cannot access private motor transport suffer considerable disadvantage. This alternative will see many existing urban areas become places catering more for cars and less for people, with their amenity and attractiveness irreparably compromised.

Need for a coordinated strategy and staged intervention

- The Options Analysis has confirmed the need for, and effectiveness of a coordinated strategy that can sustain the lifestyle and amenity of the region as it grows, through:
  - providing a high-quality region-wide public transport system to connect the region's main residential, employment and recreational precincts, supported by an integrated feeder bus and active transport network to attract passengers out of cars
  - containing the rate of urban expansion that results in car-based suburban greenfield developments to the agreed expansion areas at Caloundra South, Palmview and Beerwah East
  - locating a significant proportion of new dwellings and employment in the catchment of the quality region-wide public transport system, while maintaining a recognisable low-key Sunshine Coast character within that catchment and across the region.
- Any public transport solution for the Sunshine Coast Region will need to be delivered by the Queensland Government and funded primarily by the Queensland and Australian Governments. However, Council has undertaken the initial planning and business case work recognising the need to advocate for the sustainable future of the region.
- As part of this Options Analysis, a master plan for an integrated public transport system serving the entire region and connecting it to the rest of SEQ has been developed. This plan is consistent with the Sunshine Coast Integrated Transport Strategy, *ShapingSEQ* and the Queensland Government's North Coast Regional Transport Plan.
- A regional mass transit system has to be delivered in stages. A staging plan is proposed based on the need to service the largest travel markets first, and to arrest the growth of urban expansion by supporting the urban consolidation policies already endorsed in the existing planning strategies. The first stage of the public transport solution will be a local mass transit system in the northern part of the Sunshine Coast Urban Corridor, extending 13.6 kilometres from Maroochydore to SCUH at Birtinya town centre.

Public transport options

- Public transport options for the first stage of the mass transit system from Maroochydore to SCUH have been shortlisted for consideration in the Detailed Business Case through a rigorous process involving qualitative and quantitative analysis. Three mass transit technology options that would operate in a guaranteed priority ROW (Category B) are potentially best able to meet the Project objectives, and provide most long-term benefit to the local, state and Australian communities:

  - TT on a dedicated busway, using on-board stored energy without overhead wires (wireless)
  - LRT on a dedicated trackway with either overhead power line supply or on-board stored energy without overhead wires (wLRT)
  - BRT on a dedicated busway using on-board stored energy without overhead wires (wireless).
- The BRT project assessed in this Options Analysis utilised the Brisbane Metro electric vehicle as its reference vehicle. This vehicle is expected in Australia as a pilot vehicle in 2021. The suitability of this vehicle will be evaluated in the Detailed Business Case stage.
- The TT project represents a new vehicle technology that is in early operations in China, with other similar vehicles being developed in Europe. The availability of a suitable TT vehicle in Australia will need to be tested as part of the market sounding undertaken to inform the Detailed Business Case.
- All the Category B options will be expensive due to the need to construct a fully dedicated light rail trackway or busway. Accordingly, a cheaper general traffic (Category C) option can also be progressed for further analysis in the Detailed Business Case, either as a staging option or as ultimate option:
  - QBC in kerbside bus lanes. The lowest (or zero) emission buses that are commercially available should be used for this option, with low emission diesel as a fall back option if progress is not realised for electric or other technology options at the time of implementation.
- The implementation of some of the options can be staged to reduce the initial cost, so the most effective sectors are installed first. In particular, the BRT option may be able to be delivered in stages by initially running standard articulated buses that are already approved for safe and effective operation in sections of general traffic lanes.

Social and environmental impacts and benefits

- A preliminary Social Impact Evaluation (SIE) and a preliminary Environmental Assessment have been undertaken at desktop level to identify potential impacts and benefits of the options. These will need to be more extensively evaluated and assessed during the Detailed Business Case stage.
- When completed, it is expected the Project will improve the local environment and amenity through an improved transport system and a reduction in the growth of traffic in the project catchment. Improved local air quality and reduced local greenhouse gas emissions will also likely result from this.
- The preliminary SIE and the preliminary Environmental Assessment have identified a range of potential negative impacts that will need to be managed in the future stages of the Project, including construction and operational effects.
- The preliminary SIE and the preliminary Environmental Assessment have not identified any impacts that would prevent any of the options from proceeding.
- The preliminary SIE and the preliminary Environmental Assessment have identified further investigations and/or monitoring recommended to refine the appreciation of potential environmental and/or heritage impacts as the Project design progresses.

Economic performance of options

- A preliminary economic assessment has been conducted involving different combinations of transport options and land use scenarios.
- Key benefits estimated relate to public transport user benefits, in particular travel time savings for existing and new users together with amenity benefits and land value change associated with future land use growth being supported in the Sunshine Coast Urban Corridor
- The LRT and wLRT are estimated to produce the highest total benefits, followed closely by TT, BRT and QBC
- When considering only transport and community benefits, the benefits estimated for the mass transit options (LRT, wLRT, TT and BRT) demonstrates that these options are able to produce greater mode shift from road, together with higher customer benefits associated with improved amenity and meeting customer preferences. In contrast the QBC principally achieves benefits for existing PT users.
- Comparing both costs and benefits, the LRT/wLRT options have the potential to achieve the highest BCR of 1.2, including land use change and WEBs.

Supporting work to ensure a quality integrated public transport system is developed and used

- Modelled projections show approximately 65 per cent of public transport riders use active transport, mostly walking, to access public transport. It will be vital to deliver active transport connections both to the mass transit stations, and along the mass transit corridor in accordance with Queensland Government policies and the Principal Cycle Network Plan.
- Residents who do not live in the catchment of the first stages of the mass transit system need to be able to access it. Park 'n' Ride facilities and improved bus connections to the mass transit stations will be vital. A public transport master plan and bus network upgrade plan have been developed as part of this Options Analysis, and Sunshine Coast Council and TMR can work together to deliver these improvements in a staged but deliberate manner.

Urban change in the Sunshine Coast Urban Corridor

- The land use analysis undertaken for the Project has found the right type of environmentally friendly mass transit technology can act to increase the potential for, and benefits of, consolidation of new dwellings and employment along the mass transit route. This will enable a higher proportion of projected growth to occur within the established urban footprint and allow residents to access to key destinations and employment nodes without having to drive long distances in private vehicles. In particular:
  - The Project, if based on technology with an ability to influence urban outcomes (Category B), will deliver a significant region-shaping opportunity when enabled by appropriate changes to planning provisions.
  - Investment in the SCMT, if based on a technology with the ability to influence transport accessibility and land use outcomes, will help drive a stronger, more competitive and sustainable economy and generate substantial and lasting economic, social and environmental benefits.
- While some options are likely to have land use benefits which should be considered more fully in the Detailed Business Case, the mass transit investment will not be the sole reason for urban change in its catchment. Given the enviable lifestyle opportunities and the existence of major attractions, there should be no expectation that the Sunshine Coast Urban Corridor will remain the way it is, and that all the region's population growth can or should be accommodated somewhere else in the region. A balanced approach to urban change is required, that protects the lifestyles enjoyed by current residents, while providing opportunities for their descendants, as well as new residents to enjoy a low-key Sunshine Coast lifestyle with local employment opportunities.
- Supporting the policies in the *Sunshine Coast Planning Scheme 2014*, the relevant Sunshine Coast Council strategies, and *ShapingSEQ* that aim to contain urban expansion is an important objective of the Project.
- Urban change should be focussed on existing centres and areas close to the mass transit route that offer the greatest accessibility and potential for renewal. Importantly, urban consolidation should also focus on supporting the Maroochydore City Centre as the region's CBD, and capitalising on development opportunities in the major centres in Mooloolaba, Kawana and Caloundra town centre.
- In other parts of the corridor outside of these major centres, a carefully planned and staged approach can transform ageing and underutilised development into a modern, low key lifestyle precincts without any excessive high-rise developments that would be inappropriate for the Sunshine Coast.

Recommendations

The draft Options Analysis recommends:

1. Sunshine Coast Council and the Queensland Government continue to work together to deliver an integrated public transport system for the Sunshine Coast Region, including assigning a high priority to the staged development of the new mass transit system as proposed in the SBC and this Options Analysis report. The next stage of this joint work should be the preparation of a Detailed Business Case.
2. The results of stakeholder and community engagement undertaken, based on the draft Options Analysis, be included as relevant matters in the final Options Analysis and the Detailed Business Case process.

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3. Feedback received from stakeholders and the community on matters outside of the scope of the Project, notably certain aspects relating to urban planning and placemaking, be incorporated in the relevant processes for addressing those matters. This will include matters relevant to the preparation of the new *Sunshine Coast Planning Scheme 2014* such as zoning, building height and density.
4. The delivery of the new mass transit system commence as soon as possible. This is due to the need to reduce the accelerating trend towards urban expansion and growing congestion in the coastal corridor resulting from employment and tourism growth.
5. Stage 1 of the mass transit system be developed as a local mass transit technology in the northern part of the Sunshine Coast Urban Corridor, extending 13.6 kilometres from Maroochydore to SCUH at Birtinya town centre.
6. The operation of Stage 1 be targeted to commence in 2027. Stage 1 should be followed by ongoing development of the mass transit network as soon as possible:
   - Stage 2 – connection from the SCUH/ Birtinya town centre to Beerwah (and the existing North Coast Rail Line) most likely as regional rail.
   - Stage 3 – extension south from SCUH along the urban corridor to Caloundra using a local mass transit technology consistent with Stage 1.
   - Stage 4 – connection from Birtinya town centre to Maroochydore City Centre via the CAMCOS corridor, most likely as regional rail.
   - Stage 5 – a longer term connection from Maroochydore City Centre to the Sunshine Coast Airport via either local mass transit or regional rail.
7. Four technology options be progressed to the Detailed Business Case stage. These four mass transit technology options for Stages 1 and 3 will operate in a guaranteed priority right-of-way (Category B), are best able to meet the Project objectives, and provide most long term benefit to the local, state and Australian communities:
   - TT on a dedicated busway,
   - LRT on a dedicated trackway with either overhead power supply or
   - wLRT on a dedicated trackway with on-board stored energy through batteries or hydrogen fuel cells
   - BRT on a dedicated busway.

   The four Category B options will be expensive due to the need to construct a fully dedicated light rail trackway or busway. Accordingly, the cheaper general traffic (Category C) QBC option should also be progressed for further analysis in the Detailed Business Case, either as a staging option or as ultimate option - QBC in kerbside bus lanes, using the lowest emission buses that are commercially viable (preferably targeting zero emissions by the time of implementation).
8. The Detailed Business Case stage give further technical consideration to a range of candidate technologies to determine the most viable option to deliver local mass transit in the Sunshine Coast Urban Corridor.
9. The Detailed Business Case consider the ability of all Category B technology options to be staged to reduce the initial cost, so the most effective sectors of the dedicated Category B mass transit corridor are installed first. In particular, the BRT option may be able to be delivered in stages by initially running standard articulated buses that are already approved for safe and effective operation in sections of general traffic lanes.
10. The Detailed Business Case have a specific focus on delivering:
    - desired land use outcomes, specifically confirming the potential ability of all the candidate technology options to influence urban change and increase urban consolidation (building on the analysis already undertaken in this Options Analysis)
    - full seamless integration with the development of regional rail in the CAMCOS corridor, connecting the region to the rest of SEQ
    - integration with the Mooloolah River Interchange and Kawana Arterial road upgrade projects to ensure through-traffic that should not be on Nicklin Way uses an alternative route

- integration with the Maroochydore local road upgrade and Buderim Mooloolaba Interchange upgrade project to ensure traffic that should not be in Alexandra Headland uses an alternative route to the Sunshine Motorway southbound and is removed from Alexandra Parade and Pacific Terrace
- active transport connections both to the mass transit stations, and along the corridor in accordance with Queensland Government policies and the Principal Cycle Network Plan.

11. TMR (TransLink Division) be engaged during the Detailed Business Case stage to ensure the broader Sunshine Coast Region gains maximum benefits from improved public transport services and to progress the supporting bus network through:
    - the staged roll out of the high frequency strategic bus network identified in this Options Analysis, supported by bus priority infrastructure and Park 'n' Ride facilities
    - incremental upgrades to the local feeder bus network
    - development of bus priority and Park 'n' Ride facilities to allow residents from all parts of the Sunshine Coast to access the public transport system.
12. Sunshine Coast Council undertake the following support actions:
    - Planning and delivery of an active transport feeder network to enable people to easily access the integrated public transport system.
    - Continuing the strong focus on achieving the outcomes envisaged in the Regional Economic Development Strategy, focussed on supporting the Maroochydore City Centre project, and boosting and connecting local employment opportunities in areas close to the mass transit route to allow a greater number of residents to benefit from more convenient access to their places of employment.
    - Continuing consideration of the potential urban outcomes for the Sunshine Coast Urban Corridor to enable those outcomes to be taken into account in the Detailed Business Case.
    - Continuing to implement the Parking Management Plan to help reduce local traffic congestion, increase the attractiveness of urban areas and promote behavioural change through improved travel choices and encouraging greater use of public transport and more walking and cycling.
    - Considering the needs of patrons of local businesses, and residents, to drive their vehicles in areas located in the mass transit catchment when determining road use development.

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INTRODUCTION

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1. Introduction

1.1. Purpose and overview

Sunshine Coast Council approved the Strategic Business Case (SBC) for the Sunshine Coast Mass Transit Project (the Project) on 25 July 2019. This Sunshine Coast Mass Transit (SCMT) Options Analysis considers a range of transport investment options, with a focus on mass transit options for the Sunshine Coast Region. The SCMT Options Analysis is the second Project document developed under guidelines provided in the Building Queensland (BQ) *Business Case Development Framework* (BCDF)[16].

As required by the framework, this Options Analysis:

- Identifies the major transport and urban development challenges facing the Sunshine Coast Region
- Identifies the constraints and limitations of the current public transport (PT) system and road network in the Sunshine Coast Region
- Prepares a Stage 2: Options Analysis that builds on the assessment of service need and benefits identified in the SBC already approved by Council (comparable to Stage 1: Strategic Assessment).
- Uses a structured options assessment process where a longlist of options is reduced to shortlisted Reference Projects for further assessment
- Analyses the shortlisted options to identify preferred options for detailed analysis in Stage 3: Detailed Business Case.

The Options Analysis does not provide designs drawings, details of property impacts or certain other detailed matters. This detail will be developed as part of the Detailed Business Case (DBC) should the project proceed to that stage. The DBC will be led by the Queensland Government as asset owner, planner and is also responsible for the delivery of public transport infrastructure and services.

The SBC was developed in 2019 and approved by Sunshine Coast Council on 25 July 2019. Council also approved the progression to the Options Analysis stage. The SBC was transmitted to Infrastructure Australia (IA) and BQ for consideration and their feedback has been incorporated into this draft Options Analysis.

The Options Analysis has also been developed to meet the requirements of the Queensland Government Project Assessment Framework (PAF), the IA Assessment Framework and the National Public Private Partnership (PPP) Policy and Guidelines.

1.2. SCMT Vision and Project objectives

The vision for the Project is an important element of Council's plan to manage growth. In short, Council's vision for the Project is *"to provide a step change to public transport that can set the region on a path to sustainable transport and appropriate urban development."*

To maintain the lifestyle and amenity of the Sunshine Coast, more sustainable transport options are needed to connect people to jobs, recreation, tourism, services and education. Sunshine Coast Council's vision aims to ensure it is planning for the future, noting the region's population is projected by the Queensland Government to increase by 214,000 people between 2016 and 2041.

Project objectives were established during the SBC stage and were reconfirmed and endorsed by the Project Control Group and Business Case Reference Group (BCRG). Details of these groups are provided in the section 2.1.

Project objectives confirmed for the Options Analysis are detailed in Table 6.

[16] Supplementary BQ guidance materials including an Investment Logic Mapping (ILM) Guide, Social Impact Evaluation (SIE) guide and Cost Benefit Analysis (CBA) Guide have also been used

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Table 6 – SCMT Project objectives and sub-objectives confirmed for the Options Analysis

Project objective	Sub-objectives
Support the Sunshine Coast's productivity, employment growth and self-containment aspirations by supporting existing and emerging strategic centres	• Support the development amenity of key existing economic centres including Maroochydore, Birtinya, Sippy Downs and Caloundra • Support the delivery of region shaping projects including the Maroochydore City Centre, expanding the University of the Sunshine Coast, Sunshine Coast University Hospital (SCUH), Sunshine Coast Airport and the International Broadband Network Cable • Support the development of key industries including health and well-being, education and research, tourism, sport and leisure, knowledge industries and professional services, agribusiness, aviation and aerospace and clean technologies • Support jobs growth target of 100,000 over the next 25 years • Support employment self-containment • Support transition to the New Economy[17] for the Sunshine Coast Region
Maintain and, where possible, improve amenity and liveability, and provide for positive change by unlocking urban growth opportunities	• Support the development of diverse dwelling to meet future dwelling needs and provide affordable living options for everyone • Support the achievement of urban consolidation benchmarks including consolidation of dwelling and population growth within existing urban areas • Support the redevelopment of appropriate areas within the Sunshine Coast Urban Corridor, including Maroochydore, Kawana and Caloundra • Support the enhancement of the Sunshine Coast Urban Corridor's amenity and liveability to reinforce the lifestyle attributes of the region • Support the *South East Queensland Regional Plan – ShapingSEQ 2017 (ShapingSEQ)* benchmark of 53,700 consolidation dwellings (approximately 62 per cent) between 2016 and 2041
Improve accessibility, convenience and resilience of the integrated transport network	• Provide a highly visible, legible, frequent 'turn up and go' public transport service, that is easy-to-use for commuters and non-regular users, such as tourists and other visitors • Make a significant contribution towards improving public transport mode share across the Sunshine Coast Region to ten per cent by 2041 through providing an attractive alternative for intra-regional trips • Provide sufficient right of way and traffic signal priority to guarantee public transport travel times and reliability as a real alternative to car travel • Offer an excellent customer transport experience through improved convenience, frequency, reliability and legibility of system • Improve the resilience of the transport network • Ensure full network integration between local buses, intra-regional and inter-regional mass transit services with maximum opportunity, but minimal need, to interchange between services
Provide a deliverable and value for money solution	• Deliverability and opportunities for optimisation with staging and avoiding redundant infrastructure • Suitability of construction and delivery methodology, timeframes to develop • Minimise level of community, property, heritage and environmental impacts during construction and operation • Maximise environmental, social and sustainability outcomes • Facilitate opportunities for private investment • Create value and potential opportunities to share value to defray the cost of the Project • Defer the need for investment in other transport infrastructure, notably roads • Maximise integration with complementary infrastructure, such as active transport and open space links

[17] New Economy as defined in the Sunshine Coast Regional Economic Development Strategy 2013-2033 – a prosperous, high-value economy of choice for business, investment and employment, while offering an enviable lifestyle and environment.

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GOVERNANCE AND ASSURANCE

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2. Governance and Assurance

2.1. Options Analysis governance structure

The governance structure for the Options Analysis needed to be sufficiently robust to allow for efficient management of the Project while providing for input from a range of internal (Council) and external stakeholders. Figure 13 provides an overview of the governance structure. Key forums include:

- Project Control Group established under Sunshine Coast Council's corporate governance arrangements
- BCRG comprised of Australian and Queensland Government officials along with Sunshine Coast Council representatives
- As required, working groups on specific topics.

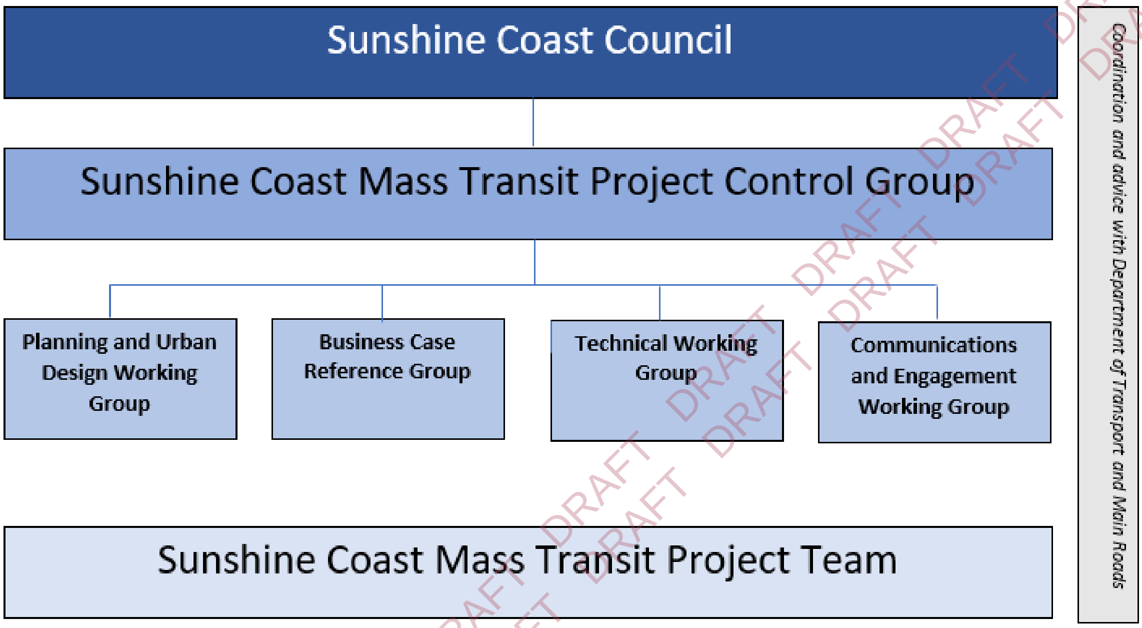

Figure 13 – Options Analysis governance structure

2.2. Stakeholder engagement

A range of internal and external stakeholders was engaged throughout the development of the Options Analysis. These stakeholders and their roles are discussed below.

2.2.1 Internal Council stakeholders

Various Council stakeholders were involved in the development of the Options Analysis and were integral to the implementation of various parts of the Project, including:

- Sunshine Coast Council Mayor
- Deputy Mayor and Community (Transport) Portfolio Councillor
- Environment and Liveability (Place making) Portfolio Councillor
- Service Excellence Portfolio Councillor
- Chief Executive Officer
- Group Executive Liveability and Natural Assets
- Chief Strategy Officer
- Group Executive Built Infrastructure
- Group Executive Customer Engagement & Planning Services.

The Project Team consulted with key Council stakeholders throughout the development of the Options Analysis to identify key issues and stakeholder requirements to inform the Project's development.

2.2.2 Queensland Government stakeholders

A number of key Queensland Government stakeholder groups were consulted through the development of the Options Analysis, including:

- The Department of Transport and Main Roads (TMR) – various areas including the North Coast Region, Transport Planning and Project Evaluation
- The Department of State Development, Infrastructure, Local Government and Planning (DSDILGP)
- Building Queensland (BQ) – now part of DSDILGP
- Queensland Treasury.

Each of these Government agencies was represented, to varying levels as described in the sections above, on the Project Control Group and/or BCRG.

2.2.3 Australian Government stakeholders

The Project team engaged with the Australian Government at appropriate times. Key Australian Government agencies and their focus areas are shown in Table 7.

Table 7 – Australian Government stakeholders

Government agency	Focus area
IA	Infrastructure Priority List and Assessment Framework – Stage 2, 3 and 4.
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC)	Transport Infrastructure programs and ATA Guidelines Step 1, 2, 3 and 4.

Representation on the BCRG provided an opportunity for Australian Government stakeholders to provide input into the Options Analysis.

2.3. Options Analysis approvals framework

The approvals process is illustrated in

Figure 14.

Figure 14 – Options Analysis approvals process

Following the conduct of the stakeholder and community engagement process in 2021, the Options Analysis will be updated and referred to Council for consideration. Subject to Council approval, the Options Analysis will be provided to the Queensland Government for consideration and assurance review, noting that subject to that, the Queensland Government and Council have agreed to jointly fund the DBC stage. Further information regarding requirements for the DBC will be provided as part of the implementation planning.

2.4. Assurance

This Options Analysis aligns with the guidelines in BQ's BCDF release 3. The BCDF advises that prior to finalising the Options Analysis, a Queensland Treasury Gate 1 assurance review should be completed (when deemed appropriate).

Council consulted both BQ and Queensland Treasury on the need for a Gate 1 assurance review to be conducted prior to completion of the draft Options Analysis and its submission to Council for its approval.

Queensland Treasury subsequently confirmed a preference that the Options Analysis be subjected to a Gate 1 assurance review upon transmission by Sunshine Coast Council to TMR. Accordingly, this draft Options Analysis has not been the subject of a Gate 1 assurance review.

The draft Options Analysis has been compiled with input of various key stakeholder agencies engaged through the BCRG, and direct consultation with other key stakeholders. Review comments on the SBC and an Interim Findings Report released in January 2020 have also been incorporated.

It has been agreed with Queensland Treasury that conducting further assurance reviews (particularly peer views of specific elements like demand modelling, economics and cost estimating) would be best suited to the establishment stage of the Detailed Business Case, following completion by TMR of the Gate 1 assurance review.

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METHODOLOGY

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3. Methodology

The purpose of this chapter is to outline the assessment and evaluation methodologies used for the Options Analysis, risk assessment and management and stakeholder engagement during development of the Options Analysis. Further information on the methodology and approaches used in the development of the Options Analysis are included in relevant chapters to contextualise the process and outcomes.

3.1. Options Analysis approach

This section summarises the approach to generating and shortlisting options, and the identification of the preferred options. It summarises the findings of the SBC, which guided the geographical scope of the Options Analysis, as well as the methodology applied for the Options Analysis to identify the preferred options for progression to the Detailed Business Case.

3.1.1 SBC options analysis

The SBC was endorsed by Council on 25 July 2019. It identified a range of strategic initiatives that respond to the service needs and achieve the benefits sought, which were defined through an Investment Logic Mapping (ILM) process. Refer to Chapter 6: Service Need for outcomes of the ILM process.

After assessment of potential infrastructure and non-infrastructure options for urban change, economic development and transport in the Sunshine Coast Urban Corridor, it was identified that investment in a new infrastructure solution is necessary to manage the Sunshine Coast Region's projected population growth in line with stated policy objectives of the three levels of Government. This supported a conclusion by the SBC that the scale of population growth forecast for the Sunshine Coast Urban Corridor will not be effectively managed without an integrated land use plan, framed around a mass transit spine extending from Maroochydore to Caloundra.

Through a strategic merit test, the SBC identified the priority first stage for the delivery of a mass transit system was from Maroochydore to the SCUH precinct, to provide a focus for the Options Analysis. The SBC recommended progression of this solution to more detailed analysis in the Options Analysis to confirm the service need and identify and assess potential project options.

3.1.2 Options Analysis

As provided by the BCDF, the Options Analysis develops potential options and narrows the breadth of options by applying rigorous evaluation criteria, before assessing the viability of any remaining options.

As part of the Options Analysis a detailed options assessment process was undertaken to generate, filter and shortlist the preferred options to deliver a mass transit solution in the corridor from Maroochydore to the SCUH precinct, building on the findings from the Strategic Business Case.

The development of the Options Analysis included a confirmation of the findings from the Strategic Business Case and a detailed consideration of the initiatives available to meet the service needs and objectives of the Project. The methodology to define the project case in the Options Analysis was developed using the BQ BCDF Release 2, 2016, the Queensland PAF and the IA Assessment Framework, with reference to the Queensland State Infrastructure Plan.

The options generation and shortlisting process undertaken as part of developing this Options Analysis is outlined in Figure 15.

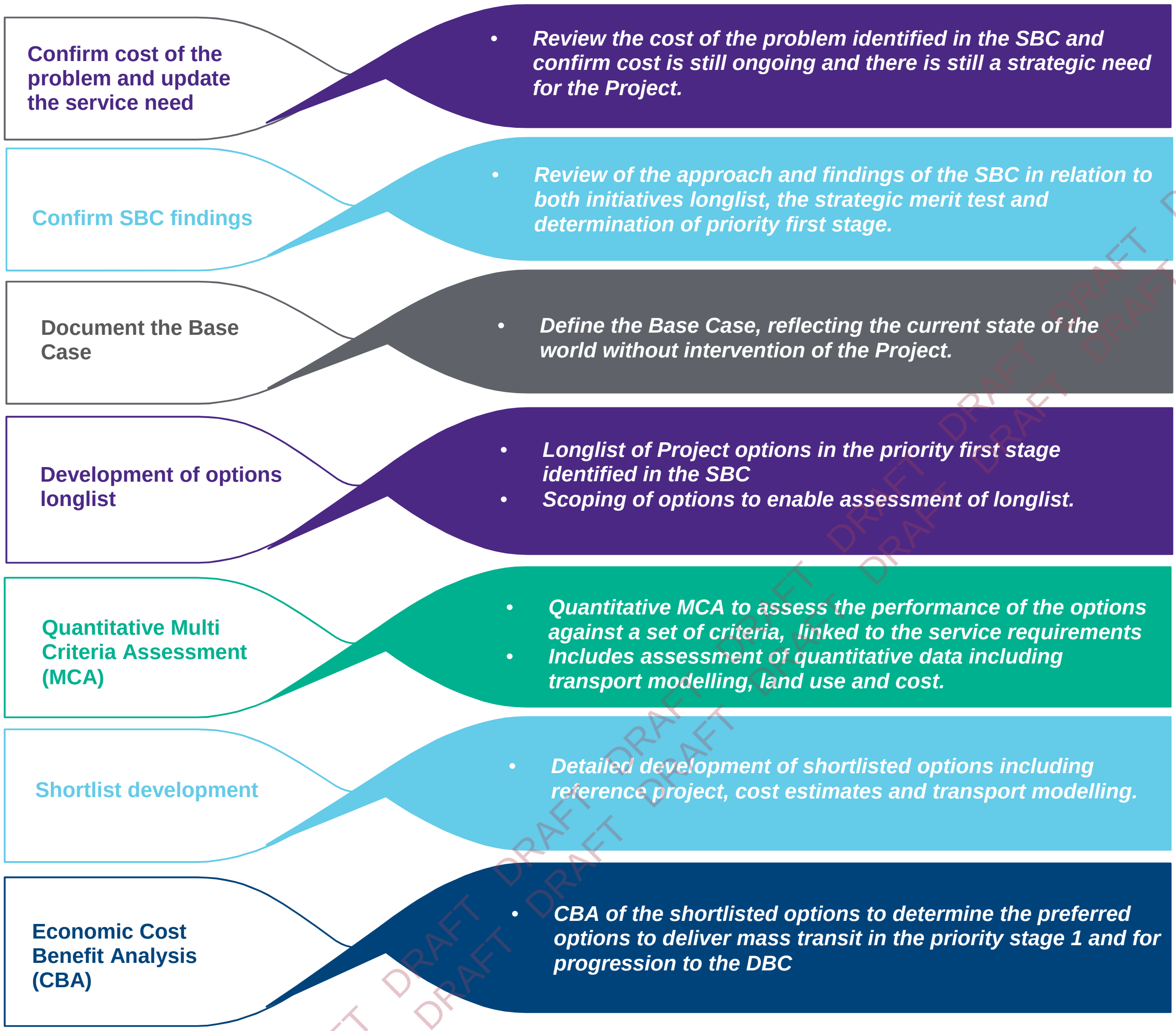

Figure 15 – Options Analysis options assessment process

3.1.2.1 Reference Project options assessment

The Options Analysis assessed various options at a high-level including the route, alignment (verge running or centre running), and station locations to inform the development of indicative Reference Projects required for assessing costs and benefits. This is documented in Reference Projects section of this report.

Public Transport services, especially mass transit services carrying high volumes of passengers, can be vulnerable to disruption from other transport users. In particular, being caught in congestion or needing to give way at intersections to other users can reduce the attractiveness of the service to passengers and affect the efficiency and cost of operations. If Public Transport is to be really successful, it is important to minimise "what gets in the way" of the vehicles by improving their right-of-way (ROW).

The mass transit options developed for assessment were classified under three ROW categories as per industry standards conveyed per international literature[18]:

1. Category A – fully separated from all traffic both horizontally and vertically (e.g. heavy regional rail)
2. Category B – partially separated from other traffic horizontally but crossing at grade (e.g. Light Rail Transit (LRT), Bus Rapid Transit (BRT))
3. Category C – urban streets mixed with traffic (e.g. current bus services, bus lanes).

[18] See for example Vol 1 – Urban Public Transportation Systems – Vukan R. Vuchic

The assessment provided particular details for the Category B options, including the most recent information on emerging Trackless Tram (TT) and wireless LRT options.

The design and specifications for the Quality Bus Corridor (QBC) option (Category C) were determined using information from CoastConnect, a bus priority project developed by TMR in the Maroochydore to Caloundra corridor, together with updated inputs (refer to Chapter 11).

This options assessment also built on the Sunshine Coast Light Rail route options stakeholder and community engagement process in October and November of 2014[19] which assessed alternative routes in the Sunshine Coast Urban Corridor. This engagement informed Sunshine Coast Council's decision on 23 April 2015 to "confirm the recommended light rail route corridor with which to proceed to more detailed feasibility and business case studies".

At that time, LRT was preferred by Sunshine Coast Council, based on its previous feasibility investigations and evaluation of other options in the "Line in the Sand" report in 2012. However, the preferred technology options are being subjected to further analysis in this Options Analysis report to determine the best mass transit technology options for further investigation, and the focus has been broadened beyond light rail.

3.2. Risk management approach

A risk management approach has been applied as part of developing this Options Analysis through suitable processes. The approach includes establishing a risk management process that complies with ISO31000:2009 (Risk management – guidelines) and the *TMR Risk Management Framework 2016*, including risk identification workshops, a risk register and regular review of process and project risks.

The risk assessment and management processes applied during development of the Reference Projects include:

- Active management and reporting of all risks associated with the Project during the pre-procurement stage (strategic and process risks) in consultation with the Project Team and other stakeholders.
- Development of a comprehensive risk register for both delivery and operating costs drawing on experience and lessons learnt through the delivery, and now operation, of other similar mass transit projects. This included an assessment of technical risks for each Reference Project.
- A Monte Carlo simulation (refer to Table 88 for a description about this process) for capital expenditure risk and opportunities to produce a risk adjusted capital cost estimate to P50 levels of confidence.
- Benchmarking of risk outputs against other similar projects to determine whether the proposed risk allowance is broadly consistent with expectations for this stage of development.
- Facilitation of a series of risk workshops to interrogate and challenge the individual risk valuations.

Additional information on the quantification and management of Project risks is provided in Chapter **14**.

[19] Sunshine Coast Council. 2014. Sunshine Coast Light Rail Route Options and Consultation Report.

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3.3. Stakeholder engagement

This section summarises the approach to stakeholder engagement for the Options Analysis.

3.3.1 Government stakeholders

Stakeholder engagement with Government is described in Chapter 2: Governance. More broadly, stakeholder consultation was undertaken with:

- Council through the Project Control Group and briefings at strategic planning workshops. The Mayor and other Councillors are representatives on the Project Control Group
- Queensland Government through the technical working group, the BCRG and the Project Control Group
- Australian Government through the BCRG (IA and DITRDC).

3.3.2 Community engagement

The Options Analysis incorporates the results of significant previous community consultation undertaken by Council in relation to transport policy, and in particular mass transit proposals in 2012, 2014 and 2018, as outlined below.

3.3.2.1 A Line in the Sand report (2012)

A Line in the Sand report process included a broadly representative community taskforce, supported by expert advisors from Council. It canvassed six technology options for a mass transit system as a game changer for the Sunshine Coast. An online consultation hub, launched in January 2012, attracted more than 2,900 visits and 228 people took part in the poll on the hub. The recommended proposal for light rail on the Sunshine Coast was supported by 82 per cent of those who completed the poll.

3.3.2.2 Sunshine Coast Light Rail – route options (2014)

In November 2014, more than 700 people provided feedback on light rail route options proposed for Maroochydore, Mooloolaba, Kawana and Caloundra. The consultation process was underpinned by a comprehensive Route Options and Impact Assessment Report[20]. The vast majority (87 per cent) supported Council's investigations into light rail and feedback contributed to the selection of route options for further study.

3.3.2.3 Integrated Transport Strategy (2018)

Council undertook market research and community consultation between November 2017 and July 2018 to help shape the Integrated Transport Strategy which was adopted by Council in late 2018. Key findings from the market research and community consultation relevant to the Project Strategic Business Case have been integrated into the Options Analysis development process.

3.3.2.4 Community and Stakeholder engagement on the Options Analysis

Sunshine Coast Council resolved on 20 August 2020 to:

> *Develop and present a comprehensive and meaningful community engagement plan which must be undertaken, completed and incorporated in the Sunshine Coast Mass Transit Preliminary Business Case, prior to proceeding through to Stage 3 of the Detailed Business Case.*

This engagement will be underpinned by this current Options Analysis report (noting that a Preliminary Business Case is now referred to as an Options Analysis in the BCDF. When the engagement is completed, the draft Options Analysis report will be updated to incorporate the results of the engagement and reported to the Sunshine Coast Council.

Further comprehensive community consultation is expected to be part of the staged Detailed Business Case stage, which will be led by the Queensland Government in partnership with Council, likely to occur in 2022.

[20] Arup Hassel Aurecon. 2014. Sunshine Coast Light Rail – Route Options and Impact Assessment.

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SUNSHINE COAST MASS TRANSIT – PROJECT BACKGROUND

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4. Sunshine Coast Mass Transit - Project Background

Sunshine Coast Council has been investigating the development of an integrated mass transit system to service the Sunshine Coast Region's growing population and support sustainable growth since 2012. The primary vehicle for these investigations is this current business case process for the Sunshine Coast Mass Transit Project.

The purpose of this chapter is to provide an overview of the Project's background and need. It also identifies previous work related to the region's mass transit needs. The analysis is conducted against a background of strong growth in the region, driven by its desirability as a place to live and work. Key attributes of this growth are shown in Table 8.

Table 8 – Sunshine Coast Region - Headlines for the future transport system in 2041

Attribute	Headline
Population growth	Population projected to grow at 2.1 per cent from 303,389 in 2016 to 518,004 in 2041,a projected increase of 214,625 people, or 71 per cent
Best estimate of resident population	The population estimate for Sunshine Coast as at 30 June 2019 is 328,428. Since the previous year, the population has grown by 2.69 per cent
Time taken to double population	With the projected compound annual growth rate exceeding 2 per cent, the region will double its present population in about 2057, 36 years in the future
Dwelling growth	Total dwellings are projected to grow from 126,019 in 2016 to at least 213,000 in 2041, a projected increase of 87,000 or 69 per cent
Employment growth	There were 139,622 people in the labour force in 2016, and the region needs to create approximately 75,000 more jobs by 2041
Travel mode share	Car mode share was 85 per cent, PT 3 per cent, active transport 12 per cent in 2016
Car ownership growth	Average of 1.9 vehicles per dwelling in 2016, with total vehicles about 240,000. Projected increase of between 148,000 and 165,000 extra vehicles on the region's roads over the period 2016 to 2041, or a 62 to 69 per cent increase
Total daily vehicle trips	Total daily vehicle trips projected to grow from 1,027,300 trips in 2016 to 1,528,900 trip in 2041, an increase of 501,600 or 49 per cent
Total daily vehicle kilometres travelled (VKT)	Total vehicle kilometres projected to increase from 10,091,800 kilometres in 2016 to 15,729,800 kilometres, an increase of 5,638,000 or 56 per cent
Total daily PT trips	Total daily PT trips projected to increase from 13,100 trips in 2016 to 25,000 trips in 2041, an increase of 11,900 or 91 per cent

4.1. Sunshine Coast Region at a glance

The Sunshine Coast Region Local Government Area (LGA) is located approximately 100 kilometres north of the Queensland state's capital, Brisbane, and covers an area of 2,280 km^2. The area is governed by Council as duly constituted in the Queensland *Local Government Act 2009.*

With a population in 2019 of over 328,000[21], the Sunshine Coast LGA is the fifth largest LGA in Queensland.

The region has experienced significant population growth, higher than South East Queensland (SEQ) and Queensland overall population growth, which has driven dwelling growth. This growth is projected to continue. Over the 25 years between 2016 and 2041, Sunshine Coast Region's population is projected to grow from 303,389 to 518,004[22] representing an increase of 214,615 people, or 71 per cent.

The Sunshine Coast Region is also an popular tourist destination, especially for domestic visitors. However, despite strong population and visitor growth, the use of public transport in the region remains low.

With the region's population and economy projected to continue growing, key challenges must be identified and addressed. The Sunshine Coast Region is experiencing growing road congestion which will greatly affect the future lifestyle and economic productivity of the region if the very high dependence on private vehicle travel is not addressed. Congestion would be further exacerbated if there was a need to expand the boundary of the urban area to satisfy the demand for new housing.

These key challenges will need to be addressed if the Sunshine Coast Region is to retain its enviable lifestyle offerings and preserve its popular natural environment as it continues to grow.

4.1.1 A fast-growing region

4.1.1.1 The regional economy

Currently some 77.6 per cent of working Sunshine Coast residents have a job located in the region[23]. Despite this, the Brisbane metropolitan area dominates employment in SEQ region[24], and growth of new industries in Brisbane represents a risk to local employment. Increased employment opportunities in high-value industries are required in the region to ensure the current level of employment self-containment can be maintained or increased.

As well as being Queensland's third largest population centre, the Sunshine Coast Region is an emerging economic hub. Its economy is now worth approximately $15.7 billion[25] and has the vibrant regional economic centres in Maroochydore, Kawana and Caloundra. A comparison with net economic worth of other City Centres that have recently implemented a major improvement to local mass transit, such as Canberra, Gold Coast, Newcastle and Parramatta is shown in Figure 16[26].

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[21] Economy.is (2020). *Sunshine Coast population estimate.* Accessed at https://profile.id.com.au/sunshine-coast/population-estimate
[22] Queensland Government population projections, 2018 edition data and ABS 3235.0, Population by age and sex, regions of Australia, 2016
[23] Australian Bureau of Statistics. 2016. Census of Population and Housing.
[24] Jobs Queensland. 2018. Anticipating Future Skills: Jobs growth and alternative futures for Queensland to 2022. p 70.
[25] Economy.id (2019). *Sunshine Coast Council.* Accessed at: https://economy.id.com.au/sunshine-coast
[26] Economy.id (2020). Sunshine Coast, Gold Coast, Parramatta, Newcastle and Canberra. Accessed at: https://economy.id.com.au

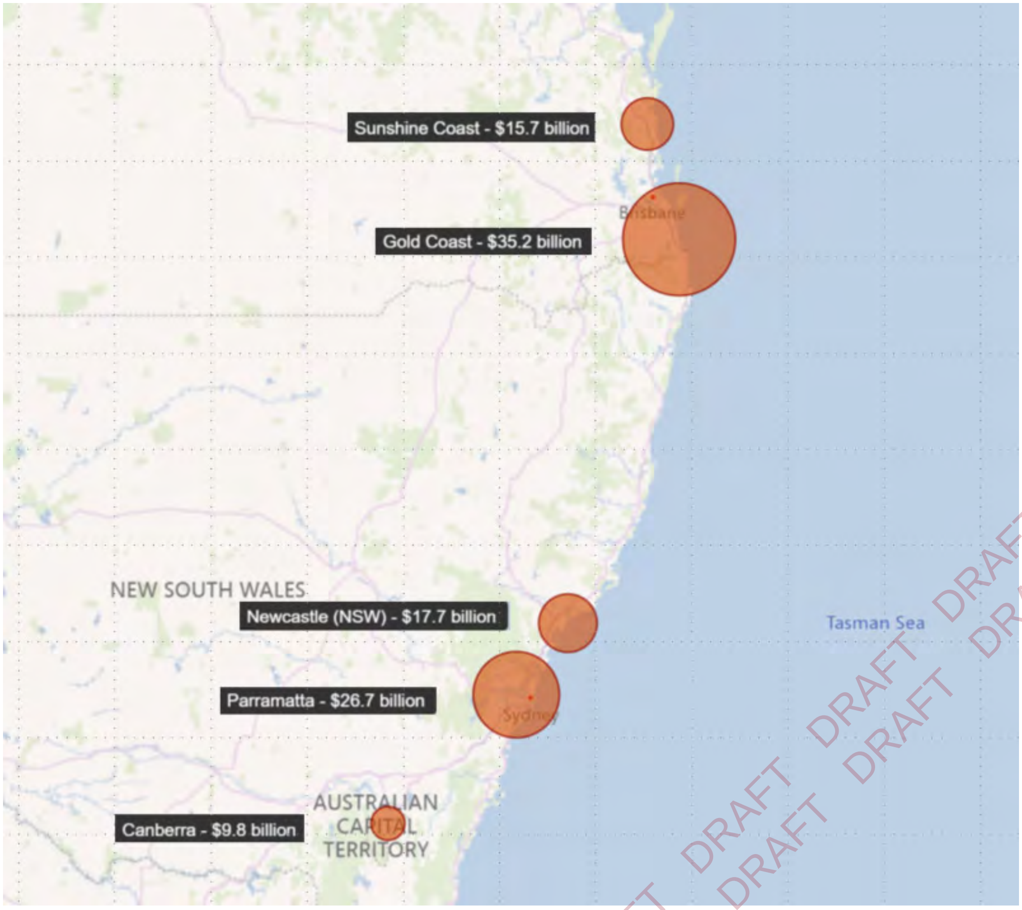

Figure 16 – Comparison of gross regional product of regions that recently implemented mass transit

There were 139,622 people who reported being in the labour force in the week before the 2016 Census night in Sunshine Coast LGA. Of these 52.5 per cent were employed full time, 35.6 per cent were employed part-time and 7.2 per cent were unemployed[27].

Apart from health care and social assistance, the trend of employment and industries in the Sunshine Coast Region leans towards lower-value industries that are highly dependent on economic cycles such as construction, retail trade and accommodation and food services.

There is a continuing need to broaden and deepen the economic base to:

- Support population growth and employment self-containment
- Reduce risk and volatility
- Increase productivity and wages
- Focus more on growing high-value industries.

To maintain its lifestyle and economy, the region needs to create approximately 75,000 more jobs by 2041[28]:

4.1.1.2 Population growth

The Sunshine Coast economy has been driven by over ten years of consistent and significant population growth, averaging 2.6 per cent annually, 1.1 per cent high than the annual population growth of Queensland[29]. The comparison between growth in the Sunshine Coast to Australia, Queensland and the SEQ region is shown in Figure 17.

COVID-19 has meant Australia's increase in population has not been driven by migration since March 2020. However this may have been partially offset by the return home of some 400,000 expatriate Australians from

[27] Australian Bureau of Statistics. https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA36720
[28] Sunshine Coast Council (2013), Regional Economic Development Strategy 2013-2033.
[29] Queensland Government Statistician's Office (2019). *Queensland Regional Profiles.* Accessed at: https://statistics.qgso.qld.gov.au/qld-regional-profiles

overseas countries[30]. Irrespective of COVID-19 legacies, the SEQ region is likely to continue to experience strong population growth through to 2041 and beyond, creating pressures on housing, transport, lifestyle, employment, social infrastructure and the environment.

Both the Australian and Queensland Governments have recognised the challenges of managing strong forecast growth in population in a manner which is timely, sustainable and promotes high-quality lifestyles. This includes recognising and responding to a trend towards increased urbanisation, and the social and environmental challenges that this can create.

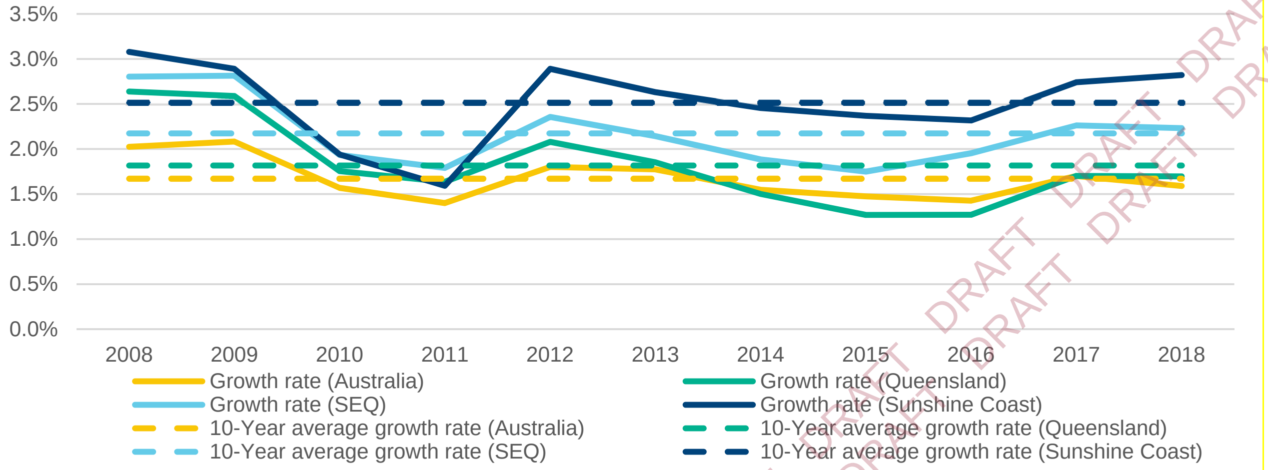

Figure 17 – Population growth rates and 10-year averages for Australia, Queensland, SEQ and Sunshine Coast[31]

The Sunshine Coast Region's population is forecast to continue to grow strongly, exceeding the national and state average population growth rates, as shown in Table 9. As noted in Section 4.1, over the 25 years between 2016 and 2041, Sunshine Coast Region's population is projected to grow from 303,389 to 518,004[32].

With the projected compound annual growth rate exceeding 2 per cent, the region will double its present population in about 2057, 36 years in the future.

Table 9 – Comparison of forecast future population growth in Australia[33]

Geography	Current population	Population growth rate p.a. 2019 - 2041
Australia	25.5 million	1.6 per cent
Queensland	5.14 million	1.7 per cent
SEQ	3.6 million	2.2 per cent
Sunshine Coast LGA	328,000	2.1 per cent

4.1.2 Managing dwelling growth – Shaping SEQ

The defining strategy providing a framework for managing and accommodating forecast growth in the rapidly growing SEQ region is the SEQ Regional Plan - *ShapingSEQ.* This Queensland Government plan identifies the challenge of delivering sustainable growth in population for the SEQ region from 3,600,000 in 2019 to an estimated 5,349,000 people by 2041.

Of the suite of strategic objectives outlined in *ShapingSEQ*, those with particular relevance to this analysis include:

- Focusing 60 per cent of new dwellings in SEQ in existing urban areas

[30] https://www.foreignminister.gov.au/minister/marise-payne/media-release/more-flights-helping-australians-return. Accessed 2 March 2021
[31] Profile.id (2019). *Sunshine Coast Estimated Regional Population.* Accessed at: https://profile.id.com.au/sunshine-coast/population-estimate
[32] Queensland Government population projections, 2018 edition data and ABS 3235.0, Population by age and sex, regions of Australia, 2016
[33] Queensland Government Statistician's Office (2018). *Population projections*. Accessed at: https://www.qgso.qld.gov.au/statistics/theme/population/population-projections

- Prioritising public and active transport
- Region-shaping infrastructure to increase accessibility and productivity.

In 2016 there were 126,019 dwellings in the region[34]. To accommodate the forecast population growth in the Sunshine Coast Region, *ShapingSEQ* projects that at least an additional 87,000 dwellings are required for the Sunshine Coast Region by 2041. *ShapingSEQ* sets the benchmark of 62 per cent of future dwellings in the Sunshine Coast Region to be by way of (consolidation) the existing urban area, as demonstrated in Figure 18. This benchmark calls for 53,940 additional dwellings to be consolidated in the existing urban areas over the 25-year period between 2016 and 2041[35].

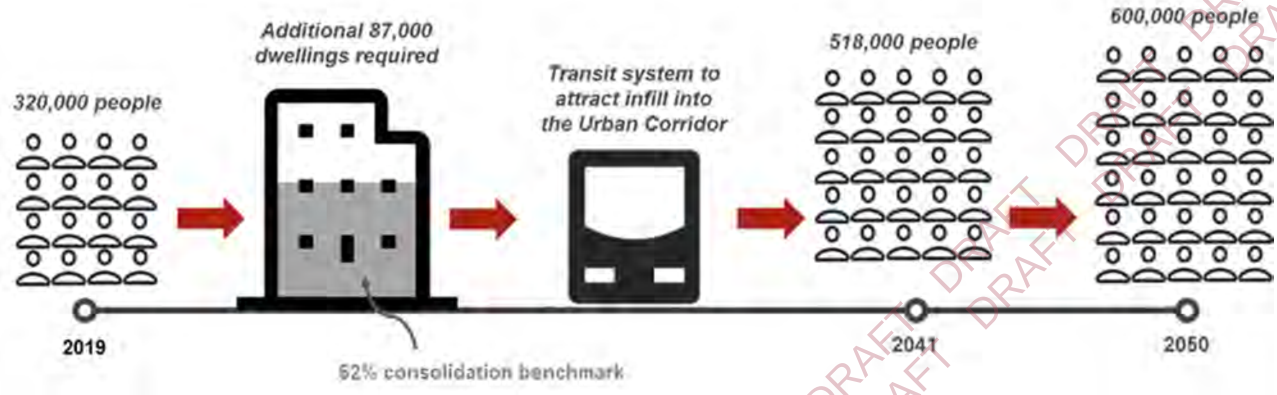

Figure 18 – Population growth and urban consolidation benchmarks

Owing to existing urban settlement patterns and geographic constraints, the Sunshine Coast Region is facing a major challenge in how it accommodates the forecast growth in population and additional dwellings. In 2019, dwelling prices in the region were significantly higher than the Queensland average, with houses 29.8 per cent higher and units 11.6 per cent higher[36], further demonstrating the strong dwelling demand in the region.

To meet the demand for housing driven by the region's strong population growth, Council and the State Government have planned for major expansion areas at Palmview and Caloundra South. Due to these plans, the need to cater for population and housing demand via urban expansion is well catered for up until at least 2031. A further major expansion area is also planned at Beerwah East, which is projected to have its first new housing development in 2027 and have at least 7,000 dwellings developed by 2041.

If the Sunshine Coast is to continue to accommodate forecast population growth primarily through urban expansion, this will result in encroachment on the region's natural resources including environmentally significantly land, highly constrained land, rural areas and agricultural areas. The expanded urban footprint will also require significant investment in the provision of infrastructure and services over a larger geographic area.

Planning by both the Council and Queensland Government focuses on accommodating future population growth through urban consolidation within the existing urban area. This policy objective is reflected in *ShapingSEQ*, the Sunshine Coast Integrated Transport Strategy and the *Sunshine Coast Planning Scheme 2014*.

[34] Sunshine Coast Council. Accessed at https://www.sunshinecoast.qld.gov.au/Experience-Sunshine-Coast/Statistics-and-Maps/Population-Forecast
[35] Department of Infrastructure, Local Government and Planning (2017). ShapingSEQ, p120. Accessed at https://dilgpprd.blob.core.windows.net/general/shapingseq.pdf
[36] Profile.id (2019). *Sunshine Coast.* Accessed at: https://profile.id.com.au/sunshine-coast

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4.1.3 A popular tourist destination

As well as being a highly desirable place to live and work, the Sunshine Coast Region is one of Australia's leading tourism destinations, offering a tourism experience centred around beaches, scenic views and hinterland, all underpinned by a comfortable climate. As an popular tourist destination, the region also has to cater for very significant volumes of visitor travel. In 2018/19 tourism visitation to the Sunshine Coast Region comprised:

- 1.7 million international visitor nights
- 7.7 million domestic visitor nights
- 4.3 million day visits[37].

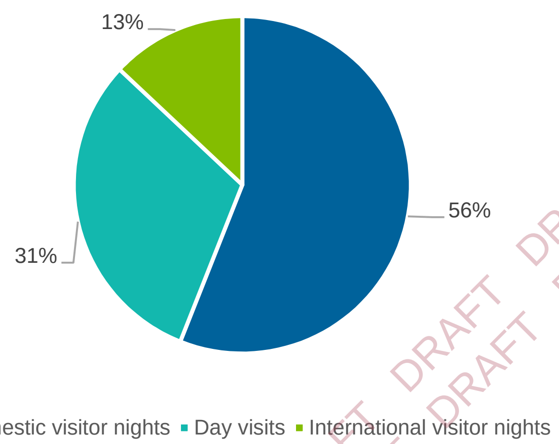

Figure 19 – Tourism expenditure in the Sunshine Coast Region

The tourism expenditure in the Sunshine Coast Region was $1.8 billion in 2018, predominantly from domestic overnight visitors (as seen in Figure 19) which was an increase of $76 million from 2017[38].

The total visitor nights grew 3.1 per cent from 2016/17. The consistent population growth in Australia, and SEQ in particular, indicates that domestic visitations are expected to continue and potentially increase in line with population.

International visitor nights grew 13.2 per cent from 2016-17 to 2018-19, significantly higher than Queensland as a whole which only grew by 2 per cent. With the recent expansion of the Sunshine Coast Airport to enable direct flights to more destinations across Australia, Asia and the Western Pacific, visitor numbers are expected to increase.

The Sunshine Coast Airport upgrade is completed and will assist the growth of the region's tourism industry once the COVID-19 pandemic has passed.

4.1.4 An emerging city with major growth in travel demand

The Sunshine Coast Community Strategy 2019-2041 notes the region is experiencing a change from a regional centre to a regional city. Sunshine Coast Council has a vision for the Sunshine Coast to be Australia's most sustainable region: Healthy. Smart. Creative.

However continuing population growth needs to be planned for to secure a sustainable future. More people will lead to more transport demand, and the number of daily trips that start or finish in the region will increase from 1.5 million to 2.4 million trips each day over the 25 years from 2016 to 2041. In 2016 there were an estimated 1.9 vehicles per household[39], or about 239,000 vehicles.

Currently, the region's population is highly dependent on cars with the second highest rate of car ownership in Australia, as shown in Figure 20. With growth in car ownership amongst the highest in Australia, the addition of 214,615 people as projected by the Queensland Government will mean between 148,000 and 165,000 extra vehicles on the region's roads over the period 2016 to 2041[40].

Modelled projections for travel growth prepared for the Options Analysis are reported in the Base Case, Chapter 9. These are shown in Table 10.

[37] Economy.id (2019). *Sunshine Coast Council economic profile*. Accessed at: https://economy.id.com.au/sunshine-coast/tourism-visitor-summary
[38] Tourism Research Australia (2018). *Local Government Area Profiles – Sunshine Coast.* Accessed at: https://www.tra.gov.au/regional/local-Government-area-profiles/local-Government-area-profiles
[39] Australian Bureau of Statistics. https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/316?opendocument
[40] Range calculated using current vehicles per capita at 0.69, and vehicles per household at 1.9.

Table 10 – Summary of travel growth projected in the Base Case, Chapter 9.

Parameter	2016	2041	Increase	Per cent increase
Total daily vehicle trips	1,027,300	1,528,900	501,600	49 per cent
Total daily vehicle kilometers	10,091,800	15,729,800	5,638,000	56 per cent
Total daily PT trips	13,100	25,000	11,900	91 per cent

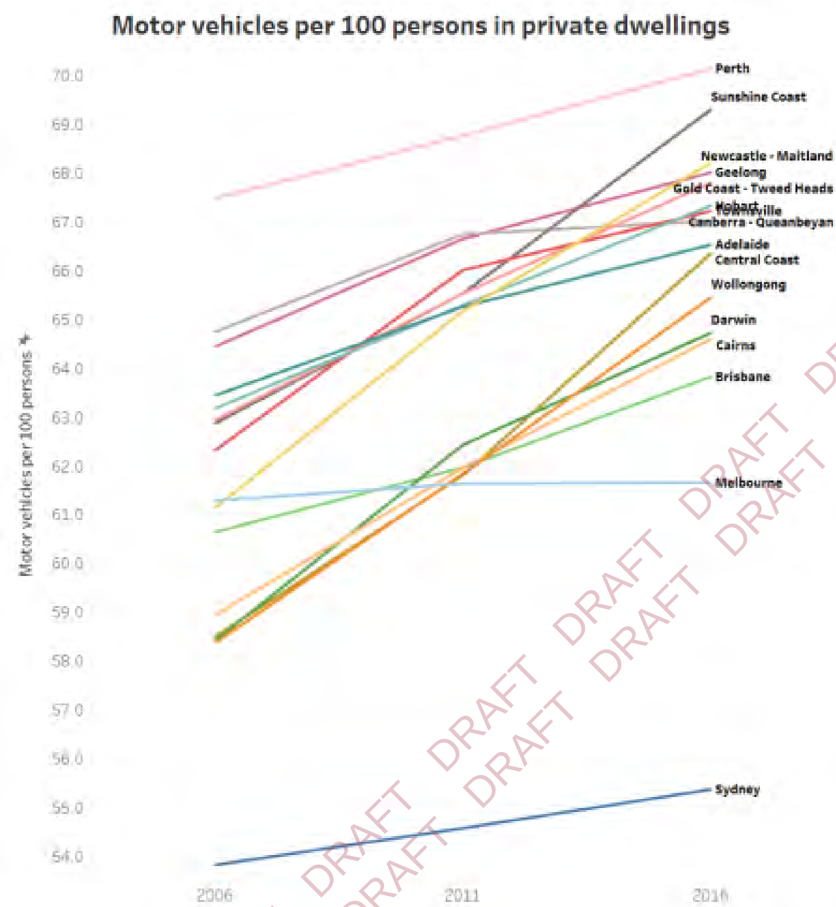

Figure 20 – Comparison of rates of car ownership on Australian cities. Source: Australian Bureau of Statistics (ABS)[41].

Presently around 85 per cent[42] of all trips by Sunshine Coast residents are made by car, and only three per cent by public transport.

This situation, if unchecked, will mean the growth in transport demand will translate to spiraling traffic congestion and ever-increasing demand for more roads and car parking.

Sunshine Coast commuters travel an average of 16.9 kilometres for work-related trips, generally twice the distance of discretionary travel such as shopping. Nearly 90 per cent of these trips to or from work are made in a car and this value remained constant between 2004 and 2011. This is considerably higher than the Queensland average that reports only 72 per cent of all trips to or from work are via car[43].

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[41] https://chartingtransport.com/2017/07/30/what-does-the-census-tell-us-about-motor-vehicle-ownership-in-australian-cities-2006-2016/

[42] Sunshine Coast Council (2020). *Integrated Transport Strategy.* Accessed at: https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Council-Strategies/Sunshine-Coast-Integrated-Transport-Strategy

[43] Department of Transport and Main Roads (2017). *Enhance QTUCS Report*.

4.1.5 A change of thinking is needed

Despite its projected growth and a vision to be a sustainable region, the Sunshine Coast has a public transport system more suited to a regional town, as seen through the high dependence on cars. To achieve the vision of sustainability and respond to the significant population growth that is expected, a step change upgrade to public transport is required to set the region on a path to sustainable transport and urban development.

Improving mass transit[44] in the major movement corridors of the Sunshine Coast Region needs to be the centrepiece of that step change public transport improvement. Sunshine Coast Council has been working with the Queensland Government to plan and deliver those improvements.

The scope of the mass transit investigations by the Council entails the planning, corridor protection and project delivery of a high frequency mass transit network, which extends from the Sunshine Coast Airport through Maroochydore, Birtinya and Caloundra to the existing North Coast Railway at Beerwah. This network requires support from local buses all connected through an integrated network planning and fare structure plus upgraded pathways and public realm to facilitate active transport connections.

To maximise customer transport options the future public transport network should also incorporate other flexible travel choices like pre-booked ride sharing all aggregated with conventional public transport into a single user booking and payment interface.

Since most people access public transport by walking or cycling, a network of improved active transport facilities is also required to connect people to the stops and stations.

4.2. Foundation planning for the Project

4.2.1 2012 – The *Line in the Sand* Report

Council's *Line in the Sand* process included a broadly representative community taskforce, supported by expert advisors from Council. The process canvassed six technology options for a mass transit system as a game changer for the Sunshine Coast. An online consultation hub, launched in January 2012, attracted more than 2,900 visits.

The task force presented its report, titled "A Line in the Sand" to Council in August 2012. It recommended:

1. A new rapid transit system, such as light rail, is a "game changing" project with the potential to transform the future of the Sunshine Coast.
2. Council endorse the next step toward the Sunshine Coast Light Rail 2020 vision by proceeding to Stage 2, full feasibility and business case.
3. The options to be considered should include:
   - The reference case; light rail at-grade;
   - A hybrid option for light rail with some sections elevated; and
   - Possibly a bus rapid transit option if it has the potential to meet longer term patronage requirements.

4.2.2 2015 – Sunshine Coast Light Rail – route options

Consultation was undertaken in late 2014 based on a detailed Route Options and Impact Assessment report. The report covered both transport needs and urban change opportunities. Feedback contributed to the selection by Council of a preferred route along the coast from Maroochydore to Caloundra for further study through is decision at the Ordinary Meeting 23 April 2015 (OM15/59):

That Council:

(b) confirm the recommended light rail route corridor with which to proceed to more detailed feasibility and business case studies

[44] Mass transit is a form of public transport that concentrates on moving large numbers of people over a fixed route or network.

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4.2.3 2019 – Integrated Transport Strategy

Council undertook market research and community consultation between November 2017 and July 2018 to help shape the *Integrated Transport Strategy*, which was endorsed in early 2019. Key findings from the market research and community consultation relevant to the Project have been integrated with the Options Analysis.

4.3. The Sunshine Coast Mass Transit Strategic Business Case

The Strategic Business Case was approved by Sunshine Coast Council in July 2019. It drew upon previous work undertaken in Council's 2012 'A line in the sand' report and comprised the first stage of the formal business case assessment of the Project.

The Strategic Business Case identified that as a region experiencing strong population growth, the Sunshine Coast is at a critical juncture in its evolution as emerging issues challenge the region's economic growth, productivity and lifestyle, liveability and sustainability aspirations.

Given the very high levels of car dependence, promoting public transport as a viable alternative for accessing key activity centres within the region and as a trigger for greater urban consolidation, will be essential to addressing these issues.

According to the Strategic Business Case, the key growth management challenges for the Sunshine Coast Region include:

- Growing levels of road congestion on key arterial roads within the Sunshine Coast Region, resulting in increasing costs of congestion, lost productivity and less time spent with families and other lifestyle pursuits
- An accelerating trend towards urban expansion on the Sunshine Coast in response to dwelling demand, leading to a greatly expanded urban area, with additional costs to Government and undermining the ability of the public transport system to operate efficiently
- A high level of dependency on private vehicle transport, resulting in low levels of public transport use and demand for more roads and car parking which will undermine urban amenity and lifestyles
- The need for continuing activity to broaden the local industry base to support continued high levels of employment self-containment. Without these efforts, there is a heightened risk of decline in the local economy and increased long distance commuting to metropolitan Brisbane, with its resultant social and environmental impacts.

4.3.1 The Service needs identified by the Strategic Business Case

According to the Strategic Business Case, the growth management challenges identified above can be addressed by meeting three key service needs:

- A major improvement to mass transit to provide an integrated network connecting the major activity centres and dwelling areas and linking it to Brisbane. This will reduce congestion, and free up road space for freight and commercial traffic
- A coordinated strategy in relation to urban consolidation, with a focus on the Sunshine Coast Urban Corridor to provide a settlement pattern that can reduce car dependency and the amount of travel required in the community
- A continuing program to expand and connect local industries in areas close to mass transit, to allow a greater number of residents to live closer to their places of employment and provide easier accessibility to those economic and employment areas.

4.3.2 Initiative assessment

The Strategic Business Case identified and assessed 17 current and potential initiatives that are and could be progressed by the Council or the Queensland Government to address the challenges and meet the service needs. These comprised a mix of:

- Non-capital initiatives; policy reform, review of operational activities, making better use of existing facilities
- Capital initiatives; the creation of new infrastructure facilities and assets.

The initiatives included:

- ten non-capital initiatives covering reform and better use
- one capital initiative to improve roads
- six capital initiatives to improve mass transit.

4.3.2.1 Non-capital initiative options

An assessment of the non-capital initiatives showed that:

- Eight current initiatives are not sufficient in their own right to address the challenges of growth management on the Sunshine Coast. They should continue to be developed as part of current planning and project development processes. They will form the basis of the 'Base Case' or 'without project case' against which any future investment could be measured.
- An initiative based solely on land use change will not adequately address challenges nor fully realise desired benefits. However, to achieve the stated urban outcomes, a land use strategy should be considered in conjunction with any preferred mass transit solution as the integration of land use and transport planning is critical to achieving optimal economic and social policy outcomes for the region.
- Implementation of significant road travel demand management and restraint of car parking supply will be insufficient to respond to the major growth in travel expected, even if this were acceptable to community stakeholders but would necessarily be required to accompany any preferred mass transit solution.

4.3.2.2 Capital initiative options

Continual major upgrades to the road network could be made under a business-as-usual approach, based on perpetuating existing travel behaviour which relies on driving and parking cars for most trips. However, this will reduce the amenity and liveability of the region, in particular making its major activity centres and beachside precincts places for cars, not people. While a program of major road investment will be needed in a growing region, it should not be the sole response, given the long-term impacts of congestion and car dependency.

Of the six mass transit system options examined in the Strategic Business Case, the option of investing in a major new mass transit system linking the existing urban areas to each other and to the rest of SEQ region was preferred. This is depicted in the strategic plan for a future mass transit system in the region as shown in Figure 21[45].

[45] Sunshine Coast Mass Transit Strategic Business Case (2019).

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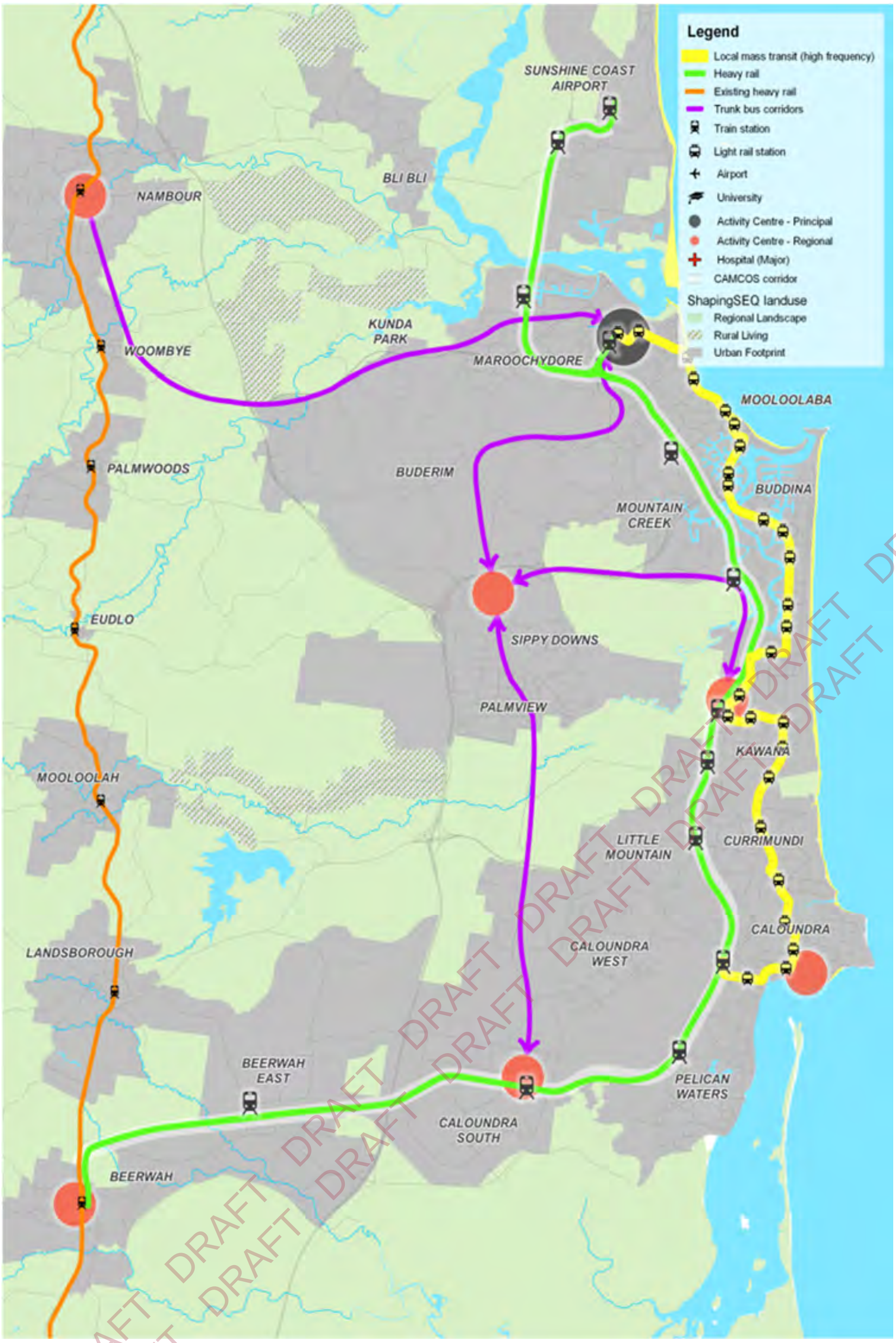

Figure 21 – Proposed mass transit network strategic plan for the Sunshine Coast from the Strategic Business Case

A strategic merit test was then applied to the proposed mass transit strategic plan for the Sunshine Coast to determine the best performing stages. The strategic merit test outcomes and subsequent staging considerations were used to develop a geographic staging plan for the transport network and to identify priority focus areas for short, medium, and long-term investigations and subsequent investment. This is shown in Figure 22[46].

[46] Sunshine Coast Mass Transit Strategic Business Case (2019).

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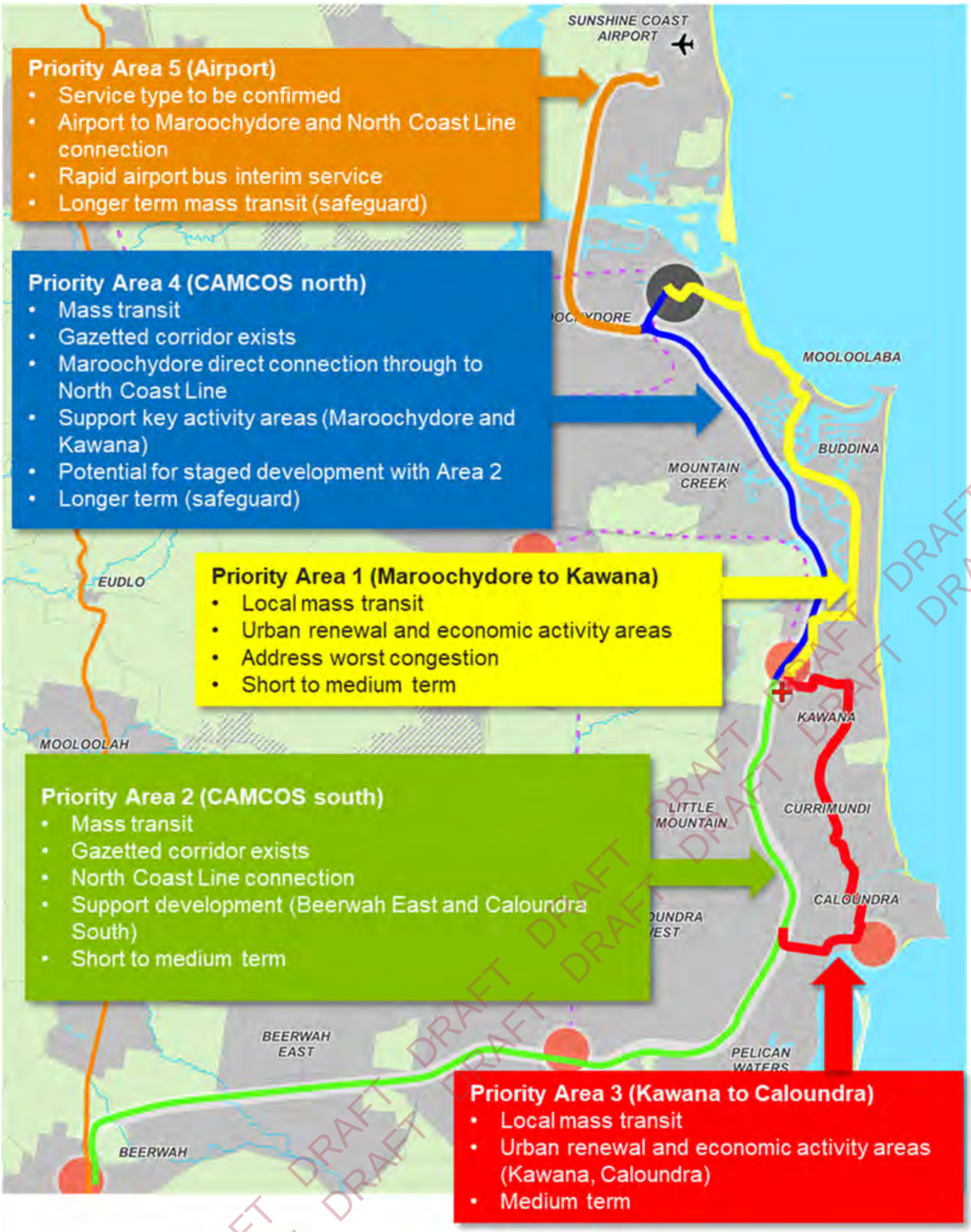

Figure 22 – Geographic breakdown and focus areas for a SCMT solution from the Strategic Business Case

4.3.3 Strategic Business Case recommendations

The Strategic Business Case recommended Council proceed with the development of a Preliminary Business Case (now called Options Analysis) for the Project noting the sequencing of the priority areas identified in Figure 22. The Strategic Business Case also recommended the concept for the mass transit system must be based on a technology that offers a high quality service, capable of attracting a significant proportion of passengers out of cars. It recommended the mass transit technology should also have a demonstrated capability to facilitate urban change in the SCMT corridor.

This draft Options Analysis has been developed in accordance with the recommendations of the Strategic Business Case and progresses the analyses to a more detailed level.

STRATEGIC CONTEXT

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5. Strategic Context

The purpose of this chapter is to provide the strategic context to the Project including alignment with strategic planning and policies, as well as drivers of transport and dwelling demands that will impact current and future service needs for the Sunshine Coast Urban Corridor.

5.1. Alignment with Council vision and priorities

5.1.1 Corporate vision

Council has embraced the long-term aspirational vision to be *'Australia's most sustainable region. Healthy. Smart. Creative'.* Strategic priorities for 2021 – 2025 include:

- Integrate transport and land use planning to support self-contained and connected communities
- Support community connectedness through planning, investing, and advocating for an improved transport system
- Apply a 'one network' approach in advocating for and providing an integrated transport system.

5.1.2 Sunshine Coast Planning Scheme 2014

The Council's vision for a sustainable region is underpinned by a growth management strategy established in the *Sunshine Coast Planning Scheme 2014*. This sets out Council's intention for future development in the planning scheme area until 2031. Major elements that underpin the growth management strategy include:

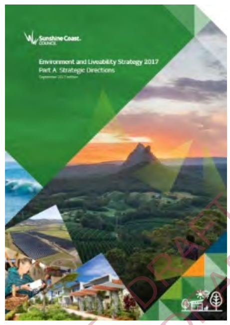
- Concentration of population growth and economic activity in the corridor from Beerwah to the Sunshine Coast Airport which will contain at least 80 per cent of future population growth and over 75 per cent of future employment growth within the Sunshine Coast Region.
- Ongoing self-containment of employment, whereby the majority of people continue to live and work within the Sunshine Coast Region.
- A high quality integrated and efficient public transport network including the North Coast Rail Line, the dedicated public transport corridor (Caboolture and Maroochydore Corridor Options Study (CAMCOS)), a high-quality mass transit system in the Sunshine Coast Urban Corridor between Maroochydore and Caloundra. This will be supported by other shared road and public transport corridors which link communities to major business, tourism, education, health centres to create high levels of local and regional accessibility.

5.1.3 Sunshine Coast Regional Economic Development Strategy 2013-2033

The Sunshine Coast Regional Economic Development Strategy 2013 - 2033 provides a 20-year vision and blueprint for sustainable economic growth. The strategy has been developed by regional business, industry and local Government leaders and informed through contributions from Sunshine Coast residents and community organisations. The strategy seeks to ensure the Sunshine Coast Region realises its full potential, with a confident future and as an active participant in the global economy, which in turn will deliver the lifestyle and opportunities for residents and businesses alike.

An important element of the strategy is the Sunshine Coast Enterprise Corridor (defined as the corridor from the Sunshine Coast Airport to Caloundra South), as the key area for commercial and residential growth. Providing a major improvement of the mass transit system in the region can support the implementation of the strategy under the second pathway, by providing reliable connectivity between the population and employment centres in the Sunshine Coast Enterprise Corridor.

5.1.4 Sunshine Coast Environment and Liveability Strategy 2017



The Sunshine Coast Environment and Liveability Strategy 2017 provides long-term strategic direction to shape the region by guiding growth and delivering the change required to maintain a healthy environment and liveable Sunshine Coast in 2041 and for future generations. The strategy notes the majority of Sunshine Coast residents live in large detached low-density dwellings with a reliance on private car travel and limited access to frequent public transport, which is placing significant pressure on finite resources and existing infrastructure. The strategy explains that an emphasis on urban change in the coastal areas of the region, supported by appropriate infrastructure can create a new way of living and minimise impacts on the natural environment and providing a diversity of dwellings to meet the needs of the population.

5.1.5 Sunshine Coast Integrated Transport Strategy 2019

The Sunshine Coast Integrated Transport Strategy presents a vision to achieve a connected, smart, safe and efficient transport system that contributes to the region's economic viability, sustainability and lifestyle. It guides the development of the transport system to meet growing demand for services and infrastructure while encouraging a shift to more sustainable modes, creation of new travel choices and readiness for smart mobility.

The strategy also establishes a policy that integrated transport and land use outcomes should be achieved on the Sunshine Coast. This includes how a more compact urban form focused around high-frequency passenger transport corridoes will reduce car dependency, manage congestion and reduce impacts of development and transport on the natural environment. A mass transit investment features heavily in the strategy, including as a potential solution to providing high-frequency public transport connections between key centres to ensure adequate capacity to accommodate growth and deliver travel time competitiveness.

5.1.6 Sunshine Coast Community Strategy 2019 – 2041

The Sunshine Coast Community Strategy provides a long-term framework for how Council and the community will work together to advance the shared goal of a strong community to 2041. The Sunshine Coast Community Strategy aims to achieve five outcomes:

- Empower the community to live **healthy** and **active** lifestyles
- Focus on ensuring community places and spaces are **vibrant**, inclusive, accessible, adaptable and meet the needs of people of all ages, abilities and backgrounds
- Strengthen connection, **inclusion** and opportunity for all people in the community
- Build capacity in communities to be **connected**, **resilient** and to respond to local issues
- Nurture **creative** and **innovative** approaches to building a strong community.

The Sunshine Coast Community Strategy Action Plan outlines the key priorities to achieve the five desired outcomes. It also provides a clear approach to regular measuring and reporting of progress towards achieving these outcomes.

5.1.7 Sunshine Coast Council's Urban Transformation Directions Paper 2017

As part of its input to *ShapingSEQ*, the Council developed the Urban Transformation Directions Paper which identifies key issues to be addressed including economic and financial sustainability, transport and congestion, community needs and affordability and natural and landscape values. The paper identifies gaps in employment, education and entertainment opportunities, and the impacts of doing nothing including increased congestion, reduced urban quality, reduced travel options and air quality impacts.

5.1.8 Sunshine Coast Council Parking Management Plan 2017

Car parking plays an important role in managing access to major activity centres. With the very high rates of car ownership prevailing in the region, if a traveller thinks they can find a free or cheap car park in a busy centre, they are most likely to drive rather than use public transport. At the same time, providing larger areas of free or cheap car parking reduces the amenity and walkability of the major centre, and requires the use of land and assets that could be utilised for more people-oriented uses such as greenspace and commercial tenancies.

On 12 October 2017, Council adopted the Sunshine Coast Council Parking Management Plan and associated 37 Local Area Parking Plans. The Parking Management Plan is an important part of the overall Sunshine Coast transport system and Council's commitment to long-term planning for the Sunshine Coast. The intent of the Parking Management Plan is to achieve an appropriate supply, not an oversupply of parking, recognising different parking needs of individuals at different times of the week and year.

5.2. Alignment with Queensland Government plans and policies

5.2.1 South East Queensland Regional Plan 2017 - *Shaping SEQ*

Recognising the need to sustainably manage the region's growth, the Queensland Government set clear directions for the future development of the Sunshine Coast through the *ShapingSEQ*. The plan identifies the need for balanced and managed growth including setting benchmarks for the provision of dwellings by way of consolidation and expansion of 62 per cent and 38 per cent respectively for the Sunshine Coast. To cater for increased urban consolidation, *ShapingSEQ* identifies an urban corridor from Maroochydore to Caloundra, supported by a high frequency passenger transport service. This would result in the urban corridor between Maroochydore and Caloundra becoming a cohesive corridor of distinctive, high quality urban environments that are typically 'Sunshine Coast' in character and optimise access to future passenger services.

5.2.2 State Infrastructure Plan 2016

The State Infrastructure Plan (SIP) sets out the Queensland Government's strategic direction for infrastructure by identifying what is required from infrastructure (objectives) and how these objectives can be best achieved (directions). These objectives and directions seek to address the high-level challenges Queensland will face over coming decades.

5.2.3 South East Queensland Regional Transport Plans 2021

The suite of three regional plans comprising the SEQ Regional Transport Plan was approved by the Hon. Mark Bailey, Minister for Transport and Main Roads on 8 March 2021. The North Coast Regional Transport Plan identifies key challenges for the North Coast Region including high reliance on cars, congestion, dispersed settlement pattern and mobility and accessibility for an ageing population. It should be noted the North Coast Regional Transport Plan covers Moreton Bay, Somerset, Noosa and Sunshine Coast LGAs. Priorities policies and actions in the plan are grouped under four areas:

Grow | **Prosper** | **Sustain** | **Live**

Table 11 – Priorities policies and actions in the SEQ Regional Transport Plan

Grow	• Urban consolidation and high-quality design, particularly in and around activity centres and along existing and planned PT corridors. • Connecting expansion areas such as Palmview, Caloundra South, Beerwah East, Caboolture West, North Lakes–Mango Hill and Warner to PT. • Improving safety and key connections in rural areas.
Prosper	• Improved freight routes, such as the Bruce Highway, D'Aguilar Highway and North Coast Rail Line. • Increased PT connecting activity centres and regional economic clusters (e.g. Noosa, Nambour, Maroochydore, Mooloolaba, Kawana, Caloundra, Caloundra South, Beerwah, Caboolture, Redcliffe, North Lakes, Morayfield and Strathpine). • Improving data accuracy and usage through smart infrastructure, real-time data and artificial intelligence.
Sustain	• Infrastructure is improved and built to minimise the impacts of flooding and incidents, such as on the Bruce Highway, Gympie Road, Sunshine Motorway and North Coast Rail Line. • Network and incident management is improved to minimise impacts of closures and disruptions. • Prioritisation of active transport. • Provision of low and zero emission vehicle infrastructure. • Infrastructure and services that minimise impacts on scenic landscapes and ecological areas.
Live	• Safe walking and bike riding is prioritised within local neighbourhoods and activity centres. • Transport choice is improved via options appropriate for the demand and land-use, including community and school transport. • Transport options for people across all demographics. • Personalised transport such as ride share

5.2.3.1 Short term actions in the North Coast Regional Transport Plan for mass transit in Sunshine Coast Region

A2.03 Maroochydore to Caloundra integrated urban public transport	Work in partnership with Sunshine Coast Council to develop a business case for an integrated urban public transport solution for Maroochydore to Caloundra.
A2.12 Sunshine Coast Airport to Beerwah public transport planning	Undertake strategic planning for the southern Sunshine Coast's public transport network to determine the most appropriate public transport modes, routes and ancillary infrastructure. Identify an ultimate preferred network, staging and delivery strategy.
A2.17 Maroochydore City Centre road corridor planning	Undertake planning in partnership with Sunshine Coast Council to establish reliable and safe arterial road connections to and from Maroochydore City Centre, through cost-effective and staged intersection and link capacity upgrades to ensure that development of the principal regional activity centre, and resulting economic growth and employment opportunities, is not constrained.
A2.22 Sunshine Motorway upgrade planning	Undertake planning for staged upgrades of the Sunshine Motorway and extension across the Mooloolah River to the Roys Road Interchange on the Bruce Highway, including planning for the Kawana Arterial and Bells Creek Arterial, to achieve a reliable and safe primary road spine for the Sunshine Coast.
A2.23 Nambour to Maroochydore public transport planning	Investigate extending a high-frequency bus connection and bus priority measures from Nambour to Maroochydore.
A2.24 Noosa to Maroochydore public transport planning	Investigate providing a high-frequency public transport and bus priority measures from Noosa to Maroochydore.

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A2.28 Green bridge and link planning	Work with local Governments to undertake planning to identify and review the need for green bridge/link opportunities to connect strategic active or public transport links.
A2.33 Transit oriented developments	Identify opportunities to develop and encourage transit-oriented developments (TOD) within the North Coast Region. Collaborate with local Governments, infrastructure project teams and other state agencies to support increased public transport mode share, residential and employment density at appropriate transport hubs. TOD sites for investigation include key transport nodes on the Caboolture and Redcliffe Peninsula rail lines as well as on future trunk-corridors (Caloundra to Sunshine Coast Airport). Options include Mango Hill (short-term), Kallangur, The Mill Priority Development Area, and locations on the southern Sunshine Coast (medium/long-term).

5.2.4 Maroochydore City Centre Priority Development Area (PDA)

Maroochydore has an important function for the region in accommodating major retail centres, Government services and residential areas for permanent residents and holiday makers alike. To support the growth of Maroochydore into a regional central business district (CBD), Council, in partnership with the Queensland Government, has progressed the Maroochydore City Centre Project. A 62-hectare greenfield site in the heart of Maroochydore is being transformed into a CBD for the 21st Century, offering major investment and development opportunities. Given the economic and community importance of the Maroochydore CBD, accessibility and connectivity to and around the City Centre will be essential. A complementary public transport solution such as the Project is an essential element of the success of the Maroochydore City Centre in boosting the economic productivity of the region.

5.2.5 SEQ City Deal 2019

City Deals are tailored agreements between Australian Government, Queensland Government and local Government aimed at creating new jobs, accelerating economic growth, and aligning governments, industry and the community to achieve productive and liveable cities. First introduced in 2016 under the Australian Government's Smart Cities Plan, City Deals signal a new mechanism to develop collaborative plans for growth, renewal and reform. A City Deal is a long-term commitment which outlines the investments, planning governance and actions needed to implement them[47].

Transforming SEQ: The SEQ City Deal Proposition, released in February 2019, sets out the shared vision of the Queensland Government and the SEQ Council of Mayors to fully realise SEQ's potential to contribute to Australia's economic success – focussed on delivering one region that is connected locally and competing globally.

Relating to transport system improvements, the City Deal Proposition provides:

- **Proposed objective:** transforming regional connectivity to support a 45-minute region and 30-minute cities, with better mobility for people, goods and services.
- **Proposed focus areas:**

1. Alignment of planning and prioritisation	2. Connecting our activity and growth centres	3. Optimising our network	4. Connecting our markets

The Project aligns well with the proposed objective and focus area two in particular.

[47] Council of Mayors and the Queensland Government. 2019. TransformingSEQ – The City Deal Proposition. P 16.

5.2.6 Other initiatives related to the mass transit on the Sunshine Coast

To support the objectives of *ShapingSEQ* and the Urban Transformations Directions Paper, the following land use and regional development projects and initiatives are being progressed by the Queensland Government and the Council including:

- Caloundra South PDA, led by Queensland Government
- Sunshine Coast Airport Expansion Project, led by Council (now complete)
- Sunshine Coast International Broadband Submarine Cable network, led by Council (now complete).

Several transport projects and initiatives are currently under consideration to support sustainable management of growth including:

- Southern Sunshine Coast Public Transport Strategy – the aim is to develop an integrated strategy for the southern Sunshine Coast which covers the area from Maroochydore to Beerwah. It will have a specific focus on identifying a preferred trunk public transport network with a supporting network of services, land-use planning and public infrastructure. The intent is to provide an alternative transport solution to cars to reduce traffic congestion. Stage 1 was completed in November 2017 and Stage 2 is currently underway.
- North CoastConnect Business Case – a three stage rail project proposed by a consortium in response to the Australian Government's fast rail prospectus which intends to provide better connections between the Brisbane, Moreton Bay and Sunshine Coast Regions. The project would consist of three key stages of work including:

Stage 1A:	Upgrade of existing section of North Coast Rail Line from Brisbane to Beerburrum
Stage 1B:	Beerburrum to Nambour Rail Upgrade Project
Stage 2:	CAMCOS – a new passenger rail service branching off the North Coast Rail Line at Beerwah and comprising a 40 kilometre spur-line.

The North CoastConnect Business Case has recently been evaluated by IA.

- North Coast Rail Line Upgrade – the Beerburrum to Nambour Rail Upgrade Project includes a duplication of the North Coast Rail Line between Beerburrum and Landsborough and a range of upgrades to the existing rail infrastructure between Landsborough and Nambour. It aims to address conflicts on the North Coast Rail Line between passenger and freight services north of Beerburrum. However, it is a more modest proposal than North CoastConnect and does not offer a fast commute from Nambour to Brisbane.
- Business Case for the Mooloolah River Interchange (MRI) – TMR is progressing delivery of a range of major road upgrades in the area of Sunshine Motorway including a new motorway standard arterial road from the MRI past the hospital to Corbould Way, expanded lane connections, new river crossing and intersection upgrades. It is expected the MRI will improve safety on the Sunshine Motorway near the Mooloolah River, improve network access to the SCUH precinct and Kawana Town Centre, and improve travel time reliability. TMR has completed the Detailed Business Case which is undergoing an internal assurance process within the Queensland Government.

5.3. Alignment with Australian Government plans and policies

5.3.1 Australian Infrastructure Plan 2016

The Australian Infrastructure Plan (AIP) provides a positive reform and investment roadmap for Australia. The plan sets out the infrastructure challenges and opportunities Australia faces over the next 15 years and the solutions required to drive productivity growth, maintain and enhance the nation's standard of living, and ensure Australian cities remain world class. The AIP identifies a strong need for Australia to upgrade its urban passenger transport networks, so they are more integrated, have higher capacity and are able to meet the twin demands of population growth and rising expectations for service levels. In particular, the AIP identifies the Sunshine Coast as a key region of Australia, alongside the eight capital cities and other key regions such as Newcastle, Wollongong, Geelong, and the Gold Coast. A key recommendation from the AIP is that the Sunshine Coast should be supported by Governments, businesses and local communities to grow its population and economy.

5.3.2 Smart Cities Plan 2016

The Smart Cities Plan, developed by the Department of the Prime Minister and Cabinet sets out the Australian Government's vision for cities and outlines three pillars of Smart Investment, Smart Policy and Smart Technology. The Smart Cities Plan identifies that most world-class cities have invested in fast, efficient public transport systems to provide viable alternatives to private passenger vehicles.

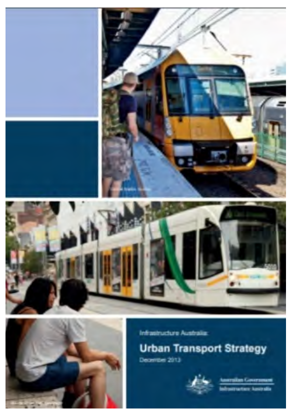
A major investment in a mass transit system for the Sunshine Coast can aim to achieve the Smart Cities Plan concept of a '30-minute city' for the Sunshine Coast by delivering a high-frequency service connecting key education, employment, residential and recreation centres.

5.3.3 State of Australian Cities 2014 – 15

The State of Australian Cities 2014-2015 report, developed by the Department of Infrastructure and Regional Development, analyses cities in relation to population, settlement, economy, human capital and infrastructure and transport. The report states that issues of space and the potential conflicts and usability of cities, long-term capacity of freight hubs and the movement of goods and people are key concerns for the continued growth of productive cities.

Australia's cities are now increasingly characterised by the significant spatial divide between areas of highly productive jobs and the areas of population-based services. The Project seeks to encourage the desired urban growth strategy through facilitating sustainable higher density development in the Sunshine Coast Urban Corridor by providing mass transit as a viable alternative to car use in congested areas, featuring frequent and reliable services with good network integration. The Project will also seek to deliver easy and accessible links to key economic activity areas within the southern corridor and the broader city area.

5.3.4 Urban Transport Strategy 2013



The Urban Transport Strategy, prepared by IA in 2013, identifies the following as key transport issues for consideration in the context of city growth:

- Integrating transport systems
- Integrating long-term infrastructure and land use planning
- The impact of urban transport systems on productivity
- The importance of urban access and equity, coherent and consistent funding and financing, consistent measurement and reporting of results.

The Australian Government has a strong interest in ensuring urban transport systems allow for productive national outcomes and that systems are planned in conjunction with the planning for urban change. The strategy states that, while large infrastructure projects are not the only urban transport issue, they can be very influential on system performance and land use over time. Finding the right balance between private car use and public transport is a key issue which impacts not only on travel but also on freight.

The Project objectives for the Sunshine Coast Urban Corridor closely align with the objectives of the strategy by seeking a more efficient, resilient and integrated transport system. The determination of the type of mass transit in the Sunshine Coast Urban Corridor is a key proposition in the Options Analysis in conjunction with coordinated urban change to give effect to the priorities of the Australian and Queensland Governments, and the Council.

5.3.5 Corridor Protection - Planning and investing for the long term 2017

This reform series report prepared by IA identifies an opportunity for Australian Governments to deliver an enduring legacy to future generations by protecting critical infrastructure corridors. At a time when Australia is undergoing a profound change, in the form of an expanding population and significant growth, corridor protection efforts need focused attention from Governments. Failing to protect corridors can result in a preferred alignment for a project being 'built out'. The IAreport provides an example of corridors that should be considered for protection, including land that may be required to accommodate public transport improvements in and around existing centres (in the context of Governments encouraging greater use of public transport). Reserving the preferred corridor limits development on the land required for the Project that would otherwise add to project costs (subject to timing of construction).

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SERVICE NEEDS AND BENEFITS

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6. Service Needs and Benefits

6.1. Strategic context

Key aspects of the strategic framework and objectives relevant to the service needs are summarised in this section to assist in framing subsequent discussion in this chapter.

6.1.1 Sustainable management of population growth

As discussed in section 4.1.1, SEQ is expected to continue to experience strong population growth, creating pressures on dwellings, transport, lifestyle and the environment.

Both the Australian and Queensland Governments have recognised the challenges of managing strong forecast population growth in a manner which is sustainable and promotes high quality lifestyles. This includes recognising and responding to a trend towards increased urbanisation, and the social and environmental challenges this can create.

6.1.2 The challenge for the Sunshine Coast

Prior to the COVID-19 pandemic, the population of SEQ was projected to grow by approximately 1,749,000 between 2019 and 2041. Approximately 190,000 people or 11 per cent of this total growth was projected to occur in the Sunshine Coast, increasing the 2016 population of 303,400 by over 70 per cent to approximately 518,000[48]. The effects of the pandemic on population projections have yet to be determined, but present indications are that there has been no slowing in the growth of the Sunshine Coast.

The region is highly car-dependent, with over 85 percent of trips taken in small private or commercial vehicles. Car ownership per household is also increasing[49].

Without intervention to support more sustainable transport modes and reduce car use, the Sunshine Coast Integrated Transport Strategy projects an additional 830,000 daily vehicle trips on the Sunshine Coast transport network by 2041, which represents a 70 per cent increase from 2016.

Forecast population growth is expected require the provision of at least 87,000 new dwellings across the region. Due to existing urban settlement patterns and geographic constraints, the Sunshine Coast is facing a major challenge in how it accommodates the forecast growth in population and dwellings.

If the Sunshine Coast accommodates forecast population growth predominantly through urban expansion, this will result in urban encroachment on the region's natural resources including environmentally significantly land, rural areas and agricultural areas. An expanded urban footprint would also require significant investment in provision of infrastructure and services over a larger geographic area.

Both Sunshine Coast Council and the Queensland Government recognise there must be a strong focus on accommodating future population growth through urban consolidation. This is reflected in *ShapingSEQ*, the Sunshine Coast Integrated Transport Strategy, the *Sunshine Coast Planning Scheme 2014* and the Sunshine Coast Environment and Liveability Strategy.

ShapingSEQ sets a benchmark of 62 per cent of new dwellings provided on the Sunshine Coast between 2016 and 2041, to be delivered by way of urban consolidation, similar to the average SEQ region wide target of 60 per cent. This translates to an estimated 53,700 new dwellings in the existing urban area of the Sunshine Coast over the next 25 years[50].

[48] The medium level forecast for Sunshine Coast LGA. Queensland Government Statistician. 2018. Population Projections, Regions.
[49] Sunshine Coast Council. 2019. Integrated Transport Strategy. p22
[50] Department of Infrastructure, Local Government and Planning (2017). *ShapingSEQ*, *p120*. Accessed at: https://dilgpprd.blob.core.windows.net/general/shapingseq.pdf

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6.1.3 The Sunshine Coast Urban Corridor

Council has responded to the expected growth challenge and assessed the ability to accommodate forecast population growth through urban consolidation.

Under the terms of *ShapingSEQ*, urban consolidation can be achieved through:

- Development of some parcels of land that are presently not developed but that sit within existing urban areas
- Redevelopment of existing vacant land or buildings in existing urban areas for a higher intensity use that includes a significant proportion of residential accommodation
- Development of new lots within the existing urban area, i.e. on the immediate urban fringe.

Council's Urban Transformation Directions Paper observe that when combined with mixed-use development to include local services and attractions, the urban consolidation processes above could be termed 'urban transformation'[51].

Urban consolidation can occur across the region, generally wherever there is existing urban development with capacity to support additional dwellings. As noted in *ShapingSEQ*, one key opportunity to achieve sustained urban consolidation occurs within the 24 kilometre urban corridor between Maroochydore and Caloundra, known as the Sunshine Coast Urban Corridor.

Consistent with recommendations of the relevant Queensland Government and Council policies and plans, the Sunshine Coast Urban Corridor can play a strong role in fostering more sustainable travel patterns, catalysing substantial employment growth and providing greater accessibility to all the lifestyle advantages the Sunshine Coast offers.

In recognition of this, and to support the strategic framework established by the growth management policies and strategies of all three levels of Government, the Strategic Business Case identified mass transit as an essential enabler of integrated land use, economic and transport planning outcomes within the Sunshine Coast Urban Corridor.

6.2. Overview of challenges

This section outlines the challenges to be addressed during the Options Analysis stage. These challenges are aligned with those defined in the Strategic Business Case (refer to Section 4.2.1) but have been updated and reframed in accordance with the four key themes of:

1. An accelerating trend towards urban expansion
2. High dependency on private car transport
3. Growing levels of road congestion
4. Economic, liveability and environmental sustainability challenges.

The challenges identified in this chapter are further developed in Table 12.

Table 12 – Challenges, problems and opportunities for sustainable management of growth in Sunshine Coast Region

Identified challenges	Problem and opportunity statement
An accelerating trend towards urban expansion	
Cost of urban expansion	Continued urban expansion will increase transport costs, traffic congestion costs, and productivity, environmental, social and infrastructure connection costs.
Reversing the current dominance of low-density dwellings	The lack of affordable and type of dwelling in the Sunshine Coast Urban Corridor has led to a migration to urban expansion development areas where greater stock and dwelling affordability is available and can be supplied quickly.

[51] Sunshine Coast Council (2017). *Urban Transformation – Directions Paper for the future of the Sunshine Coast, P 20*. Accessed at: https://d1j8a4bqwzee3.cloudfront.net/~/media/Corporate/Documents/Planning/Light%20Rail/SCC_UrbanTransformationDirectionsPaper_Web_170131.pdf?la=en

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Identified challenges	Problem and opportunity statement
High dependency on private car transport	
Public Transport challenges will hinder urban and economic growth	Existing challenges identified with the Public Transport system within the Sunshine Coast Region will inhibit the achievement of strategic urban and economic growth targets.
High dependency on private cars and declining PT use	The car dependency of current transport mode share trends in the Sunshine Coast places high pressure on the existing road network and will not support the liveability and economic attractiveness of the Sunshine Coast Urban Corridor necessary to deliver urban consolidation objectives. This lack of support will be exacerbated if combined with urban expansion.
Growing car parking demand	Plentiful supplies of free and low cost car parking will support growth of car travel, occupy valuable spaces in major centres and work against travel behaviour change.
Growling levels of road congestion	
High level of road congestion on key arterial roads in the Sunshine Coast	Congestion is currently occurring in key areas on the Sunshine Coast in peak times including on key routes in the Sunshine Coast Urban Corridor.
Effects of congestion on business and industry	Road congestion will reduce the likelihood of the region reaching its urban consolidation benchmarks and delay or inhibit urban change opportunities. In particular, the coastal areas that are also tourist precincts will likely suffer reduced attractiveness to visitors due to congestion. This will result in decreased income for businesses and industry and will also result in decreased agglomeration benefits, which occur when there is an increase in effective density due to reductions in transport accessibility.
Liveability and environmental sustainability challenges	
Impacts of reduced levels of employment self-containment	The present high level of employment self-containment in the Sunshine Coast presents an opportunity to provide effective PT and reduce negative environmental externalities associated with long trips in cars. Failure to act may see people attracted to jobs in metropolitan Brisbane.
Future jobs and productivity growth	Lack of physical connectivity between the major activity centres of the region, reduced business-to-business interaction (reduced agglomeration and clustering opportunities) and the lack of reliable access to local workforce are impacting the ability to attract new growth in employment opportunities and development of a broader industry base.
Impacts of growth on the natural environment	Catering for population growth by urban expansion can undermine the quality and extent of the natural environment. Urban consolidation provides an opportunity to deliver affordable lifestyles in the coastal precincts and reduce the amount of urban expansion required.
Increased environmental externalities	Urban expansion and reduced levels of employment self-containment will sustain very high levels of car dependence, increase the amount of travel, and the level of energy consumption and emissions from transport activity. Energy consumption is higher due to less efficient transport practices, and there are increasing emissions which affect air and noise quality, and emission of greenhouse gases.
Climate change resilience	Increasing travel demands, made in more vehicles powered by fossil fuels will hinder the region's ability to respond to climate change imperatives.

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6.3. Problem 1 – An accelerating trend towards urban expansion

Projections produced by the Queensland Government Statistician's Office (QGSO) in 2018 show the population of the Sunshine Coast growing from 303,400 in 2016 to at least 518,000 in 2041. It is anticipated the region will require a minimum of 212,877 dwellings, an increase of at least 87,000 dwellings from 2016[52].

Since the 1980s, the Sunshine Coast Region has experienced significant pressure for urban expansion which is impacting its ability to sustainably accommodate and appropriately service this population growth. Recent releases of major new housing areas at Caloundra South and Palmview are examples of this (see section 6.3.3), and intervention is required to maintain the region's attractive lifestyle and amenity. The dimensions of this problem can be better understood by considering the effects of continuing urban expansion.

6.3.1 Less affordable living

While the Sunshine Coast lifestyle remains one of the region's strengths, community and visitor surveys suggest that it is being increasingly perceived as having poor affordability and a high cost of living[53]. In 2018 the Sunshine Coast was rated one of the least affordable dwelling markets in Australia[54]. There is currently a lack of affordable dwellings in the Sunshine Coast Urban Corridor for example, in major centres such as Maroochydore, Mooloolaba and Caloundra, the median house prices are $640,000, $870,000 and $530,000[55] respectively. The exception is Kawana with a significantly lower median house price of $300,000. The median house prices in the Sunshine Coast Region's economic centres are considerably higher than the median house price of Queensland which is $400,000.

The high property prices in cities such as Brisbane, Sydney and Melbourne have increased the rates of migration to areas such as the Sunshine Coast. A resurgence of the tourism industry and a number of infrastructure projects, including the second stage of the SCUH, and the Caboolture Hospital redevelopment is expected to maintain economic activity and further drive migration and population growth. The associated increase in dwelling demand saw property prices rise in the region by 6.1 per cent in the 12 months to June 2018, compared to 3.1 per cent in Brisbane. This trend is expected to continue, with Sunshine Coast property prices predicted to cumulatively increase 9 per cent over the next three years to June 2021[56].

As of January 2019, median house prices on the Sunshine Coast were materially higher than those in Brisbane for the first time since July 2008[57]. There is a wide range of factors that influence dwelling affordability, including aspects that are outside the jurisdiction of local government. However, the way in which growth is managed plays a significant part. The concept of 'affordable living' implies a more comprehensive response than simply providing an ample supply of new land for development. It also requires thinking about the type of dwellings available and where it is located in relation to employment, facilities and services.

While the initial purchase price of new dwellings may be less expensive in outer areas, the on-going cost and time associated with travel to jobs, education and services can be significant[58]. The higher median house price of the Sunshine Coast will potentially encourage homebuyers to consider other areas outside the Sunshine Coast Urban Corridor. This would further impede the ability to realise the *ShapingSEQ* urban consolidation benchmarks.

[52] Department of Infrastructure, Local Government and Planning (2017). *ShapingSEQ, p120*. Accessed at https://dilgpprd.blob.core.windows.net/general/shapingseq.pdf
[53] Sunshine Coast Council (2017). Urban Transformation – Directions Paper for the future of the Sunshine Coast, P 11.
[54] Demographia (2019). 15th Annual Demographia International Housing Affordability Survey (2018: 3rd quarter).
[55] Realestate.com.au. *Neighbourhoods.* Accessed at https://www.realestate.com.au/neighbourhoods
[56] QBE (2018). *QBE Australian Housing Outlook 2018-2021*. Accessed at: https://www.qbe.com/lmi/-/media/lenders-mortgage-insurance/housing%20outlook%202018/qbe%20australian%20housing%20outlook%202018-2021.pdf
[57] https://accomproperties.com.au/news-info/article-display/property-market-sizzles-on-the-sunshine-coast,238
[58] Sunshine Coast Council (2017*). Urban Transformation – Directions Paper for the future of the Sunshine Coast, P 11*. Accessed at: https://d1j8a4bqwzee3.cloudfront.net/~/media/Corporate/Documents/Planning/Light%20Rail/SCC_UrbanTransformationDirectionsPaper_Web_170131.pdf?la=en

6.3.2 Cost of urban expansion versus urban consolidation

While urban expansion provides a solution to the projected population growth and dwelling demand within the region, ongoing urban expansion threatens the achievement of a sustainable form of urban development and protection of the high quality of life that presently exists in the Sunshine Coast Region. A continuing shift to urban expansion will:

- Increase the separation between people and their destinations by dispersing the settlement pattern, thereby increasing the amount and cost of travel, the energy consumed and the emissions from vehicles
- Reduce the effectiveness and therefore the level of service offered by public transport, thereby increasing car dependence
- Increase the costs to Government for the provision of infrastructure, facilities and services
- Provide little alternative but for people to drive to the major destinations in the region, thereby increasing congestion and reducing the amenity of those destinations
- Make it harder for local business and industry to connect with each other and their workforces
- Occupy areas of land with habitat or agricultural values.

Comparatively, there is increased recognition of the net benefits that urban consolidation provides for the community, as established by a growing evidence base as discussed in the 'Promoting informed debate around infill housing in Australian cities paper' prepared by SGS Economics and Planning in 2015[59]. For instance, the evidence suggests that the following costs are attributable to urban expansion:

- Non-urban land consumption – with less non-urban land being available for productive uses such as agriculture, recreational and environmental uses.
- Infrastructure connection costs – particularly with respect to transport and utilities infrastructure but also potentially in terms of social infrastructure service provision.
- Transport congestion costs – as residents of new expansion communities are distantly located from jobs and services, lengthy commuting times and distances result causing significant social and environmental costs.
- Labour force productivity costs – as agglomeration economies and human capital benefits are thwarted by spatial dislocation and congestion.
- Reduced dwelling choice – as constrained urban consolidation dwelling options fail to match the latent demand for inner suburban living, with prospective residents prepared to trade-off private space with improved accessibility to jobs and services.

Additional analysis of the differences in the costs and benefits of urban consolidation development compared to urban expansion include:

- The Property Council of Australia (2016) found that dwellings in large-scale infill projects could be connected to infrastructure by Government at a cost of around $56,000 per dwelling, as opposed to around $151,000 per greenfield dwelling. This equates to an extra cost to the community of $95 million for every 1,000 lots developed in greenfield sites[60].
- SGS (2013) found that in a rural setting, the 30-year settlement cost of greenfield developments was approximately $58,000 per site, compared to urban consolidation developments of approximately $39,000 per site[61].
- Trubka (2010) found that the upfront costs of infrastructure were approximately $50.5 million per 1,000 dwellings for infill development and approximately $136 million per 1,000 dwellings for greenfield development. The study also concluded that the 15-year net present value of transportation costs (calculated as functions of VKT, covering all private, public and external costs) was around $169 million per 1,000 dwellings for infill development, and $335 million per 1,000 dwellings for greenfield development, resulting in extra $166 million transportation costs per 1,000 lots of greenfield over 15 years[62].

Urban consolidation can also revitalise an area by:

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[59] SGC Planning and Economics (2015). *Promoting informed debate around infill housing in Australian cities.* Accessed at: https://www.sgsep.com.au/

[60] Property Council of Australia (2016). *Infill Projects could save Perth billions.* Accessed at: https://www.propertycouncil.com.au/Web/News/Articles/News_listing/Web/Content/News/National/2016/Infill_could_save_Perth_billions.aspx

[61] SGS Economics and Planning (2013). *Financial costs of settlement patterns in rural Victoria: Final Report*, *p30*. Accessed at: https://www.sgsep.com.au/

[62] R.Trubka, P.Newman, and D.Bilsborough (2010). The Costs of Urban Sprawl – Infrastructure and Transportation, p5.

- Attracting new residents and businesses
- Developing new or upgrading existing infrastructure
- Fully utilising spare capacity of existing infrastructure.

Urban consolidation also encourages active living, as neighbourhoods with a greater population density, good activity mix, high connectivity and good provision of walking and cycling facilities are more likely to encourage the use of active transport[63].

However urban consolidation needs to be carefully planned and rely on consultation with the entire regional community. Poor urban consolidation dwelling design can impart real costs on individual properties, be it through overshadowing, loss of privacy, or increased noise. The importance of the statutory planning system should not be underestimated as its purpose is to:

- Sufficiently enforce good design for consolidated dwellings
- Provide supporting infrastructure and public realm improvements.

Given the region's consolidation benchmark is significantly higher than the expansion benchmark (62 per cent consolidation versus 38 per cent expansion), there is a need to invest in means by which Council can achieve consolidation, such as by attracting residents and businesses through better accessibility and connectivity via a mass transit system throughout the Sunshine Coast Urban Corridor.

6.3.3 Existing provision of urban expansion areas

Three significant urban expansion areas are identified within the Sunshine Coast Region – Palmview, Caloundra South and Beerwah East. The already approved expansion areas at Palmview and Caloundra South contain sufficient supply to meet the majority of expected demand to 2031[64], subject to actual take-up rates and land availability.

Caloundra South is projected to ultimately support 50,000 people in 20,000 dwellings while Palmview is expected to support up to 17,000 people in a maximum of 7,000 dwellings. Take-up rates in these two new communities are relatively strong, as shown in Table 13.

Table 13 – Population and dwellings in the three major expansion areas of the Sunshine Coast

Urban Expansion Area	Opening year	Ultimate population	Ultimate dwellings	Average dwellings per annum	Estimated current dwellings (May 2020)
Caloundra South (Aura)	2015	50,000	20,000	500	2,100
Palmview	2017	17,000	7,000	312	1,100
Beerwah East	2027[65]	50,000	20,000	N/A	0
Total	**N/A**	**116,000**	**46,397**	**N/A**	**3,200**

Source: ShapingSEQ and Sunshine Coast Council data

Future land for urban expansion has been identified through *ShapingSEQ* with a 'Major Development Area' identified at Beerwah East. The forecast capacity of Beerwah East is at least 50,000 people in 20,000 dwellings, with up to 7,000 dwellings being delivered by 2041[66]. Total planned supply of new expansion dwellings up to 2041 is therefore 46,397, whereas *ShapingSEQ*'s 62/38 split for consolidation compared to expansion dwellings would result in a need for only 33,060 expansion dwellings over the period from 2016 to 2041.

[63] Healthy Spaces & Places (2009). *Infill Development*. Accessed at: https://www.healthyplaces.org.au/userfiles/file/Infill_Development%20June09.pdf
[64] Urban Transformation – Directions Paper for the Future of the Sunshine Coast, 2017, Sunshine Coast Council, p24
[65] Estimated based on *ShapingSEQ*
[66] ShapingSEQ. 2017. p122.

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By the same token, if the 62/38 split of the total new dwellings of 87,000 is substantially rebalanced in favour of urban expansion as is the current trend, these currently planned urban expansion areas may not be sufficient, leading to pressures to develop more areas of currently undeveloped land. A 50/50 balance would see a need for at least 43,500 urban expansion dwellings over the 25-year period from 2016 to 2041. This is approaching the total capacity of the three approved expansion areas. It is apparent that if the balance between consolidation and expansion dwellings turns out to be greater than 50/50 in favour of expansion, pressures will begin to mount for additional urban expansion areas to be made available.

If the additional dwellings are delivered by 30 per cent consolidation and 70 per cent expansion, 61,000 expansion dwellings would be required, leaving 14,500 additional dwellings to be located in new expansion areas outside of the currently approved areas noted in Table 7. This equivalent to another area about 70 per cent the size of Caloundra South.

In respect of longer term urban expansion in the northern sub-region, *ShapingSEQ* notes[67]:

> *The major area in the sub-region that may be suitable for future urban growth is Halls Creek. The intent for this area is set out in Chapter 4. 6. No other Potential Future Growth Areas are identified in the Northern sub-region. However, Sunshine Coast and Noosa Shire councils will be encouraged to investigate the potential to identify limited additional longer-term urban growth opportunities.*

Having regard to the negative impact of ongoing urban expansion noted above, the draft Options Analysis does not support the proposition of ongoing urban expansion to Hall's Creek and other areas, and aims to achieve the 62 per cent urban consolidation benchmark set down in *ShapingSEQ*.

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[67] Queensland Government. 2017. Shaping SEQ. p 123.

6.3.4 Lack of mass transit network matched to the scale of growth and size of the Sunshine Coast

Transport infrastructure directly affects land use planning by signalling where new urban change is feasible, and by supporting denser development, directly generating opportunities for agglomeration economies.

Without investment in an efficient and effective public transport network for the Sunshine Coast Urban Corridor:

- Planned activity centres within the corridor would remain functionally separated and only activated at certain times of the day, reducing foot traffic for businesses and making people feel unsafe
- Planned urban change and employment growth would not be achieved, resulting in less travel destinations being contained within the Sunshine Coast Urban Corridor and less diverse interactions between businesses and people
- There would be increased environmental, noise, visual, health and safety impacts as commuters need to travel further to their chosen destinations
- Active transport options would be less feasible due to longer trips being required.

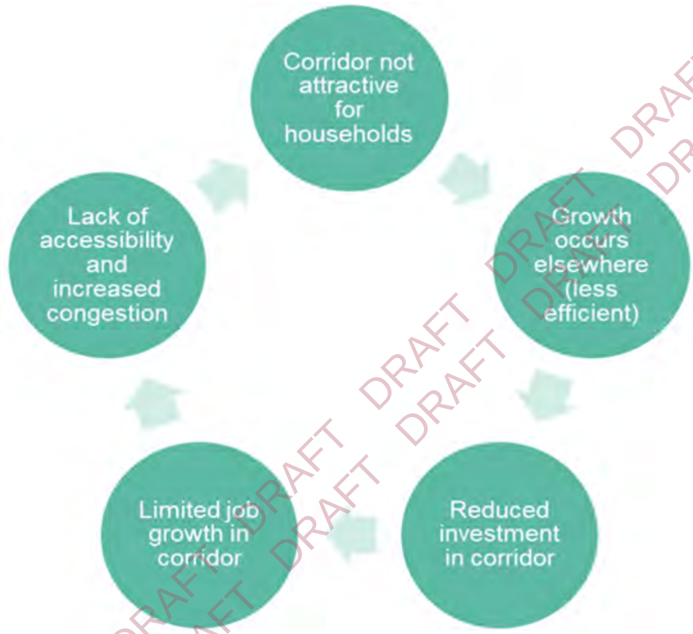

Figure 23 - Regional implications of urban expansion

This has potentially severe long-term consequences in relation to the economic prosperity of the region, as residents and workers are required to travel further, on an increasingly congested road network. This could become a vicious circle spiralling towards less sustainable outcomes.

Investing in mass transit can avoid this spiral by encouraging more people to live and work within the SCMT corridor, resulting in less travel demand overall and making public transport and active transport more viable options. This consequently reduces traffic and improves urban amenity.

6.3.5 Lack of dwelling choices

Table 14 provides a summary of the percentage of current dwelling types (as at 2016) within the Sunshine Coast, compared to the Gold Coast, Greater Brisbane and SEQ[68].

Table 14 – Comparison of housing types between Sunshine Coast, Gold Coast, Greater Brisbane and SEQ

Housing type	Sunshine Coast	Gold Coast	Greater Brisbane	SEQ
Separate housing	69.8%	54.5%	74.4%	70.5%
Medium-density housing	17.4%	24.6%	15.3%	17.2%
High-density housing	9.7%	19.1%	9.0%	10.8%
Other	3.1%	1.8%	1.3%	1.5%

Table 14 shows the Sunshine Coast is largely on par with SEQ in relation to the split of housing types. However, when compared to the Gold Coast, there is significant difference in the levels of high-density and medium-density housing. These differences can be attributable to a range of factors (historical population

[68] Profile.id (2019). *Sunshine Coast – Dwelling type.* Accessed at: https://profile.id.com.au/sunshine-coast/dwellings

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growth, maturity of the Gold Coast apartment property market, tourism demands etc.). However, the differences suggest that greater intervention will likely be required to influence meaningful change in the split of housing types within the region.

The lack of affordable housing and choice of housing type in the Sunshine Coast Urban Corridor has supported a migration to urban expansion development areas where greater housing stock is available and affordability is perceived to be higher. Increasing the range of dwelling types available in desirable and/or previously high-cost areas such as the Sunshine Coast Urban Corridor will increase accessibility for average income households to these locations.

Expanding the choice of housing types within the Sunshine Coast Urban Corridor by leveraging the lifestyle and amenity of a coastal setting that is also close to town centres and jobs within the catchment of mass transit stations, will attract people and businesses to the area, supporting population growth and further economic development of the area.

Urban consolidation and the resulting increase in supply of housing in central areas is particularly attractive to younger households, as it can assist them to find dwellings whose location and tenure type might otherwise be unaffordable[69].

6.3.6 Service needs of the Sunshine Coast Region to reverse the trend towards accelerating urban expansion

There is a need to fundamentally influence the current path of development that is occurring on the Sunshine Coast. Urban consolidation needs to be supported, not only to meet Government policy requirements, but to support the needs of residents to easily access their places of employment and leisure and to ensure the ongoing sustainability and liveability in the region.

A mass transit system will support urban consolidation in appropriate parts of the Sunshine Coast Urban Corridor and will make a positive contribution to the urban amenity that increases the attractiveness of the area.

It is also clear that *ShapingSEQ's* policy to direct the provision of a significant proportion of the projected consolidation dwellings in the Sunshine Coast Urban Corridor is soundly based. The corridor needs to attract growth through ensuring high levels of local amenity and sustainable transport solutions. Quality mass transit systems are an important element of creating liveable and efficient urban environments in places that are experiencing high growth.

Urban consolidation should be focussed on existing centres and areas close to the mass transit route that offer the greatest accessibility and potential for change. Importantly, urban consolidation should also focus on supporting the Maroochydore City Centre as the region's CBD, and capitalising on development opportunities in the major centres Mooloolaba, Kawana and Caloundra. In other parts of the corridor outside of these major centres, a carefully planned and staged approach can transform ageing and underutilised development into modern, low key lifestyle precincts without any excessive high-rise development that would be inappropriate for the Sunshine Coast.

The service need in response to Problem 1 – Accelerating trend towards urban expansion is to:

Enable suitable parts of existing urban areas to develop as lifestyle precincts clustered around mass transit, and closer to jobs and attractions

[69] Australian Housing and Urban Research Institute (2010). *Planning reform, land release and the supply of housing, p 20.* Accessed at: https://www.ahuri.edu.au/__data/assets/pdf_file/0023/2876/AHURI_Positioning_Paper_No126_Planning-reform,-land-release-and-the-supply-of-housing.pdf

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6.4. Problem 2 – High dependency on private car transport

There are high levels of car dependency in the region resulting from key factors such as:

- Inadequate public transport system
- Car culture that does not see public or active transport as features of the regional lifestyle
- Ease of accessibility to free car parking.

Without intervention, existing challenges identified with the public and active transport systems within the Sunshine Coast Region will combine with car based urban expansion to increase car dependency and inhibit the achievement of strategic urban and economic growth outcomes.

6.4.1 High dependency on private cars and declining public transport use

The growth of car ownership on the Sunshine Coast is amongst the highest in Australia. In 2016, 68 per cent of working residents in the region drove themselves to work and a further 25 per cent were passengers in a car, as shown in Figure 20[70]. The total mode share for public transport on the Sunshine Coast is currently around four per cent in total and less than four per cent of journeys to work are taken on public transport[71].

This is lower than the journey to work shares for the Gold Coast (4.2 per cent) and significantly lower than Queensland as a whole (7.1 per cent)[72].

A Sunshine Coast community survey found:

- 87 per cent of people rarely or never use public transport
- Only two per cent use public transport daily, five per cent weekly and six per cent once a month[73].

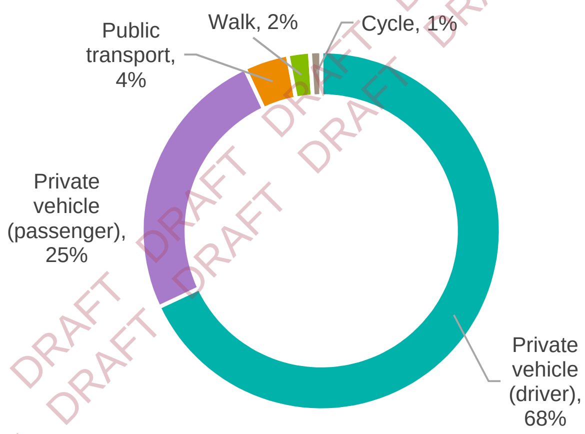

Figure 24 – Sunshine Coast journey to work mode share

Without intervention to support more sustainable transport modes and reduced car dependency, the Sunshine Coast Integrated Transport Strategy forecasts an additional 830,000 daily vehicle trips on the Sunshine Coast transport network by 2041, which represents a 70 per cent increase from 2016[74]. Lack of public transport accessibility and congestion resulting from car dependency has the potential to constrain growth, hamper productivity improvement and lead to sub-optimal urban change outcomes.

Dispersed land use outcomes and inadequate public transport provision within the region are key drivers of this forecast increase. The abundance of free or cheap parking in close proximity to key centres and the lack of alternative travel options also influence high car use[75].

The current dispersed settlement pattern within the region and lack of suitable alternative transport options means that private car travel is often the best choice for commuters. However, sustained, high car dependency can have undesirable impacts across a range of social, economic and environmental areas including:

- Limited mobility for those too old, too young or otherwise unable to drive a car
- Encouraging urban expansion and inhibiting achievement of urban consolidation

[70] Department of Transport and Main Roads (2017), *How Queensland Travels report.* Accessed at: https://www.tmr.qld.gov.au/Community-and-environment/Research-and-education/Queensland-Travel-Survey
[71] Sunshine Coast Council (2018). *Integrated Transport Strategy, p24.* Accessed at: https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Council-Strategies/Sunshine-Coast-Integrated-Transport-Strategy
[72] Home.id (2019). *Demographic Resources.* Accessed at: https://home.id.com.au/demographic-resources/
[73] Sunshine Coast Council (2018). *Integrated Transport Strategy,* p22.
[74] Sunshine Coast Council (2018). *Integrated Transport Strategy,* p35.
[75] Sunshine Coast Council (2018). *Integrated Transport Strategy,* p27. Accessed at https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Council-Strategies/Sunshine-Coast-Integrated-Transport-Strategy

- Reducing the use of more efficient modes of travel, like public transport, increasing space required for roads and car parking at residences and major centres
- Increased environmental externalities e.g. air pollutants and greenhouse gas emissions.

Public transport uses scarce urban spaces much more efficiently, reduces the environmental impacts of car usage, and provides an alternative transport mode for all travellers.

6.4.2 Inadequate public transport system will hinder urban consolidation and economic growth

While some parts of the Sunshine Coast Region are close to the North Coast Rail Line, public transport to the major activity centres on the coast relies on a bus system.

The bus network is relatively basic, with only one bus route (the 600 route) between Caloundra and Maroochydore offering a high frequency service (with headways of 15 minutes in peak periods). The network includes several services with headways exceeding one hour and some which do not operate on weekends. It also continues to be a challenge to provide timely public transport infrastructure and services to efficiently service emerging communities in urban expansion areas[76]. Figure 25 provides a comparison of public transport service and passenger kilometres between the Sunshine Coast and SEQ, as well as average passenger load per service for each region.

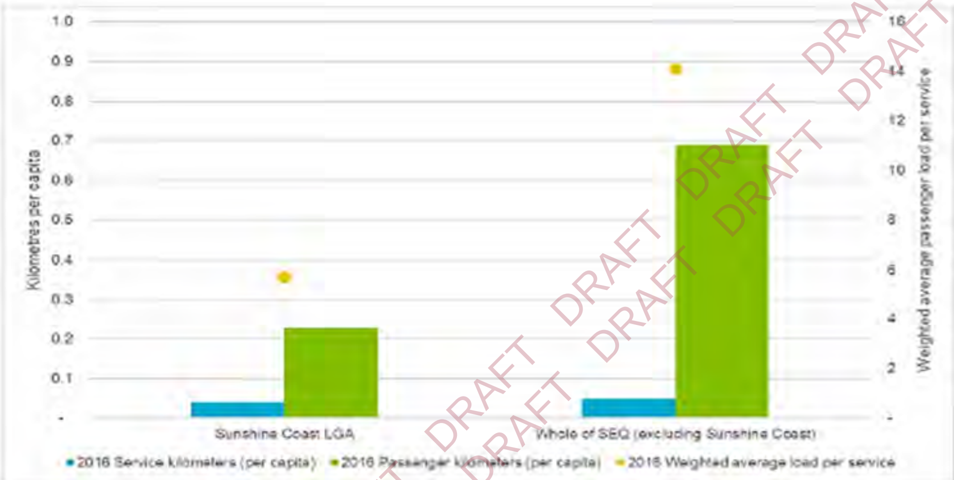

Figure 25 – Comparison of Public Transport service kilometres and passenger kilometres in 2016[77]

This shows the number of service kilometres on the Sunshine Coast per capita is similar to SEQ (excluding Sunshine Coast) average, equating to around 0.05 kilometres of public transport services per person per day. However, the number of passenger kilometres travelled on public transport is significantly lower on the Sunshine Coast. Around 0.25 passenger kilometres are taken per person per day on the Sunshine Coast, compared to 0.7 passenger kilometres in SEQ more broadly. It can be concluded from this analysis that the 'average' bus on the Sunshine Coast has around five people travelling on it while the average bus in SEQ region more broadly has approximately 14 people travelling on it.

This is most likely attributable to the bus network not meeting the needs of commuters through lack of coverage and service frequency, as well as the fact bus transport is not perceived as competitive with car travel for most trips.

Urban change that consolidates development over such a large geographic area such as the Sunshine Coast Urban Corridor must be supported by a sustainable urban form with high levels of living amenity, while encouraging a diverse range of housing styles. These housing styles must recognise changing lifestyles, demographics and housing preferences consistent with a vibrant modern coastal city, while remaining affordable.

[76] Sunshine Coast Council (2018). *Integrated Transport Strategy,* p27. Accessed at https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Council-Strategies/Sunshine-Coast-Integrated-Transport-Strategy.

[77] Service km refer to number of km travelled per annum by buses. Passenger km refer to the number of km travelled on buses by passengers. The weighted average load per service is the average number of people on a bus at a given point of time based on these two figures (and is equal to passenger km divided by service km).

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High-frequency mass transit systems are recognised globally as agents of urban change and enablers of more compact, transit-oriented communities with key elements including:

- Higher-density urban development located around high-frequency mass transit stations
- A diversity of uses including housing, shopping, commercial, recreation and education
- Precinct layouts that encourage and prioritise walking, cycling and public transport use.

Quality mass transit systems are therefore an important element of creating liveable and efficient urban environments in high growth cities such as the Sunshine Coast. If the current level of car dependency within the region remains unchecked and greater use of public transport is not achieved, there is a high risk that chronic road network congestion will inhibit economic development, and strategic benchmarks for urban change and employment growth will not be met.

6.4.3 Declining public transport patronage

Sunshine Coast public transport trips have been in decline since 2010. Council has set a goal for public transport mode share for the region (including personal public transport) to be ten per cent by 2041. However, given that over the past decade the rate of usage has fallen by 2 per cent[78], the 2041 mode share target will only be achieved if usage grows by a significant average of 6.6 per cent each year for 25 years.

The decline in public transport mode share can possibly be attributed to a combination of factors including improved data collection and more accurate patronage as well as fare increases. There has also been limited service expansion and investment to match the population growth. It is difficult to encourage people to elect to use public transport if it is not an attractive or available alternative[79]. Furthermore, comparative analysis of journey to work between public transport and car within the region shows that currently public transport trips generally take two to four times longer than car travel[80].

6.4.4 Growing car parking demand

In places with high car ownership, the availability and price of car parking at the destination is a major driver of mode choice. This is because the majority of costs in making a car journey are usually capitalised into the purchase and maintenance costs of the vehicle, so once a car is owned, there is an incentive to use it. If car parking is scarce and/or expensive, this can influence the marginal costs of the trip, and provide a reason to choose an alternative mode.

Car parking demand is forecast to grow strongly on the Sunshine Coast in the medium term (beyond the next five years), correlating with the forecast growth in car usage in the region. For example, Council's Local Area Parking Plans have identified there are requirements for an additional 300 parking bays in Caloundra and 900 parking bays in Maroochydore over the medium term. It is important to note that spaces dedicated to parking can have a significant opportunity cost, and that this land may have a higher value use than as parking.

6.4.5 Service needs of the Sunshine Coast Region to address high dependency on cars

The Sunshine Coast Integrated Transport Strategy establishes a desired public transport mode share target of ten per cent by 2041. Using the Base Case for land use allocation and transport investment, the 2041 modelling for a mode share of ten per cent equates to approximately 205,000 trips taken by public transport per day on the Sunshine Coast each day. This analysis shows that a 400 per cent increase in daily patronage will be required by 2041 to meet the ten per cent mode share target, representing an approximate required compound annual growth rate (CAGR) of 6.6 per cent to 2041. Compared to the region's current decline in public transport trips (a drop of 2 per cent between 2013 and 2016)[81], it can be concluded that without intervention, the 2041 mode share targets will not be achieved, and car dependency will continue to grow within the region.

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[78] Calculated using Sunshine Coast total weekday boarding data received from TMR by Veitch Lister Consulting
[79] Sunshine Coast Council (2018). *Integrated Transport Strategy*, p28.
[80] Sunshine Coast Council (2018). *Integrated Transport Strategy*, p28.
[81] Calculated using Sunshine Coast total weekday boarding data received from TMR by Veitch Lister Consulting.

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Since the present network is inadequate for such a task in the future, there is a demonstrated need to improve the capacity, service level, legibility, coverage and efficiency to encourage travellers to choose public transport over cars.

Investment in the Sunshine Coast's public transport must be considered in conjunction with the land use intentions discussed in Chapter 8. Integration of land use and transport outcomes is required in order to maximise the benefits of mass transit investment to the region.

The service need in response to Problem 2 – High dependency on private car transport is to:

Develop an efficient mass transit system connecting population and employment centres that is accessible and offers a viable alternative to using cars

6.5. Problem 3 – Growing levels of road congestion

The Sunshine Coast LGA region's population is expected to grow by over 70 per cent (or a CAGR of 2.2 per cent) by 2041 to over 518,000 people. Comparatively, Australia's overall population is expected to grow annually at a rate of no higher than 1.8 per cent per year[82].

Sustained population growth has the potential to cause a significant increase in congestion, compounded by the high use of cars and low public transport mode share.

Transport and economic modelling was undertaken as part of the Strategic Business Case to monetise and quantify the problems identified. Through this process it was estimated the cost of the problem (nominal), relating to congestion (including externality costs) was:

- $500 million per annum for the entire Sunshine Coast LGA in 2016, rising to $3 billion per annum in 2041
- $350 million per annum for the urban corridor from Maroochydore to Caloundra, rising to $2.2 billion in 2041
- $160 million per annum for the urban corridor from Maroochydore to Kawana, rising to $1 billion in 2041.

6.5.1 Forecast high level of road congestion on key arterial roads in the Sunshine Coast Region

The Sunshine Coast already has a high level of car dependency and there is a low public transport mode share in the region. Congestion is currently occurring in key areas on the Sunshine Coast in peak times, most notably on Nicklin Way, Sunshine Motorway, Caloundra Road, as well as other key routes where future jobs and activity are to be focused along the Sunshine Coast Urban Corridor.

Key tourism locations on the Sunshine Coast are already under significant pressure from day trippers and overnight visitors during peak holiday seasons. On the weekends, day trippers put particular strain on the road network including the Bruce Highway. The local road network also experiences a higher proportion of trips (75 per cent) in the off-peak periods compared to weekdays (58 per cent)[83].

This congestion is forecast to increase significantly as increased numbers of residents and tourists compete for road space in Caloundra, Mooloolaba and Maroochydore by 2041[84]. As the Sunshine Coast Region grows, demand on the road network will continue to rise and without intervention, runs the risk of escalating to a state that is not possible to manage. Traffic congestion has a significant social cost to both:

- Road users through lost time and extra vehicle operating costs
- Society through environmental costs and lost productivity.

[82] ABS (2017). *Population Projections, Australia, 2017 (base) – 2066*. Accessed at: https://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/3222.0
[83] Sunshine Coast Council (2019). *Integrated Transport Strategy*. Accessed at: https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Council-Strategies/Sunshine-Coast-Integrated-Transport-Strategy
[84] Refer to chapter 9 of the Options Analysis for more detail on congestion in 2016 and 2041.

Interventions to address forecast congestion should include road upgrades. However, relying solely on this approach will further support the region's dependency on cars and fundamentally change the urban form of the Sunshine Coast Region.

Modelled congestion levels

During development of the Strategic Business Case, expert advisors Veitch Lister Consulting (VLC) undertook preliminary analysis of the traffic flows under a "do minimum" scenario[85]. The analysis demonstrates that traffic flows across the road network are already restricted, with a peak hour volume to capacity (VC) ratio of 0.7 – 0.85, which indicates a reasonably restricted level of flow. By 2041, forecast traffic volumes will result in considerable levels of traffic congestion, and reveals a road network in Kawana that is heavily congested, particularly around the SCUH.

The projected levels of traffic congestion on the Sunshine Motorway and Kawana Way in 2041 (VC ratio greater than 1.3) would force more traffic onto an already congested Nicklin Way. The main route between the Sunshine Motorway and Mooloolaba (Brisbane Road) is projected to see peak traffic congestion by 2041. Traffic congestion in Maroochydore is projected to increase as population and jobs increase. There are also bottlenecks projected to form at the Sunshine Motorway's MRI by 2041 without major intervention.

6.5.2 Effects of congestion on business and industry

The Sunshine Coast industrial structure includes a number of industries to which road freight is particularly important as shown in Figure 26[86].

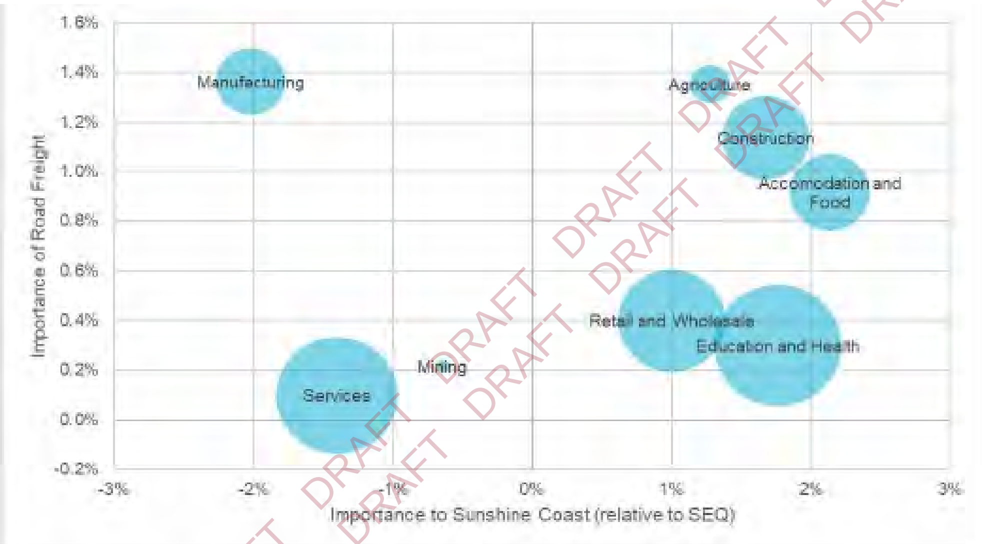

Figure 26 – Importance of road freight to key stakeholders on the Sunshine Coast

This emphasises the potential future impacts of congestion on the region[87]. Congestion also impacts the community through a loss in productivity or "lost hours". Without intervention there is forecast to be an increase in lost hours due to congestion in the core commercial zone of the Sunshine Coast, in particular the Maroochydore City Centre. Figure 27[88] summarises the forecast daily lost hours during peak periods in the Maroochydore City Centre that result from the projected increase in traffic congestion, showing an increase of 330 per cent.

[85] This section is a summary of the modelled congestion levels as assessed at the time of the Strategic Business Case. Since then, VLC has undertaken further modelling with updated demographics and bus network, and with parking controls. The updated congestion level modelling, which supersedes the SBC analysis, is presented in Chapter 9: Base Case.

[86] Graph complied using data from ABS: Australia National Accounts: Input/Output tables

[87] Negative values indicate that the industry has a lower importance on the Sunshine Coast compared to the rest of SEQ. The y axis shows the importance of road freight to that industry. The size of the bubbles represents the relative employment shares on the Sunshine Coast.

[88] LCV refers to a light commercial vehicle and HCV refers to a heavy commercial vehicle.

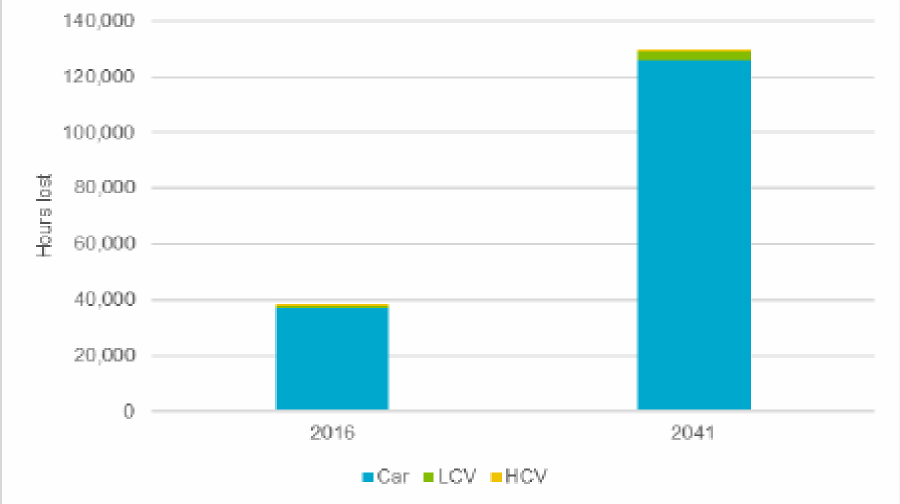

Figure 27 – Daily time lost travelling to and from Maroochydore City Centre in the morning

High levels of congestion will also impact the attractiveness of the Sunshine Coast as a tourist destination. The Sunshine Coast Integrated Transport Strategy highlights that easy travel is an integral part of a visitor's experience during their stay on the Sunshine Coast[89].

Various studies have confirmed the intuitive link between impacts on tourism behaviour and road congestion[90]. One study in particular found that 29 per cent of tourists who had visited a coastal tourism location that experiences high levels of congestion, would visit less often in the future in response to congestion[91]. This level of impact would have significant repercussions on the tourism industry on the Sunshine Coast, an important contributor to economic activity and employment.

Direct congestion costs

As part of the Strategic Business Case, a preliminary economic analysis was undertaken on congestion projections to quantify the impacts of the congested traffic flows for the region. Figure 28 provides a summary of the comparable cost of congestion in 2016 and 2041 under current Queensland Government projections (without a mass transit project) for various areas of the Sunshine Coast Region.

These costs were calculated using Australian Transport Assessment and Planning (ATAP) parameters based on transport modelling completed for the Strategic Business Case.

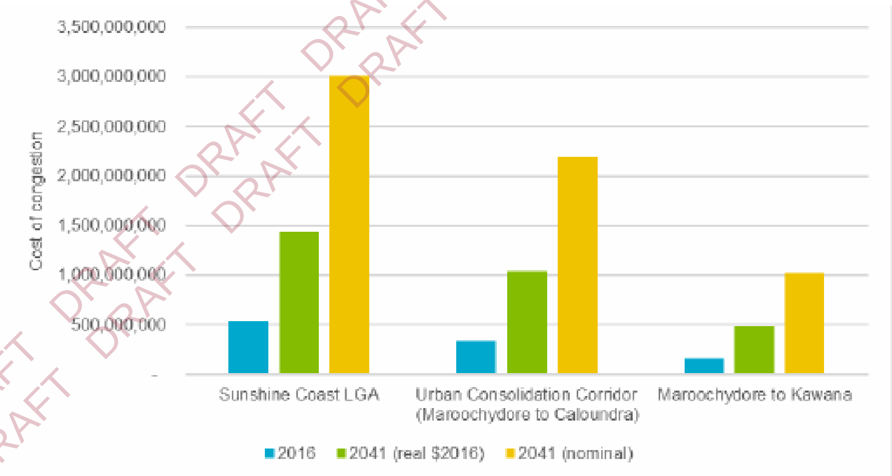

Figure 28 – 2016 to 2041 comparable cost (real) of congestion (annual) for the Sunshine Coast Region without a mass transit project[92]

[89] Sunshine Coast Council (2018). *Integrated Transport Strategy*, p31. Accessed at: https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Council-Strategies/Sunshine-Coast-Integrated-Transport-Strategy
[90] See for example I.Albaladejo (2018). Congestion affecting the dynamic of tourism demand: evidence from the most popular destinations in Spain.
[91] J.Wiersma and R.Robertson (2003). Traffic Congestion and Tourism Displacement In The NH Route 1a/1b Corridor, p159.
[92] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case

The results of the preliminary economic analysis show that without major intervention[93]:

- For the Sunshine Coast Region, in real terms, the annual cost of congestion (real) is projected to grow to $1.45 billion by 2041, an increase of 290 per cent over 25 years.
- The annual cost of congestion (real) for the Sunshine Coast Urban Corridor is projected to grow to $1.0 billion by 2041, an increase of 250 per cent, over 25 years.
- More specifically, the annual cost of congestion (real) between Kawana and Maroochydore is projected to grow to $500 million in 2041, an increase of 280 per cent over 25 years.

Without major intervention, the annual cost of congestion in the Sunshine Coast Region and the Sunshine Coast Urban Corridor could almost treble by 2041 in real terms. In particular, the coastal centres that are also tourist precincts would likely suffer reduced visitation due to congestion.

Congestion of this magnitude would have major impacts on liveability, restrict economic activity and negatively affect the functioning of the Sunshine Coast Region. In the absence of a mass transit system, road congestion and/or loss of amenity due to high traffic volumes will deter potential land use change and undermine the ability of the region to achieve its objective of containing urban expansion.

6.5.3 Service needs of the Sunshine Coast Region to address growing levels of congestion

Various industries within the region are experiencing growth, which will continue to place pressure on the region's existing transport networks. Without intervention, this will result in longer and more variable travel times, significant peak period congestion on the arterial road network and increased costs and lost productivity.

The region needs to facilitate positive economic growth by ensuring that industries and businesses established in the region are not losing productivity due to worsening road congestion within the region. Businesses in the region need to be accessible to consumers, and the workforce needs to be accessible to the industries on the Sunshine Coast. Tourism will also suffer if congestion deters visitors.

The service need in response to Problem 3 – Growing levels of road congestion is to:

Move more people in less vehicles through efficient mass transit transit that is easily accessed by active transport

6.6. Problem 4 – Liveability and environmental sustainability challenges

Increased levels of urban expansion and reduced levels of employment self-containment lead to an increase in long distance commuting and its associated economic, social and environmental impacts. Council's vision to be *'Australia's most sustainable region: Healthy. Smart. Creative'* necessarily includes protecting the liveability of the region and its natural environment. Key measures of the region's liveability, economic sustainability and environmental impacts include:

- The growth of high-value industries and improved self-containment of the region
- The amount of natural environment consumed by urban expansion
- The amount of VKT which impacts on the need for roads and parking
- The level of energy consumed, and level of pollutants emitted from transport
- The level of greenhouse gas emissions produced by its transport system users.

[93] An updated economic analysis has been undertaken for this Options Analysis (refer to Chapter 19 – Economic Appraisal).

6.6.1 Future jobs and productivity growth

Transport systems shape cities, support lifestyles and build economies. The right type of transport network can effectively bring businesses closer together by reducing travel times between key activity centres and increasing the transport service level for potential employees. The closer businesses are to each other, the higher their productivity will be, with greater specialisation, more intensive knowledge transfer, and employees who are better matched to their organisation[94].

During the past 30 years, the Sunshine Coast has undergone extraordinary change. The region has experienced significant employment and productivity growth and now has a regional economy worth more than $17 billion. The region's top industries by employment are shown in Figure 29.

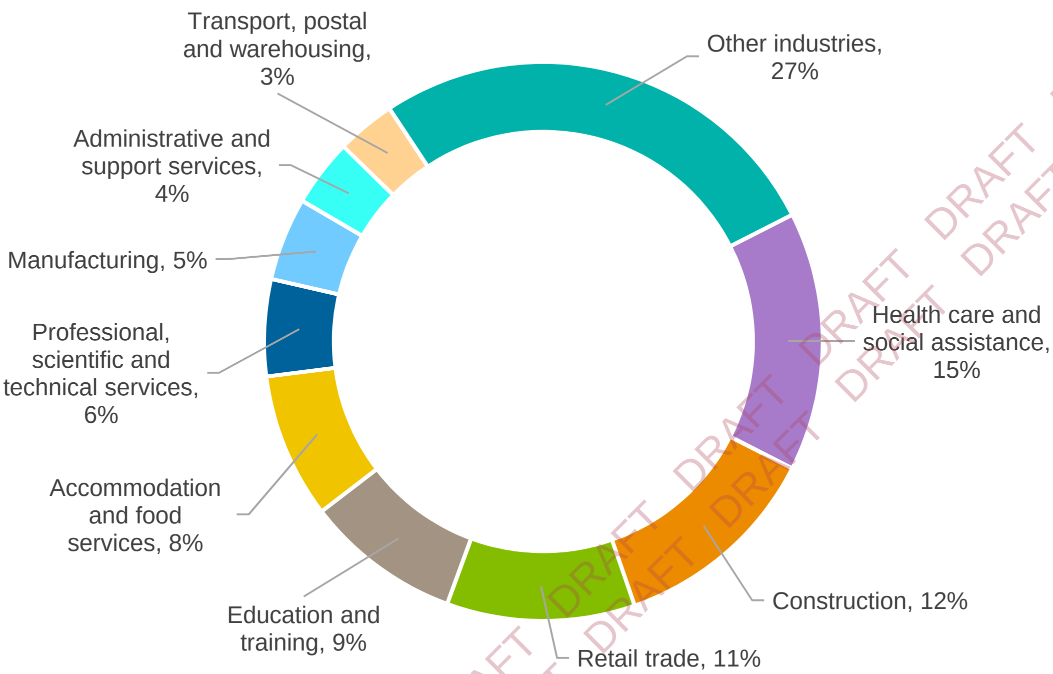

Figure 29 – Sunshine Coast industries by employment - 2016[95]

Apart from health care and social assistance, the trend of employment and industries in the Sunshine Coast Region leans towards lower-value industries that are highly responsive to economic cycles such as construction, retail trade and accommodation and food services.

There is a continuing need to broaden and deepen the economic base to:

- Support population growth and employment self-containment
- Reduce risk and volatility
- Increase productivity and wages.

The region needs to create approximately 75,000 more jobs by 2041 and is focused on growing seven high-value industries[96]:

- Health and well-being
- Education and research
- Tourism, sport and leisure
- Knowledge industries and professional services
- Agribusinesses
- Aviation and aerospace
- Clean technologies.

[94] Infrastructure Australia (2013). *National Infrastructure Plan, p30*. Accessed at: https://www.infrastructureaustralia.gov.au/
[95] Queensland Government Statistician's Office (2019). *Queensland Regional Profiles.* Accessed at: https://statistics.qgso.qld.gov.au/qld-regional-profiles
[96] Sunshine Coast Council (2013), Regional Economic Development Strategy 2013-2033.

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All of these industries have the potential to generate higher-paying enduring employment opportunities and are supported by Council's 'region shaping' projects including:

- The mass transit system
- Development of the SCUH
- Development of the Maroochydore City Centre
- Recent expansion of the Sunshine Coast Airport
- Expansion of the University of the Sunshine Coast
- Delivery of the Sunshine Coast International Broadband Submarine Cable network.

Currently, connectivity between key employment, tourism and health centres via public transport is poor. Lack of effective public transport connectivity to these strategic precincts will affect Council's ability to achieve employment and growth outcomes. If planned activity centres within the Sunshine Coast Urban Corridor remain functionally separated, there will be fewer, and less diverse, interactions between businesses and people. Typically people do not enjoy commuting, with the morning journey between home and work rated by Queenslanders as the least desirable activity and the evening commute rated as the third worst activity[97]. Longer commutes are associated with lower levels of job satisfaction and increased turnover in workers. More reliable local connectivity will be an essential feature in facilitating the growth and expansion of the regional economy and ensuring greater worker retention.

Transport connectivity is also important to attracting new employers and employees through creating a more pleasant and efficient place to work and live. It also supports increased productivity through agglomeration. Agglomeration is the basic process of city building whereby people and businesses co-locate because they draw benefit from being in close proximity to each other and thus they become more productive through collaboration, competition and access to a larger number of employer and employee pools. For regional economies, such as the Sunshine Coast, it is important to drive a critical mass of high value employment. Once achieved this is enhanced by agglomeration which through a self-reinforcing circle, attracts further high value businesses to the region.

provides an overview of this strategy.

Figure 30 - Creating a sustainable and productive industry base

Without the development of the 'region shaping' projects and the other employment attracting initiatives outlined in the Sunshine Coast Regional Economic Development Strategy, there is a risk that the Sunshine Coast will not achieve its economic goals and the long-term sustainability of the local economy will be at risk.

This in turn will reduce self-containment, decrease local wage growth and reduce local productivity and employment opportunities. It will create an increased demand for people to either travel to different areas for employment (most likely Brisbane) or to move to those areas (which will reduce demand for core industries and further reduce local employment opportunities thus creating a negative, self-reinforcing cycle of economic downturn).

To address these vital economic development goals, a major improvement to the local public transport system in the region can provide reliable connectivity between major population and employment centres in the corridor.

[97] Jachimowicz, J., Gino, F., Lee, J., Staats, B. & Menges, J. (2019). Between Home and Work: Commuting as an Opportunity for Role Transitions.

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6.6.2 Employment self-containment

Employment self-containment is often determined by the relative level of local workers who also reside in the region[98]. The current level of people who work and live within the Sunshine Coast Region is over 90 per cent.

Another measure relates to where residents work. Of the region's working residents[99], 77.6 percent also work in the region. The Sunshine Coast Urban Corridor also has very high levels of self-containment. Over 50 per cent of Maroochydore residents work within the Maroochydore region, with a further 17 per cent travelling to Kawana for work, and 21 per cent travelling to other areas within the Sunshine Coast Region. Interestingly, only three per cent of Maroochydore residents travel to Brisbane for work, two per cent travel to the Noosa LGA and less than one per cent travel to Caboolture.

Caloundra offers a similar profile to Maroochydore for journey to work trends, with almost two thirds of Caloundra residents being employed in locations within the Sunshine Coast Urban Corridor. Rather more residents commute south to their jobs, including 11 per cent to Brisbane, perhaps owing to Caloundra's position on the southern end of the Sunshine Coast.

This high level of self-containment is positive for lifestyles and amenity since it:

- Reduces the need to travel, saving people time and money
- Reduces energy consumption and emissions of pollutants and greenhouse gases
- Increases the amount of time people have to spend with families and other worthwhile activities outside of working and commuting.

This high level of local employment is a feature of the Sunshine Coast lifestyle that Council wishes to continue into the future. However, Brisbane is projected to dominate employment growth in the SEQ region over the next three decades[100]. Major improvements are also mooted to the SEQ region's transport network to support the concept of a 45-minute region[101]. While connectivity to the State's capital is always an important objective, for the Sunshine Coast, improved accessibility to the major employment growth centre of Brisbane runs the parallel risk of reducing local economic productivity and hindering the growth of local business and industry.

To maintain its present high level of employment self-containment there must be a continued strong focus on local transport solutions to connect local businesses and encourage investment in high-value industries. This will deliver more enduring employment opportunities that respond to market need and support a rapidly growing population. These industries will also require excellent and reliable local connections to each other, and to their potential labour force in local catchments.

6.6.3 Service needs to support economic growth and employment self-containment

The travel patterns of residents on the Sunshine Coast demonstrate a clear need to continue supporting the demand for local travel. Reflecting Council's self-containment vision for the region, living and working within the region will continue to be encouraged.

The Sunshine Coast Regional Economic Development Strategy identifies the need to support the development of:

- Key economic centres including Maroochydore, Kawana, Caloundra and Sippy Downs
- Key industries such as health, education, tourism
- Region shaping projects such as the Maroochydore City Centre, expanding the new Sunshine Coast Public Hospital and the Sunshine Coast International Broadband Cable to help deliver at least 75,000 additional jobs over the next 25 years.

[98] Typically, this is measured by "workers' journey to work" data extracted from the ABS Census
[99] Measured by "residents' journey to work in the ABS census
[100] ShapingSEQ. p54.
[101] See for example Department of Infrastructure (2019). *South East Queensland City Deal – Statement of Intent*. Accessed at: https://www.infrastructure.gov.au/cities/city-deals/south-east-queensland/files/seq-statement-of-intent.pdf

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Transport connectivity is also key to attracting new employers and employees through creating a more pleasant and efficient place to work and live. Precedent transport projects have also shown that the more permanent the infrastructure investment, the more confidence businesses have to invest in the region. The benefits of urban agglomeration are best achieved by investment in public transport infrastructure to efficiently link workers with the knowledge-intensive jobs that drive economic activity[102].

6.6.4 The amount of natural environment consumed by urban expansion

Sunshine Coast Council is committed to protecting rural, landscape and natural areas which underpin the character and lifestyle of the Sunshine Coast. These areas provide important environmental, economic, tourism, recreational and landscape opportunities.

There are trade-offs to be made in managing growth. The more the urban area continues to spread outwards, through the development of new expansion areas, the more pressure will be placed on the rural, natural and landscape areas. There are few areas remaining on the Sunshine Coast that are physically unconstrained or without intrinsic value as agricultural, landscape or ecological resources.

Urban expansion is well catered for on the Sunshine Coast, with a total planned supply of new expansion dwellings up to 2041 of 46,397. *ShapingSEQ*'s 38 per cent benchmark for expansion dwellings would result in a need for only 33,060 expansion dwellings out of the total of 87,000 new dwellings over the period from 2016 to 2041.

However, if planned urban consolidation outcomes are not achieved, a significant increase in expansion areas would be required. For example, if 70 per cent of new dwelling growth was by way of urban expansion there would be a requirement to source additional land to accommodate about 15,000 extra dwellings outside of the expansion areas already underway or planned. This would put considerable pressure on the areas of natural landscape close to the existing urban footprint.

6.6.5 Total amount of vehicle kilometres travelled

Without major intervention, VKT within the Sunshine Coast LGA is forecast to increase by 61 per cent between 2016 and 2041, an additional 6.1 million kilometres on an average weekday (see Figure 31).

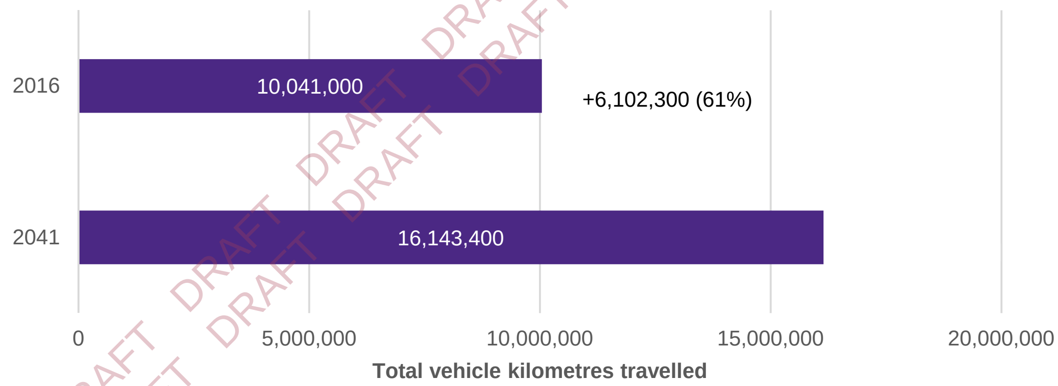

Figure 31 – Total vehicle kilometres travelled within the Sunshine Coast LGA

6.6.6 Energy and emissions

Transportation modes are currently powered by various energy types, predominantly petroleum and other liquid fuels. The consumption of these fuels has a resultant impact on the environment through emissions that contribute to reduced air quality as well as impacts to other parts of the environment such as water sources. The impact of energy consumption and resultant emissions is based on emission factors for different types of vehicles and transport modes. Freight and heavy vehicles generally have higher emissions than cars. An efficient mass transit system powered through battery storage or via the electricity network,

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[102] Department of Infrastructure and Regional Development (2015). *State of Australian Cities 2014-15, p111*.

such as light rail will result in substantial reductions in VKT and generally have far reduced emissions per passenger or users than other modes.

6.6.7 Greenhouse gas emissions

Most scientists agree that global warming caused by human-generated greenhouse gas emissions is one of the most serious environmental problems facing the world today. Notably, 13 per cent of Australian greenhouse gas emissions are generated from road transport.

Data provided by VLC has allowed for a preliminary comparison of transport-originated greenhouse gas emissions attributed to journey to work trips for LGAs across the SEQ region. These are based on emission factors for different types of cars and different transport modes and have been quantified using ATAP parameters. Figure 32 provides a comparative summary of greenhouse gas emissions generated by journey to work trips in comparable LGAs, relative to the Sunshine Coast LGA.

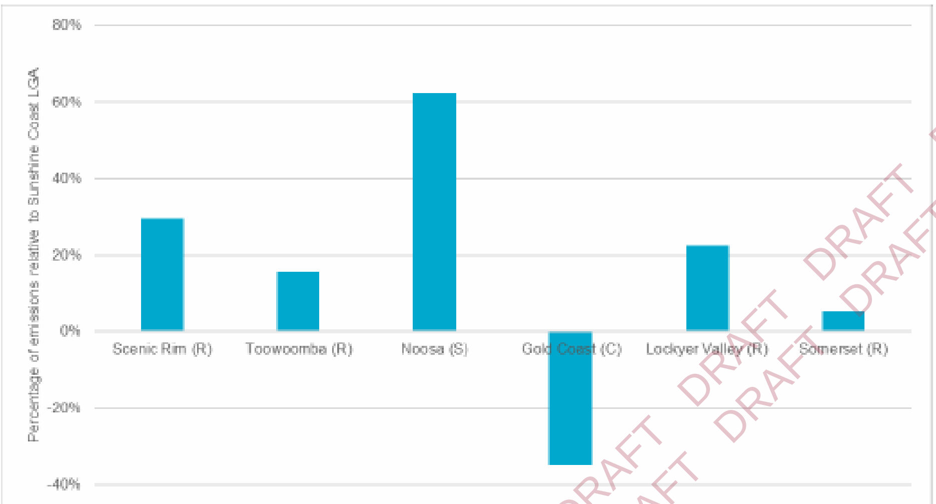

Figure 32 – LGA greenhouse gas emissions from journey to work trips relative to the Sunshine Coast

Figure 32 shows there are significant environmental benefits resulting from the Sunshine Coast's self-containment, as shown by the relative differences in emissions compared to a location such as Noosa, which has only 59 per cent self-containment and 62 per cent higher emissions than the Sunshine Coast.

In contrast, the Gold Coast LGA's high self-containment and high public transport mode share has resulted in the significant reduction in journey to work emissions of 35 per cent compared to the Sunshine Coast. This difference is attributable to the carefully planned investments made in alternative transport modes on the Gold Coast, including heavy and light rail, thereby encouraging journeys to work to be taken by public transport as opposed to car.

Given the comparable self-containment levels, this demonstrates a significant opportunity for investment in public transport on the Sunshine Coast to encourage intra-regional commuters away from private cars and onto public transport to reduce greenhouse gas emissions and deliver significant long-term environmental benefits to the region.

6.6.8 Service needs to address environmental issues with urbanisation and transport

The travel patterns of residents on the Sunshine Coast demonstrate a clear need to continue to meet the demand for local travel. Reflecting Council's self-containment vision for the region, living and working within the region will continue to be encouraged.

The trend towards urbanisation is resulting in a decrease in the natural environment as additional land is required to support dwelling growth as well as an overall increase in the number of vehicle kilometres travelled on the transport network. If Council's vision to be 'Australia's most sustainable region' is to be achieved there is a need to reverse the current trend towards urban expansion. Growth orientated towards urban consolidation is likely to result in lower use of cars and a shift to public transport and active transport.

This will reduce the associated air pollution and greenhouse gas emissions associated with a significant increase in car use. Additionally, increased urban consolidation reduces the pressure on the natural environment as there is a reduction in the amount of rural, natural and landscaped land being converted to urban land for new development.

While the Sunshine Coast is expected to continue its rapid growth, there is a requirement to ensure sustainable growth which retains the liveability and environmental quality the region is renowned for. Reducing the growth of urban expansion through urban consolidation, and development of a mature public transport network to connect people and places are essential to achieving this goal.

The service need in response to Problem 4 – Liveability and environmental sustainability challenges is to:

Maintain and enhance the sustainability, liveability and environmental quality of the region as it continues to experience rapid growth by reducing the growth of urban expansion and reducing the amount of energy used and emissions made by transport in the region

6.7. Risks of a business-as-usual approach to transport

Increased population growth will lead to an increase in transport demand. While it has been demonstrated that the overall cost of congestion to the economy based on QGSO projected population growth is significantly less than the costs associated with increased urban expansion, there will still be transport demand that will need to be serviced.

Without intervention to provide a major investment in mass transit, a business-as-usual approach will see a need for progressive upgrades to major roads, incremental improvements to bus services, and ongoing expansion of car parking in major activity centres and beachside precincts. To date this type of investment has lagged behind the growth.

6.7.1 Transport modelling of business-as-usual

To test the effectiveness of a business-as-usual approach, a transport modelling assessment was undertaken of the projected requirements for additional traffic capacity in the Sunshine Coast Urban Corridor between Maroochydore and Caloundra. The modelling assumed the development of the region as projected by QGSO. Population growth will increase transport demand, which, based on current trends, in the absence of intervention will be largely car based. Under business-as-usual this increased demand would need to be met through significant upgrades of the major roads servicing these areas, most significantly:

- widening of Nicklin Way to provide an additional one lane each way, and
- delivery of the planned MRI upgrade and Kawana Arterial project to deliver an additional one lane each way initially and two lanes each way in ultimate development.

However for the purposes of this test, the modelling assumed no improvements to road networks beyond those already committed, and the gap established would therefore represent one estimate of the required major road upgrades.

6.7.1.1 QGSO Projected population distribution 2041

Figure 33 identifies the location of population growth under QGSO projections made in 2018. A significant proportion of population growth is projected to occur along the Sunshine Coast Urban Corridor, given its high amenity and proximity to both employment and activity centres.

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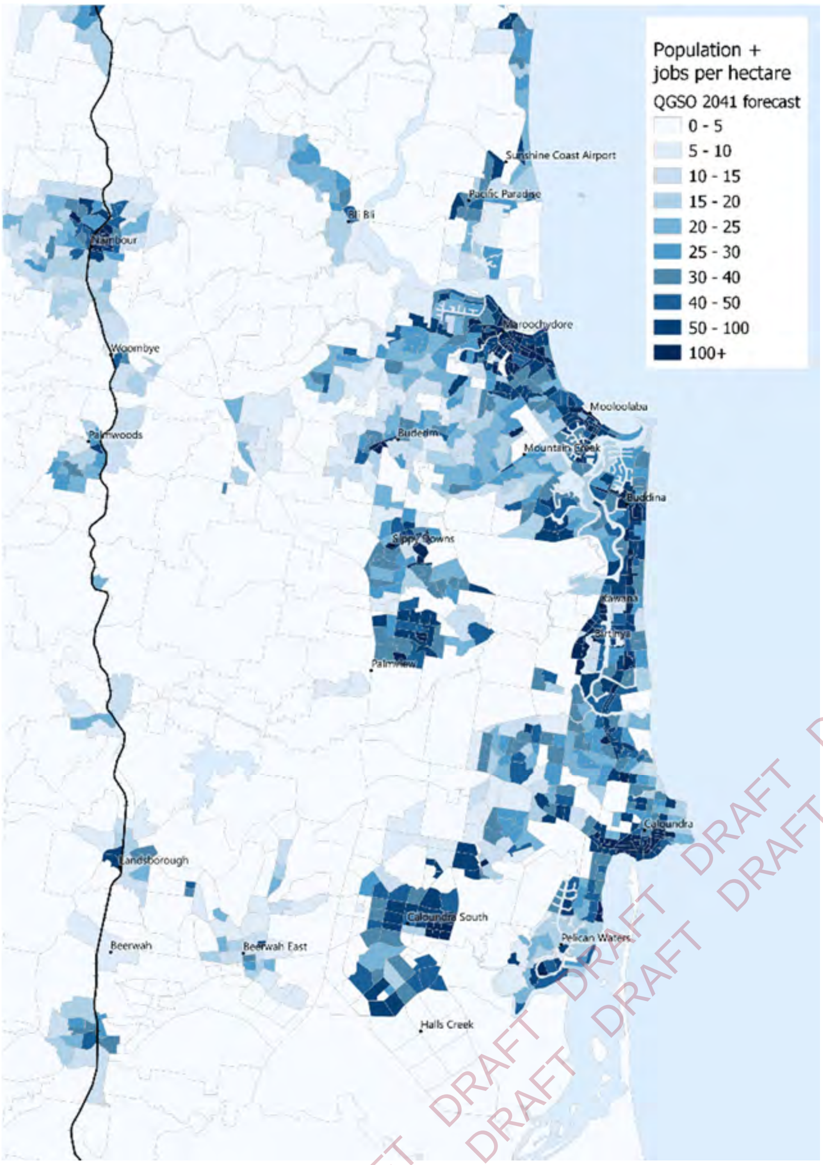


Figure 33 Population distribution in Sunshine Region in 2041 - QGSO forecast

6.7.1.2 Setting the desired level of service to estimate road capacity needs

Analysis was undertaken to examine and understand the requirements to service demand through upgrades to the existing road network. Level of service for roads is usually described through a Volume on Capacity (VC) ratio. This is the actual or projected amount of traffic using the road divided by its theoretical capacity under comfortable driving conditions. A VC ratio of 1 means the road is at capacity and is just able to carry the volume of traffic without significant interruptions to traffic flow, meaning it has reached its “tipping point” for significant congestion.

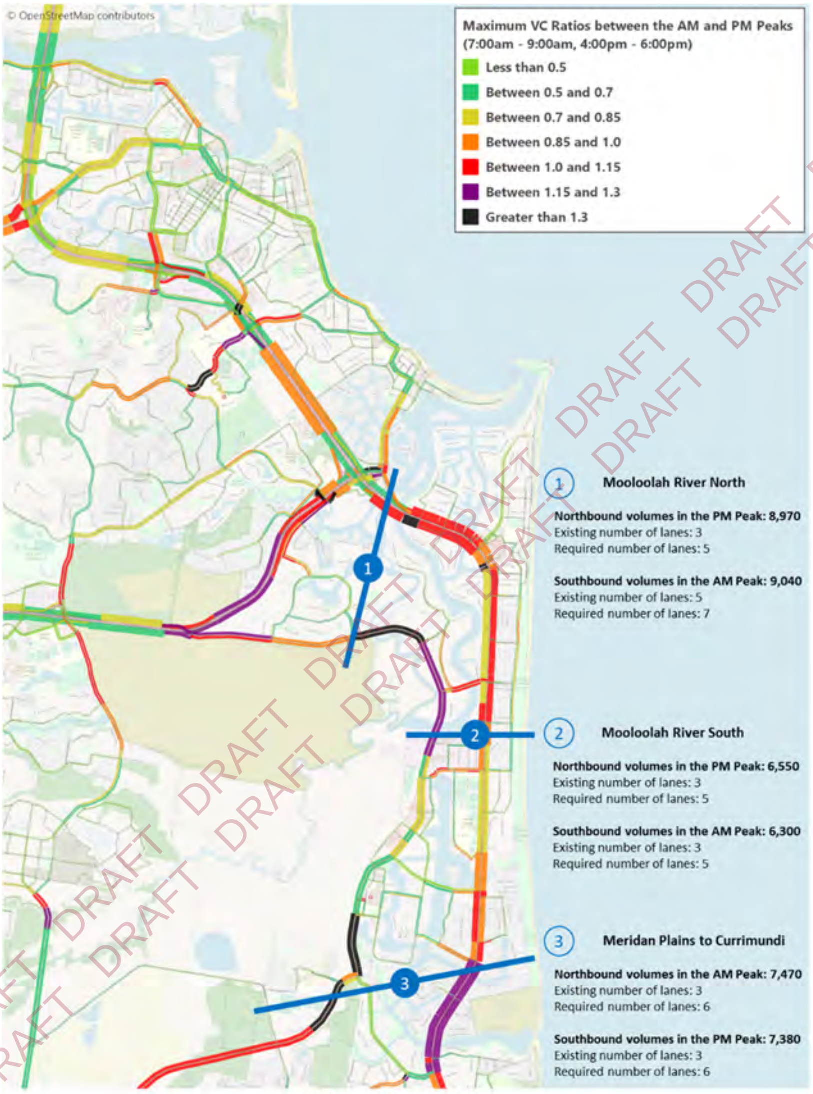
This business-as-usual VC assessment identified the required network upgrades to meet the target VC ratio of a maximum of 0.85 for arterial and sub-arterial roads, per the *Sunshine Coast Planning Scheme 2014* Policy SC6.17 (Planning Scheme Policy for the Transport and Parking Code), based on 2041 road volumes. A VC ratio of 0.85 means the road is approaching capacity but traffic flow should still be smooth under most conditions.

6.7.1.3 Results of VC assessment – business-as-usual

The results of this assessment are depicted in Figure 34. To ensure the test considers the full range of new road projects available, the modelled results utilise ‘screenlines’ that encompass all the existing and proposed roads in the corridor, depicted on the map as the blue lines 1, 2 and 3. In summary, having regard to the desired level of service:

- Without the construction of major roads upgrades on Nicklin Way and the delivery of the MRI/Kawana Arterial, all roads in the corridor are either approaching, at, or over capacity by 2041.
- An additional four lanes of arterial traffic are required at screenlines 1 and 2, in the northern and central sectors of the Sunshine Coast Urban Corridor. This can be met by the full development to four lanes of the MRI/Kawana Arterial road, or by developing the MRI/Kawana Arterial as two lanes, and adding additional two lanes to Nicklin Way, to make it eight lanes in the northern sector, and six lanes in the central sector.
- An additional six lanes of arterial traffic are required at screenline 3, in the southern sector of the Sunshine Coast Urban Corridor. This can be met by either:
  - full development of the four lane MRI/Kawana Arterial road, and adding an additional two lanes to Nicklin Way, to make it six lanes
  - by developing the MRI/Kawana Arterial as two lanes, and adding additional four lanes to Nicklin Way, to make it eight lanes.

The analysis identifies that Nicklin Way is forecast to experience the most significant capacity issues at the river/canal crossings at Wurtulla in the absence of other interventions.



Volume/Capacity Map
with number of lanes required to reach a VC ratio of 0.85

Figure 34 – VC ratio at key locations and additional lanes required to avoid excessive delays 2041

6.7.2 Can business-as-usual road upgrades achieve the Project objectives in the Sunshine Coast Urban Corridor?

The Project objectives have been developed through the Strategic Business Case and confirmed through further analysis in this chapter. An assessment was made of the ability of business-as-usual to meet these objectives. Table 15 outlines the results of this assessment in the terms of the Project objectives outlined in Section 1.2.

Table 15 – Comparison of business-as-usual to project objectives

Project objective	Impact of business-as-usual on project objective
Support the Sunshine Coast's productivity, employment growth and self-containment aspirations by supporting existing and emerging strategic centres	Delivery of road upgrades to the identified scale to meet the future transport demand would result in short-term reduced congestion. However, demand will overtake capacity eventually, and the long-term consequential impact of continued reliance on cars will inhibit the growth and productivity of the Sunshine Coast.
Maintain and, where possible, improve amenity and liveability, and provide for positive change by unlocking urban change opportunities	Major road upgrades will significantly reduce the amenity and liveability of the Sunshine Coast by increasing traffic and demand for more parking in centres. This would lead to loss of visual amenity and significant increase in car trip volumes.
Improve accessibility, convenience and resilience of the integrated transport network	Road upgrades will reduce congestion, and therefore improve travel times. However it will not result in an improved accessibility and resilience of the transport network or support a more integrated network with increased options for users. Increased car dependence will mean those who cannot access car transport will be disadvantaged.
Provide a deliverable and value for money solution	Road upgrades as identified will be expensive to deliver and since they will adversely affect the quality of life in the corridor, will not represent value for money.

6.7.3 Business-as-usual will not achieve the vision of a sustainable region

There are significant current and forecast transport and land use problems within the region, as demonstrated by the analysis presented in this chapter:

- Congestion along key arterial routes within the region is currently costing over $500 million per annum. This is forecast to continue to grow and cost the regional economy $3 billion per annum (nominal) by 2041.
- Without intervention to address congestion, the economic productivity of the region will be impeded as time goes on. Lost hours in Maroochydore alone due to congestion is forecast to reach 130,000 homes per annum in the peak period by 2041. Lost productivity will have serious flow-on impacts, limiting any agglomeration opportunities and failing to support the region's forecast 75,000 additional jobs over the next 25 years.
- Urban expansion within the Sunshine Coast Region has been successful in supporting population growth and the demand for housing. However, there is significant risk of detrimental outcomes and higher costs to Government if this urban expansion is not balanced with appropriate urban consolidation. Research suggests that for every 1,000 additional urban expansion dwellings built, the costs for supporting social infrastructure total almost $95 million more than for the equivalent number of consolidation dwellings.
- At least an additional 53,700 consolidation dwellings by 2041 are required within the region to achieve the overall *ShapingSEQ* consolidated dwelling benchmark of 62 per cent by 2041. This equates to approximately 2,240 additional urban consolidation dwellings in the existing urban area each year from 2017 to 2041. Based on current projections, it is estimated only about 40 per cent of the required 53,700 dwellings will be taken up without intervention to enable and support urban consolidation. Without this intervention, the *ShapingSEQ* benchmarks will not be achieved and the increased demand for housing will need to be met by opening up new urban expansion areas.
- Without intervention to deliver more sustainable transport modes and reduced car dependency, an additional 830,000 daily vehicle trips are forecast on the Sunshine Coast transport network by 2041, which represents a 70 per cent increase from 2016.

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- Dependency on private cars will continue within the region and given the current rate of public transport usage has fallen by two per cent between 2013 and 2016, the desired 2041 public transport mode share target of ten per cent for the region will not be achieved.
- Continued expansion of urban areas in the region will consume the natural landscape, degrade the environment, increase car dependency and create the need for longer trips with more emissions of pollutants and greenhouse gas emissions.

To avoid the consequences of business-as-usual for the region's quality of life, there is a confirmed need for an integrated mass transit system within the Sunshine Coast Region, and in particular the Sunshine Coast Urban Corridor. Without intervention to address these needs, economic, social and environmental impacts will increase and put at risk the visions and strategic objectives of approved key policy documents of all three levels of Government.

6.8. Project Benefits

There are a range of regional benefits that can only be achieved through an integrated approach to land use planning and economic development undertaken in conjunction with the delivery of an efficient integrated mass transit solution. The benefits sought as a result of responding to the challenges and service needs identified above are outlined in Table 16.

Table 16 – Benefits sought linked to Service Need and Challenges

Challenges	Service need	Benefits sought
An accelerating trend towards urban expansion The region is experiencing accelerating urban expansion in its southern sector. Too much reliance on urban expansion will lead to loss of valuable natural areas, higher servicing costs, and longer trips, most likely in private cars.	Transform suitable parts of existing urban areas into lifestyle precincts clustered around mass transit, and closer to jobs and attractions.	Improved land use outcomes including a broad range of housing opportunities such as affordable living, 'missing middle' housing and mixed-use development in established urban centres and places of high public transport accessibility on the Sunshine Coast.
High dependency on private car transport The region has a high dependency on private cars which is inhibiting the achievement of strategic urban and economic growth outcomes and resulting in low PT mode share and growing congestion.	Develop an efficient integrated mass transit system connecting population and employment centres, that is accessible and offers a viable alternative to using cars.	Increased transport options (both public and active transport) for people of different ages and mobility levels without reliance upon private cars.
Growing levels of road congestion The region will continue to expand its population and its economy throughout the 21st century. Since the transport system is heavily car dependent, this expansion will lead to spiralling congestion and reduce the quality of life in the region.	Move more people in less vehicles through efficient mass transit that is easily accessed by active transport.	Increase public mode share through the provision of high quality services and connecting active transport options resulting in a reduction in car volumes and an easy way for people to travel and avoid congestion.
Liveability and environmental sustainability challenges The region is experiencing sustained urban expansion which can undermine quality of life, compromise the natural environment and increase vulnerability to climate change impacts.	Maintain and enhance the sustainability, liveability and environmental quality of the region as it continues to experience rapid growth by reducing the amount of energy used and emission made by transport in the region.	Support the economy by linking primary economic development between Maroochydore and Kawana, to knowledge-based industry areas (Kawana Health Precinct) and tourist destinations (Maroochydore to Mooloolaba). Support the community with reduced environmental impact though cleaner air, lower emissions of greenhouse gas and protection of natural areas.

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In summary, the benefits that may be achieved by introducing a mass transit system on the Sunshine Coast extend beyond transport outcomes and align with Council's vision *to provide a step change to public transport that can set the region on a path to sustainable transport and appropriate urban development.*

6.9. Summary of problems, opportunities and service needs

6.9.1 Key problems

Analysis undertaken during development of the Options Analysis has identified the region faces major challenges in managing growth over the coming decades. There is a risk of a vicious circle developing that degrades the qualities of the region that make it an attractive place to live and visit. Key problems underpinning this risk are:

1. An accelerating trend towards urban expansion as the dominant form of new urban development
2. High levels of dependency on private motor transport, with low use of public and active transport
3. Predicted rise in congestion unless major intervention occurs, leading to demand for major expansion of road and car parking infrastructure
4. Combination of all factors to degrade the region's liveability and environment.

6.9.2 A strategy to respond

Responding to the identified problems can deliver a range of regional benefits that may only be achieved through an integrated approach to land use planning and economic and community development undertaken in conjunction with the delivery of an efficient transport network. Analysis undertaken has therefore confirmed the need for a coordinated three-pronged strategy addressing the problems of growth and urban expansion being experienced by the Sunshine Coast Region, as previously determined in the Strategic Business Case[103]:

- A major improvement to mass transit to provide an integrated network connecting the major activity centres and housing areas and linking the region to Brisbane. The first stage of this mass transit system should connect from Maroochydore City Centre to SCUH.
- A coordinated program to promote urban change, establishing high quality and affordable housing choices on land in existing centres and along the mass transit alignment that currently host ageing and under-utilised development.
- An ongoing program to boost and connect local employment opportunities by supporting commercial and mixed-use development on land in existing centres and along the mass.

6.9.3 Service needs to support the strategy

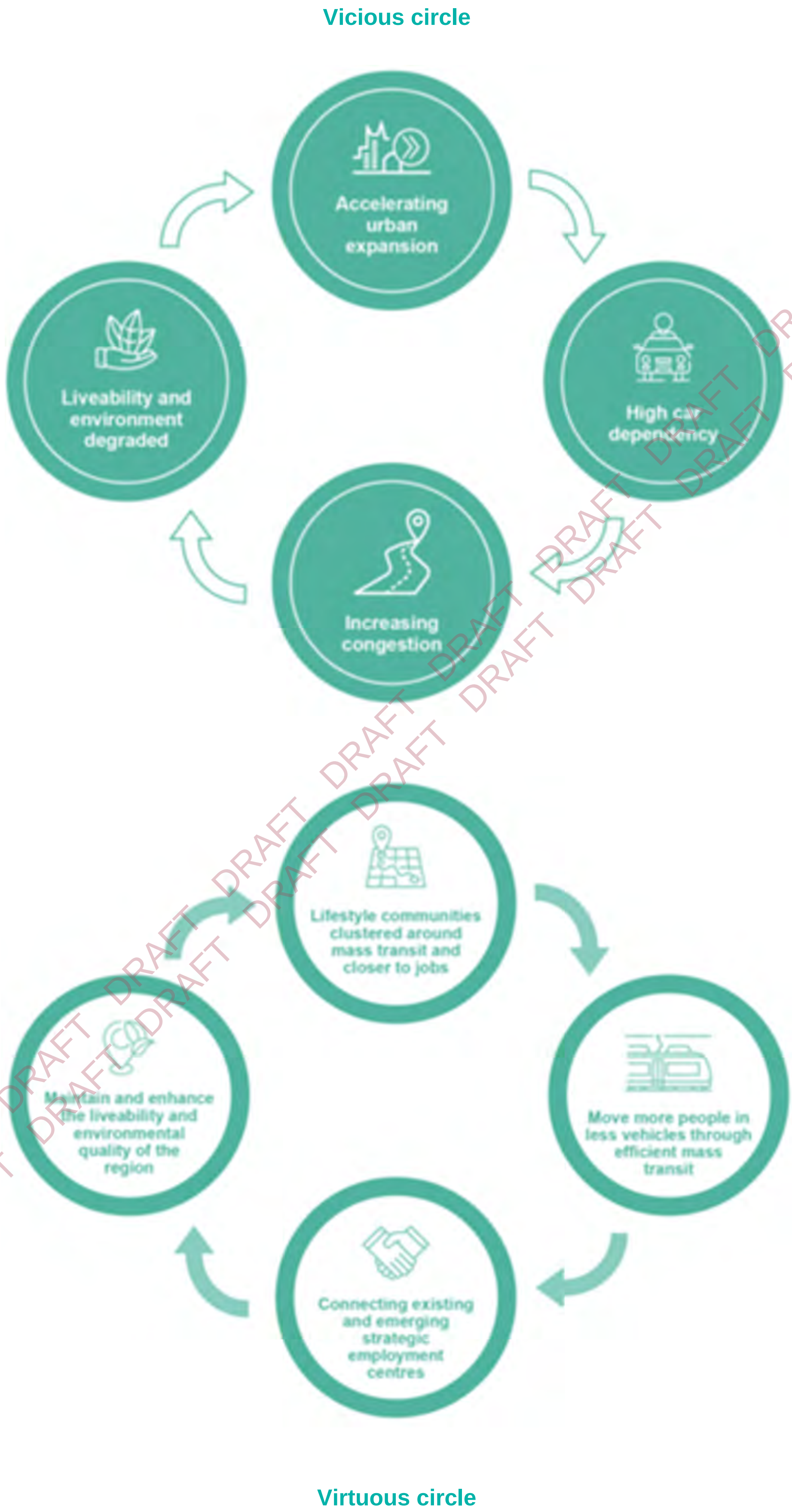
The service needs for the Project options analysis stage are identified as:

5. Transform suitable parts of existing urban areas into lifestyle precincts clustered around mass transit, and closer to jobs and attractions.
6. Move more people in less vehicles through efficient mass transit that is easily accessed by active transport.
7. Connect existing and emerging population and employment centres to the mass transit system, offering a viable alternative to using cars.
8. Maintain and enhance the sustainability and the liveability and environmental quality of the region as it continues to experience rapid growth by reducing urban expansion and reducing the amount of energy used and emissions made by transport in the region.

As shown in Figure 35, meeting these service needs will address the risk of a vicious circle by creating a virtuous circle.

[103] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case. p 19

Figure 35 – Vicious and virtuous circles



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Sunshine Coast Mass Transit
DRAFT Options Analysis
APRIL 2021

INVESTMENT STAGING PRIORITIES

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7. Investment Staging Priorities

Intervention to provide improved transport infrastructure and enable suitable urban change is resource intensive and needs to be rolled out in a series of prioritised stages. To determine optimum areas in which to intervene, and their staging priorities, analysis was undertaken to determine the most effective ways to address the challenges and achieve the benefits identified in Chapter 6. This analysis commenced with a recap of the Strategic Business Case findings. The analysis then reviewed the Strategic Business Case findings with respect to staging priorities:

- Assessing the performance of each stage as if it were an independent, first stage of investment
- Then comparing the combinations of stages in either the CAMCOS corridor or the SCMT Corridor.

7.1. Recapping the staging program from the Strategic Business Case

The service need analysis in the preceding chapter confirmed the need for a coordinated three-pronged strategy addressing the problems of urban expansion being experienced by the Sunshine Coast Region[104]. Through the Strategic Business Case, the area between Maroochydore and Caloundra was designated as the 'Sunshine Coast Urban Corridor'. This corridor has been identified as providing a significant opportunity to contribute to the achievement of the Queensland Government's *ShapingSEQ* urban consolidation benchmark. It is approximately 24 kilometres in length, occupies an area of approximately 4,670 hectares and currently accommodates over 80,000 people[105]. The Sunshine Coast Urban Corridor incorporates the major road corridors of Aerodrome Road, Alexandra Parade, Brisbane Road, Kawana Way and Nicklin Way.

7.1.1 Staged delivery of the mass transit master plan

The Strategic Business Case identified the need for a major improvement to mass transit to provide an integrated network across the region. Transport modelling undertaken as part of the Strategic Business Case confirmed that a mass transit system on the Sunshine Coast will need to balance:

- local accessibility, which supports the local integration of transport and land use outcomes
- regional connectivity, catering for longer distance travel to Brisbane metropolitan region and beyond.

To address these needs, the Strategic Business Case proposed a mass transit master plan derived from the Sunshine Coast Integrated Transport Strategy.

Figure 36 provides an overview of the long-term optimised mass transit network for the Sunshine Coast Region. The mass transit system consists of a comprehensive trunk network supported by an optimised bus network feeding into key activity centres and transit nodes.

A combination of transport technologies (regional rail, local mass transit, bus and active transport) could provide complementary services across key travel routes to meet the service needs identified in Chapter 6 and support the objectives of the Project.

[104] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case. p 19
[105] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case

Figure 36 – Optimised mass transit master plan for the Sunshine Coast

It should be noted Figure 36 shows the Sunshine Coast Urban Corridor serviced by a local mass transit style service between Maroochydore and Caloundra. This system connects at several places with a regional rail branch in the CAMCOS corridor, extending from the existing North Coast Rail Line at Beerwah linking to Caloundra South and then north through an inland route via Birtinya and Maroochydore to the Sunshine Coast Airport. These two connected mass transit routes are also complemented by connecting trunk bus routes to secondary locations throughout the region. There would also be supporting local bus and active transport routes.

To implement this master plan, the Strategic Business Case evaluated a range of potential structural options for mass transit improvement:

- Option 1 – Passenger rail between Beerwah and Sunshine Coast Airport
- Option 2 – Faster rail between Beerwah and Sunshine Coast Airport
- Option 3 – Local mass transit between Maroochydore and Caloundra
- Option 4 – Local mass transit between Beerwah and Maroochydore
- Option 5 – Local mass transit between Maroochydore and Kawana, and passenger rail to Beerwah
- Option 6 – Passenger rail between Beerwah and Sunshine Coast Airport, and local mass transit between Maroochydore and Caloundra.

Option 6 (Passenger rail between Beerwah and the Sunshine Coast Airport, and local mass transit between Maroochydore and Caloundra) delivers on all Project objectives as it is considered to be an ultimate mass transit solution, with the exception of value for money, having comparatively the largest capital and operating costs. However, out of all initiatives assessed, this initiative delivers the highest accessibility outcomes given the network coverage provided and induces a higher number of public transport trips within the region.

The Strategic Business Case found that Option 6 is most closely aligned with the Concept Mass Transit Network Strategic Plan[106]. It represents a potential ultimate solution for the Sunshine Coast. While it will require significant capital outlay to deliver the required infrastructure, delivery of a mass transit network aligned to Option 6 offers numerous staging possibilities.

7.1.2 Strategic Business Case mass transit investment staging priorities

Utilising the preferred Option 6 as the overarching network structure, the Strategic Business Case recommended staged development of mass transit should proceed in the following order of priority:

1. **The coastal northern sector of the Sunshine Coast Urban Corridor between Maroochydore and Kawana.** Investing here as a priority provides the strongest basis for achieving key policy goals of supporting urban consolidation and employment growth and managing congestion. Given this sector of the corridor contains the major employment and business growth centres of the region, this area provides the greatest opportunity to build connected, ‘lifestyle precincts’ with diverse housing and employment choices, all linked by local mass transit.
2. **The growth corridor between Kawana and Beerwah, which includes the inland southern sector of the preserved mass transit corridor known as ‘CAMCOS’.** This southern sector of CAMCOS contains significant planned residential and employment growth. Mass transit investment here will link this growth area to Kawana and Maroochydore and also link to the North Coast Rail Line (NCRL) at Beerwah for service to Brisbane. This southern sector of the CAMCOS corridor should represent a high priority for mass transit investment once connectivity between Maroochydore and Kawana is achieved.
3. **The coastal southern sector of the Sunshine Coast Urban Corridor from Kawana to Caloundra.** This sector provides integrated land use and transport opportunities, and connections from Caloundra to the regional rail services to Brisbane. This is an important area for ongoing urban change that should be progressed as soon as possible after completion of the priorities described in points (1) and (2).
4. **The northern sector of CAMCOS from Maroochydore to Kawana.** This sector offers the opportunity to provide a direct rapid transit connection between Maroochydore and the major urban growth communities on the southern perimeter of the Sunshine Coast Region, as well connecting the Maroochydore City Centre to Brisbane.

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[106] VLC. (2018). *Draft Sunshine Coast Concept Mass Transit Plan. Report*, p 34

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5. **The northern sector of CAMCOS from Maroochydore to the Sunshine Coast Airport.** Development of mass transit here would connect the growing Sunshine Coast Airport to its local southern catchment, through the Maroochydore City Centre. This will support interstate and overseas air connections to underpin the region's ongoing success as a destination for business and tourism. Initially this connection can be provided by a dedicated 'limited stops' bus service to Maroochydore similar to the TransLink 777 airport service that operates on the Gold Coast. A dedicated fixed track mass transit connection would be a long-term priority.

On 25 July 2019, the Strategic Business Case was endorsed by Council along with the following recommendation:

> *"The scope of the business case is proposed to be focused on the Maroochydore to Kawana corridor… with safeguarding for network extensions and/or connections to potential future mass transit solutions in the southern coastal corridor between Kawana to Caloundra, as well as the inland corridors between Beerwah and the Sunshine Coast Airport[107]."*

7.2. Analysis of mass transit investment staging priorities for the Options Analysis

The Strategic Business Case recommended a staging plan or program of investment as noted earlier. However, for the Options Analysis, more detailed evaluation was undertaken to review the priorities proposed by the Strategic Business Case.

This staging analysis does not consider benefits relative to costs, as even high-level costs are not available for some segments, hence a fair comparison is not possible. The benefits and costs of specific mass transit technology stages in each segment should be determined through a full economic appraisal at a future stage of assessment.

Instead, this staging analysis focuses on core performance metrics to determine which segment offers the highest benefit in terms of the Sunshine Coast's service needs identified in Chapter 6.

Three approaches to staging analysis program were tested:

- **Stage 1** – testing the effectiveness of **each Priority Area stage** of mass transit, assuming that each stage was provided independently of others (i.e. it was the first stage of mass transit provided).
- **Stage 2** – testing the relative effectiveness of alternative corridor **investment programs** providing either the full CAMCOS or the full SCMT corridor.
- **Stage 3** – testing the effectiveness of alternative investment programs in the Sunshine Coast Urban Corridor for Birtinya to Maroochydore by mass transit, assuming that a regional rail connection had already been provided from Beerwah to Birtinya.

7.2.1 Base transport network assumptions for staging analysis

The modelled road network used in this staging analysis is the Base Case 2041 network which includes only committed and funded road projects. The supporting public transport network (Figure 37) was a 'do-minimum' approach consisting of existing bus routes with minor extensions that provide public transport to Caloundra South and Beerwah East. Demographics are based on QGSO's projections made in 2018. Refer to Chapter 9 for more detail on the 2041 base network.

CAMCOS South (Priority Area 2), CAMCOS North (Priority Area 4) and the Airport Connection (Priority Area 5) sections of the mass transit plan use the dedicated CAMCOS corridor. Refer to **"Figure 22 – Geographic breakdown and focus areas for a SCMT solution from the Strategic Business Case"** for a recap of the Priority Areas on a map. In these areas, mass transit routes have been added and integrated with the base public transport network. Maroochydore to Kawana (Priority Area 1) and to Caloundra (Priority Area 3) will be largely accommodated within the existing road reserve. For these areas, the base bus network has been modified by truncating bus routes and replacing them with mass transit services.

[107] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case. p 138.

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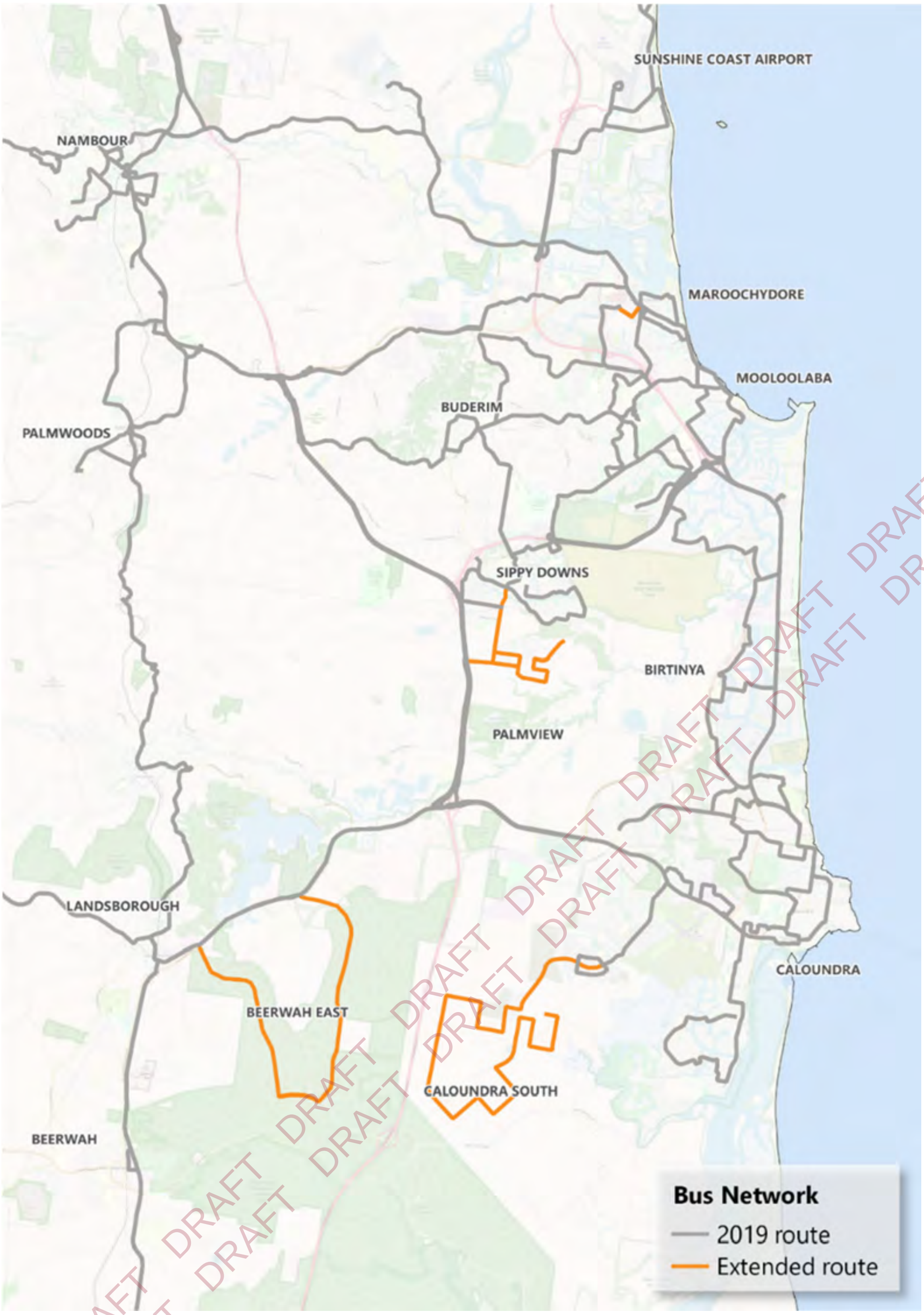

Figure 37 – Base case bus network 2041

7.2.2 Stage 1 staging analysis – independent stages

The Stage 1 analysis compares the benefits of each segment of "Priority Area" when measured against the Project objectives. To verify this, modelling of each Priority Area has been undertaken to determine relative benefits of building each stage as an independent section of a mass transit system, assuming that segment of the mass transit system was provided independent of other (i.e. it was the first stage implemented).

7.2.2.1 Mass transit technology assumed for the Stage 1 investment priority analysis

In order to ensure a fair and balanced appraisal of each Priority Area, it was decided to adopt one mass transit technology across all areas. Three technologies were considered:

- Heavy regional rail (e.g. the present Queensland Rail service to Nambour)
- Bus Rapid Transit (e.g. a bus system operating on a busway generally segregated from other traffic)
- LRT (light rail vehicles operating on trackway generally segregated from other traffic).

The 2018 QGSO population growth projections were utilised as the demographic scenario for the transport modelling.

Regional rail

Heavy regional rail based on current Queensland Rail technology cannot feasibly be installed in Priority Areas 1 and 3 due to physical design requirements which would entail full grade-separation and poor integration with the urban fabric. It would be feasible in the CAMCOS Priority Areas 2, 4 and 5. However, for practical reasons, regional rail would have to be staged outward from the present North Coast Rail Line at Beerwah.

Therefore, regional rail must first be installed in Priority Area 2 and the other sectors of CAMCOS being Priority Areas 4 and 5 could be staged later. This means that these Priority Areas 4 and 5 could not be considered as independent stages of a mass transit system. While regional rail, when built in stages, is certainly a valid option for all three CAMCOS Priority Areas, it was considered best to focus on one independent technology only for the analysis of investment priorities.

Bus rapid transit/Trackless Tram

A BRT solution was previously mooted in the CAMCOS corridor in precedent TMR investigations, as a forerunner to regional rail. However, that solution was not adopted and the final CAMCOS conclusions supported regional rail[108]. BRT or the more recent TT has potentially lower vehicle ride quality than rail-based options which may make it unsuitable for longer haul running required on the CAMCOS corridor west of Caloundra.

Light Rail Transit

LRT is adaptable and can operate in a variety of environments, including long haul as would be needed in the CAMCOS corridor (Priority Areas 2,4 and 5), and short haul, mixing with traffic as could be needed in the SCMT corridor (Priority Areas 1 and 3).

Conclusion - LRT technology adopted for Stage 1 testing purposes

Accordingly, regional rail was ruled out as a suitable option to test staging of all segments, and BRT/TT is not considered suitable for the long haul task required in some segments. This means to provide a fair basis for comparison, LRT is the most feasible option if each Priority Area is to be evaluated as an independent link.

Evaluation criteria for the Stage 1 prioritisation analysis

To assess the relative benefits of each Priority Area against the service needs identified in Chapter 6, the transport modelling results of each Priority Area were assessed against the following criteria which were derived from the service needs analysis:

- **Urban change – Supporting urban consolidation:** in the SCMT corridor
- **Transport network – Improving accessibility:** for residents and tourists.
- **Economic development – Connecting employment:** in key business, tourism and health precincts within the Sunshine Coast Urban Corridor.
- **Liveability and environmental protection – Sustaining communities and the environment:** of the Sunshine Coast

[108] Department of Transport and Main Roads (2019), *CAMCOS: Caboolture to Maroochydore Corridor Study.* Access at: https://www.tmr.qld.gov.au/Projects/Name/C/Caboolture-to-Maroochydore-Corridor-Study

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7.2.2.2 Summary of stage 1 staging analysis – independent stages

Transport analysis

Transport analysis has confirmed the Strategic Business Case conclusion that constructing the first stage of the mass transit in Priority Area 1 would provide the most significant benefit by:

- Serving the highest number of persons and jobs
- Promoting urban consolidation by supporting growth within the Existing Urban Area
- Offering the highest potential to attract trips away from cars
- Reducing congestion for much of the Sunshine Coast Urban Corridor
- Delivering the highest public transport mode share
- Attracting the most trips
- Delivering the second most significant reduction in VKT.

Liveability and protection of the natural environment

The environmental analysis shows all three CAMCOS priority areas have a higher impact on environmental values:

- Priority Area 2 has been the subject of assessment under the Environment Protection and Biodiversity Conservation Act 1999, although there will be extra costs to preserve habitat and address acid sulphate soils and improving resilience to tidal inundation and creek flooding.
- Priority Area 4 is a complex stage with many interfaces with vegetation protection, the National Park, coastal habitat and flooding.
- Priority Area 5 is less problematic as it runs through an existing road corridor with disturbed environmental values. Flood mitigation may be an issue as the sector crosses a floodplain (although this is already crossed by the Sunshine Motorway).
- Priority Areas 1 and 3 are routed through existing urban areas and will require careful management of disruption to residents and businesses during design and construction. They present little concern from an environmental perspective. Liveability and environmental issues can be managed with the normal precautionary measures. The crossing of the Mooloolah River by Priority Area 1 will result in some disturbance of marine habitat, however this river crossing is already the site of significant transport infrastructure.

Overall assessment of Stage 1 testing of independent staging priorities

Table 17 shows a summary of the rankings against a subset of the metrics presented in this chapter. The metrics included in this table have been selected to avoid the risk of double counting as far as possible. Outputs from the transport modelling are scaled to have values between 0 and 5 and all criteria are weighted equally. For the liveability and environmental protection criteria, the best performing option is assigned a value of 5, with the rankings that flow to a value of 1 for the poorest performing candidate.

Table 17 – Summary of priority area rankings in investment program analysis

Challenges	Criterion	Metric	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	Priority Area 5
Urban growth	**Supporting consolidation**	Growth served by stations (Persons)	5.00	0.00	3.07	1.07	0.91
		Growth served by stations (Jobs)	5.00	0.16	1.66	1.94	0.00
Transport network	**Improving accessibility**	Persons within 800m of a station (2041)	5.00	2.26	3.03	0.51	0.00

Challenges	Criterion	Metric	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	Priority Area 5
		Change in excessive delay relative to the Base Case in 2041	0.00	5.00	2.17	1.92	1.62
		PT mode share (2041)	5.00	2.50	1.65	1.19	0.00
		Total number of trips made within the station catchment of each priority area (2041)	5.00	0.30	1.47	0.34	0.00
Economic development	**Connecting employment**	Journey to work PT mode share	5.00	3.91	1.48	1.37	0.00
Liveability and environmental protection	**Sustaining communities and the environment**	Change in kilometres travelled by people in cars	4.66	5.00	0.12	0.00	0.02
		Change in kilometres travelled by people using PT	1.23	5.00	0.00	0.03	0.60
		Liveability and protection of the natural environment	4.00	2.00	5.00	1.00	3.00
Options Analysis confirmed ranking score: highest is best			**39.89**	**26.13**	**19.65**	**9.37**	**6.15**

This summary analysis confirms Priority Area 1 as the highest priority for mass transit investment.

The relativities between Priority Area 2 and Priority Area 3 relate to the importance placed on the respective Project objectives. If maximising trips and serving urban consolidation is seen as the priority following delivery of Priority Area 1, then Priority Area 3 could offer the greatest benefit. However, Priority Area 2 serves significant growth areas and connects to the regional rail at Beerwah. It has significant benefits in terms of reducing overall VKT and congestion. These benefits, in unison with the interregional connection it offers, makes Priority Area 2 the likely candidate for the second stage of investment, as validated by the scores.

Priority Area 4 and Priority Area 5 remain the lowest priority with limited benefit in terms of reduced reliance on cars and support for urban consolidation. If constructed in isolation, these two areas return the lowest public transport patronage and mode share and have no significant benefits in terms of reduced congestion. However, when connected to a more complete network, and developed as a later stage of the mass transit network, these priority areas still offer many potential benefits. Priority Area 4 has the highest potential for disturbance of coastal habitat, which will add cost and complexity to this stage.

7.2.2.3 Conclusion on Stage 1 testing of independent stages

The findings of the Strategic Business Case were validated in the Priority Areas as assigned therein are exactly the same when each stage is considered as an independent priority and subjected to detailed assessment.

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7.2.3 Stage 2 testing of alternative corridor investment programs

The North Coast Regional Transport Plan[109] proposes investigation of two major public transport corridors:

- A2.03 Maroochydore to Caloundra integrated urban public transport

  Work in partnership with Sunshine Coast Council to develop a business case for an integrated urban public transport solution for Maroochydore to Caloundra.

- A2.12 Sunshine Coast Airport to Beerwah public transport planning

  Undertake strategic planning for the southern Sunshine Coast's public transport network to determine the most appropriate public transport modes, routes and ancillary infrastructure. Identify an ultimate preferred network, staging and delivery strategy[110].

The Regional Transport Plan does not specify which of these two investigations should have priority as far as this mass transit staging analysis is concerned.

Both are highly effective projects as envisaged in the priority staging analysis undertaken by the Strategic Business Case and reported earlier in this chapter. To test the effectiveness of these two major public transport corridors in meeting the service needs, and compare their relative priorities, further analysis has been undertaken below.

The 2018 QGSO population growth projections were utilised as the demographic scenario for the transport modelling.

This section outlines:

- Location of the development corridors
- Methodology for testing alternative investment strategies
- Results of the assessment of these alternative strategies.

7.2.3.1 Location of both corridors

The **Sunshine Coast Airport to Beerwah** corridor assumes the construction of a regional rail corridor between Beerwah, Birtinya, Maroochydore and Sunshine Coast Airport. This is in the public transport corridor preserved following the CAMCOS in 2005. Development of this corridor for regional rail will comprise a new branch line off the North Coast Rail Line to link the Sunshine Coast to Brisbane and the Gold Coast. It was assumed rail services that use the new branch line will run through to Varsity Lakes on the Gold Coast Line.

The **Maroochydore to Caloundra integrated urban public transport corridor** runs through the Sunshine Coast Urban Corridor. The analysis assumed a local urban mass transit, e.g. LRT, BRT, from Maroochydore to Caloundra. This corridor was endorsed by Sunshine Coast Council in 2015[111] for further planning and feasibility work relating to the then Sunshine Coast Light Rail project. The corridor generally follows to the coastline and provides access from Maroochydore to SCUH and Caloundra, terminating close to the Caloundra Aerodrome.

Both of these corridors are shown in Figure 38 below.

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[109] Queensland Transport and Main Roads. 2021 North Coast Regional Transport Plan. Pp 78-79
[110] This refers to the preserved public transport corridor widely known as CAMCOS.
[111] Ordinary Meeting of Council on 23 April 2015. See https://www.sunshinecoast.qld.gov.au/Council/Planning-and-Projects/Major-Regional-Projects/Sunshine-Coast-Mass-Transit-Project/Document-Library

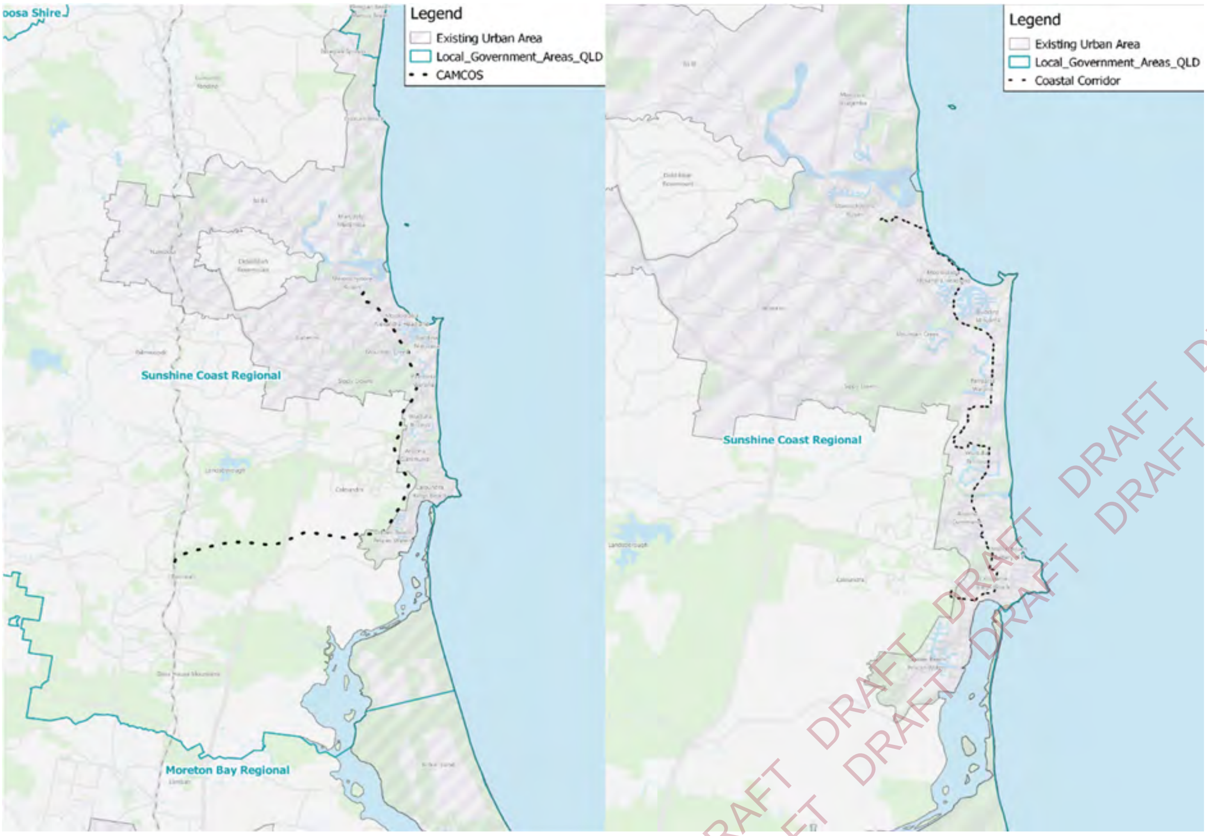

Figure 38 – CAMCOS corridor Beerwah to Maroochydore (left), Sunshine Coast proposed route for further investigation (right)

7.2.3.2 Methodology for testing alternative investment strategies

The analysis of the two corridors establishes a comparative assessment of corridor level mass transit investment, and the respective ability to provide benefits against the strategic growth priorities. Analysis has been undertaken by conducting strategic demand modelling to determine whether each corridor investment scenario meets the service needs and benefits identified in Chapter 6.

The options were assessed against two key transport criteria as shown in Table 18.

Table 18 – Criteria for comparison of CAMCOS and Sunshine Coast Urban Corridor transport modelling outcomes, 2041

Criteria	Description	Source
Maximise public transport ridership	Measures the total ridership	Transport Model
Maximise the number of people choosing PT for travel to work	Percentage of journey to work trips made by PT within the Sunshine Coast LGA	Transport Model

7.2.3.3 Results of the assessment of the alternative strategies

Table 19 – Comparison of CAMCOS and SCMT Corridor transport modelling outcomes, 2041

	SCMT Corridor (Sunshine Coast mass transit route)	**CAMCOS** (Beerwah to Maroochydore)	**Total difference Coast-CAMCOS**	**Percentage difference**
Public Transport Boardings within Sunshine Coast LGA 2041				
First daily boardings	61,572	51,178	+10,394	16.88%
Transfer daily boardings	7,835	6,343	+1,492	19.04%
Total daily boardings	**69,407**	**57,521**	**+11,886**	**17.13%**
Journey to work mode share within Stage 1 (Kawana to Maroochydore)				
Car	89.7%	94.0%	- 4.3	- 5%
Public transport	10.3%	6.0%	+4.3	+41%

The results in Table 19 show the SCMT Corridor scenario performs better than the CAMCOS scenario with respect to public transport as it serves more potential trips, with a total of additional 10,639 boardings under the SCMT Corridor scenario than the CAMCOS scenario.

This effect is most pronounced within the impacts of journey to work mode share, showing that almost double the proportion of workers (10.3 per cent) use public transport under the Sunshine Coast Urban Corridor scenario.

In addition to modelled results, a comparative assessment of both options against the Project objectives as established in Section 1.2 was undertaken. Table 20 outlines the results of this assessment.

Table 20 – Comparative assessment against Project objectives

Project objective	Impact of alternative strategies
Support the Sunshine Coast's productivity, employment growth and self-containment aspirations by supporting existing and emerging strategic centres	Development in the Sunshine Coast Urban Corridor supports existing and emerging strategic centres in the Sunshine Coast.
Maintain and, where possible, improve amenity and liveability, and provide for urban change by supporting consolidation opportunities	Development in the Sunshine Coast Urban Corridor supports urban consolidation providing opportunities for investment in these areas.
Improve accessibility, convenience and resilience of the integrated transport network	Development in the Sunshine Coast Urban Corridor is forecast to deliver greater utilisation of the public transport network.
Provide a deliverable and value for money solution	The Sunshine Coast Urban Corridor is some 23 kilometres long while CAMCOS is 48 kilometres long, hence the costs of CAMCOS are likely to be at least twice those of the SCMT.

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7.2.3.4 Summary of Stage 2 testing of staging priorities

Overall, regional rail in CAMCOS provides less support for the movement of people within the Sunshine Coast. It does not increase public transport mode share and journey to work mode share to the same extent as a mass transit system. SCMT will result in an additional 10,639 daily boardings as compared to CAMCOS and a journey to work mode share within the Sunshine Coast for public transport of ten per cent compared to five per cent for CAMCOS.

Based on the outcomes of this assessment a mass transit system best meets the Project objectives. However, if the objectives were different, for example, connecting the Sunshine Coast to metropolitan Brisbane, the results would likely be reversed in favour of the regional rail in CAMCOS, which it serves these inter-regional trips much better. It should be noted however, that some 77 per cent of Sunshine Coast resident workers travel to a destination in the Sunshine Coast Region, whereas only five per cent work in the metropolitan Brisbane region.

The full construction of regional rail all the way from Beerwah to the Sunshine Coast Airport (i.e. Priority Areas 2, 4 and 5) carries less passengers and does not serve journeys to work as well as the mass transit. However, for Priority Area 2, the connection to regional rail at Beerwah, remains an important priority.

These results are consistent with the findings of the Stage 1 staging analysis, supporting the development of mass transit options in the SCMT corridor, commencing with mass transit in Priority Area 1, Maroochydore to SCUH.

7.2.4 Stage 3 – Testing the effectiveness of alternative investment programs to link Maroochydore with Birtinya by mass transit,

Despite the priority staging analysis reported above favouring the development of Priority Area 1, local mass transit in the SCMT corridor extending between Maroochydore and SCUH, the Options Analysis has also considered the possibility that Priority Area 2, a rail connection from Beerwah to Birtinya, may be provided first.

In that event, a decision would need to be taken as to whether to provide either:

- a regional mass transit system in the CAMCOS corridor, to link Birtinya to Maroochydore; or
- a local mass transit system, as proposed by Priority 1, to link Birtinya to Maroochydore.

The Stage 3 testing provides a comparative assessment of mass transit options against the objectives of supporting consolidation and intra-regional travel within Priority Area 1, assuming that a regional rail connection had already been provided from Beerwah to Birtinya The two options assessed are:

- Option 1: CAMCOS Stage 2 – a regional rail extension from Birtinya to Maroochydore aligning to the protected CAMCOS corridor.
- Option 2: Mass Transit Stage 1 – a local mass transit system along the SCMT corridor, connecting from regional rail at Birtinya through to Maroochydore City Centre.

The 2018 QGSO population growth projections were utilised as the demographic scenario for the transport modelling.

The same base rail and bus network was used for modelling both options to maintain consistency and best highlight the transport impacts of both scenarios.

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7.2.4.1 Base Case: Regional rail in CAMCOS – Beerwah to Birtinya

CAMCOS Stage 1, being the heavy rail extension from Beerwah to Birtinya, is included in the Base Case that underpins the assessment. This provides a new regional rail service branching off the North Coast Rail Line connection at Beerwah and running through to Birtinya, terminating near Birtinya town centre.

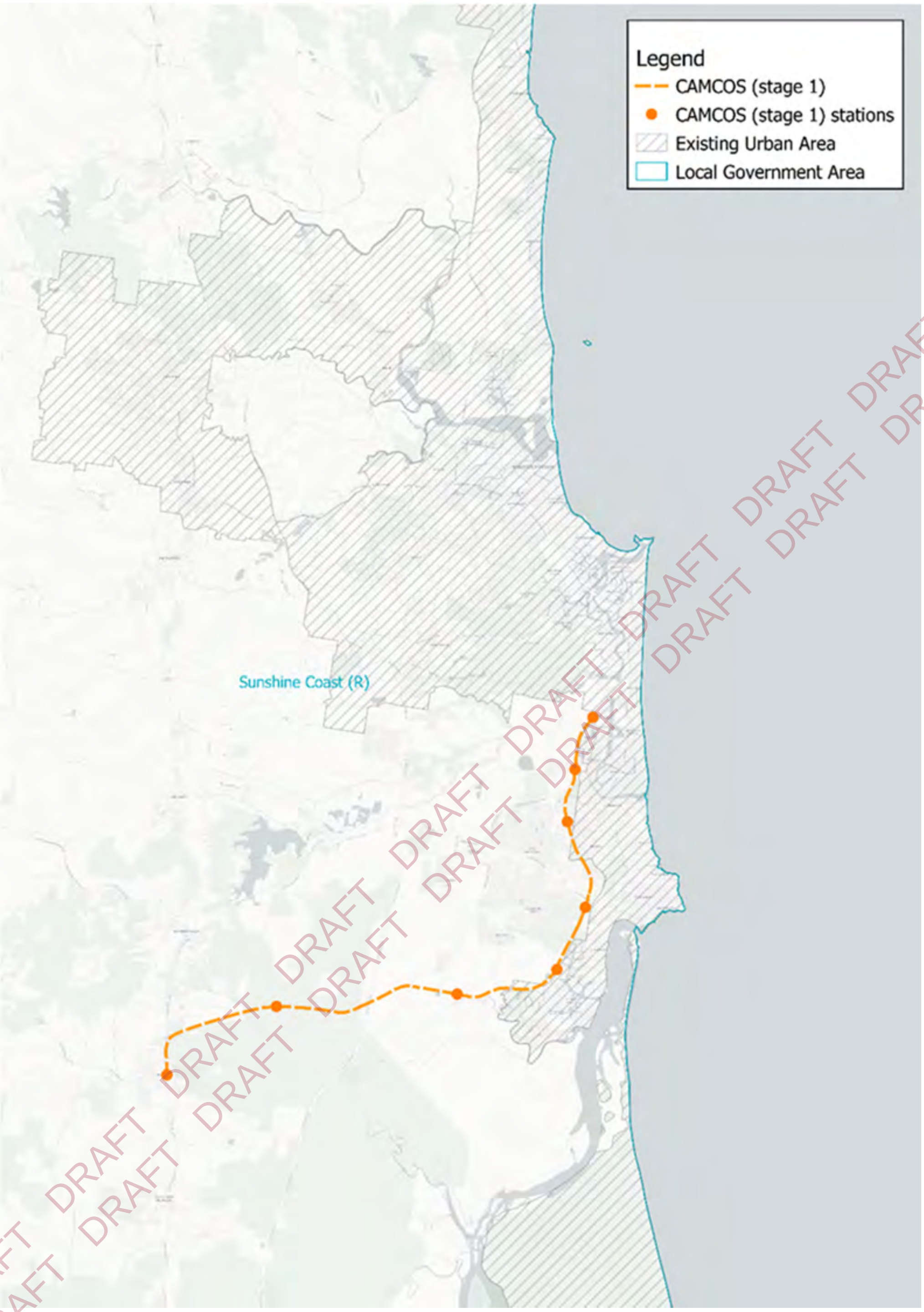

Figure 39 – Base Case – Regional rail in CAMCOS - Beerwah to Birtinya

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7.2.5 Option 1: Regional rail in CAMCOS Birtinya to Maroochydore

This option is a regional rail extension in a ROW Category A to link Birtinya to Maroochydore, as demonstrated in Figure 40. The extension includes three additional railway stations at Parrearra, Mooloolaba and Maroochydore City Centre. This option is illustrated in Figure 40Figure 41.

Figure 40 – Option 1 – regional rail connection (Category A) in CAMCOS from Birtinya to Maroochydore

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7.2.6 Option 2: SCMT Stage 1

Option 2 comprises the SCMT Stage 1, modelled as a local mass transit system in a Category B ROW between Birtinya and Maroochydore. The northern terminus is at the transit hub for the new Maroochydore City Centre. It is directly connected to the regional rail station at Birtinya and terminates at SCUH. Option 2 includes 16 new LRT stations. This option is illustrated in Figure 41.

Figure 41 – Option 2: Local mass transit (Category B) in the SCMT corridor from Birtinya to Maroochydore

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7.2.7 Results of Stage 3 testing

7.2.7.1 Station catchment analysis

An analysis of station catchments showed a considerable difference in the number of people living within 800 metre (walkable catchment) of the proposed Option 1 CAMCOS stations versus the proposed Option 2 local mass transit station. The results are shown in Table 21.

Option 2 showed over five times more population living within 800 metres of a station compared to Option 1 in CAMCOS, largely due to 2018 QGSO population projections reflecting higher urban consolidation along the SCMT corridor out to 2041.

However, given that Option 2 contains more stations, an indication of average population per station is useful. For Option 1 in CAMCOS, there is an average of 4,107 people living within 800 metres of the three stations. Under Option 2, SCMT Stage 1, there are 16 proposed stations averaging 5,310 people within each station catchment.

Having more people within the catchment results in public transport becoming more of an attractive option particularly as congestion on the roads worsens, leading to an increase in public transport use.

Table 21 – Comparison of catchment populations in 2041 – Option 1 CAMCOS vs Option 2 SCMT Stage 1

	CAMCOS Beerwah to Birtinya (Base Case)	Option 1 CAMCOS Birtinya to Maroochydore	Option 2 SCMT Stage 1 Birtinya to Maroochydore	Difference 2-1
Population within 800 metres of a new station	29,457	12,323	66,088	53,765

7.2.7.2 VKT and hours of delay

There are slightly fewer VKT under Option 1 CAMCOS (-0.15 per cent) due to a more significant proportion of long trips being made by public transport, when compared to Option 2 SCMT Stage 1. Under Option 2, there are also marginally more hours of excessive delay for vehicles (+0.92 per cent) due to more kilometres travelled by car each day and, the reduction in road capacities required to accommodate on-road mass transit. The relevant figures are summarised in Table 22.

Table 22 – Hours excessive delay and car kilometres travelled within the Sunshine Coast LGA (daily) Option 1 vs Option 2 in Priority Area 1 in 2041

	Option 1 CAMCOS	Option 2 SCMT Stage 1	Difference 2-1	Percentage difference 2-1
Hours excessive delay (hours)	12,789	12,908	-119	-0.92%
Car kilometres travelled (kilometres)	14,383,161	14,405,282	-22,121	-0.15%

7.2.7.3 Public transport boardings

Table 23 outlines the 2041 public transport boarding forecasts for the two options across the Sunshine Coast LGA. There are significantly more boardings made under the Option 2, the SCMT Stage 1 than with the Option 1 in CAMCOS. When considering first boardings (i.e. total number of trips where the option is boarded before another public transport service) Option 2 sees over 10,000 more trips than Option 1 in CAMCOS.

As the Option 2 passes through more densely populated areas than the CAMCOS corridor in Option 1. Option 2 is more accessible to active transport. As a result Option 2 offers a more attractive alternative mode for shorter trips within its catchment.

Table 23 – Public transport boardings within the Sunshine Coast LGA Option 1 vs Option 2 in 2041

	Option 1 CAMCOS	Option 2 SCMT Stage 1	Difference 2-1	Percentage Difference 2-1
First boardings	51,178	61,455	10,277	16.72%
Transfer boardings	6,343	12,098	5,755	47.57%
Total boardings	**57,521**	**73,552**	**16,031**	**21.8%**

7.2.7.4 Trips made by car vs public transport

In looking at the split between car and public transport trips within the Sunshine Coast LGA (Table 24), a greater proportion of trips would be made by public transport under Option 2 than under the Option 1 (2.9 per cent vs 2.2 per cent respectively). This is reflective of the public transport boardings data above, where more trips are being made on public transport due to population density around the route and the on-road nature of LRT.

Table 24 – Share of car vs public transport trips within the Sunshine Coast LGA – Option 1 vs Option 2 in 2041

Mode	Option 1 CAMCOS	Option 2 SCMT Stage 1
Car	97.8%	97.1%
Public transport	2.2%	2.9%

While the split for journey to work trips is similar at the LGA level, Table 25 shows a significant difference when looking specifically at the mode share of journey to work trips within the Priority Area 1. The significantly higher public transport mode share under the Option 2 is predominately due to better walk-up access than under the Option 2 in CAMCOS.

Table 25 – Journey to work mode share within Priority Area 1 Option 1 vs Option 2 in 2041

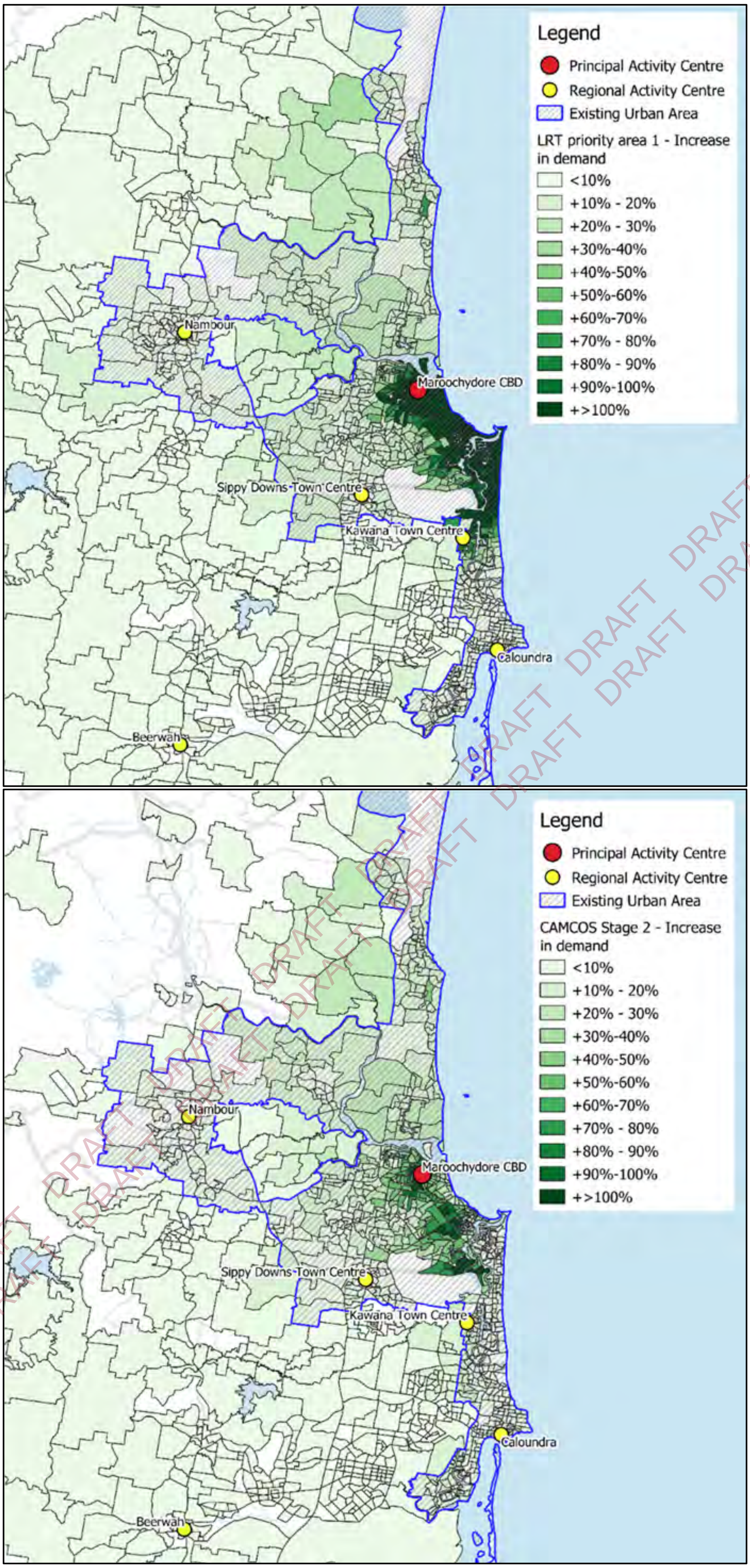
Mode	Mode share Option 1	Mode share Option 2
Car	94.6%	90.2%
Public transport	5.4%	9.8%

7.2.7.5 Change in public transport demand

In looking at the increase in public transport use for internal trips within the Sunshine Coast LGA, there are differences in geographic distribution between the two options. The highest increase in demand (darker green zones in Figure 42) occurs in Option 2 SCMT Stage 1. This is because the Option 2 alignment serves more people under the 2018 QGSO population growth projections.

Under Option 1 in CAMCOS, there is a smaller increase in public transport demand overall, with the most significant shift occurring close to the more limited number of regional rail stations. The higher increase in ridership in Option 2 SCMT Stage 1 demonstrates the effectiveness of the Category B mass transit in shifting more trips to public transport due to closer stop spacing, higher frequencies and greater population densities leading to more trips being taken from within the walkable catchment.

Figure 42 – Change in public transport demand for internal trips under Option 2 vs Option 1



7.2.7.6 Summary of findings – Stage 3 testing of CAMCOS vs SCMT Stage 1

The testing of two options for mass transit between Birtinya and Maroochydore shows:

- The journey to work public transport mode share is double in Option 2 SCMT Stage 1 in 2041, demonstrating that mass transit in the SCMT corridor supports commuters significantly better than Option 1, regional rail in CAMCOS.
- Public transport boardings for trips within the Sunshine Coast LGA in 2041 are about 20 per cent higher under Option 2 SCMT Stage 1 than Option 1 in CAMCOS due to Option 2 being located in more populated areas.
- Within Priority Area 1, in 2041 there will be over five times the number of people living within 800 metres of a proposed station under Option 2 (66,088) than under Option 1 in CAMCOS (12,323).
- Slightly longer car travel times are experienced under Option 2 in 2041 compared to Option 1 due to a higher concentration of longer trips being served by Option 1.
- Option 1 provides slightly higher congestion relief demonstrated by lower VKT and fewer hours spent in excessive delay.

7.2.8 Summary of overall findings – investment staging priorities

Three approaches to a mass transit investment staging program were tested in this section:

- **Stage 1** – testing the effectiveness of **each Priority Area stage** of mass transit, assuming that each stage was provided independently of others (i.e. it was the first stage of mass transit provided)
- **Stage 2** – testing the relative effectiveness of alternative corridor **investment programs** providing either the full CAMCOS or the full SCMT corridor
- **Stage 3** – testing the effectiveness of alternative investment programs in the Sunshine Coast Urban Corridor to link Birtinya to Maroochydore by mass transit, assuming a regional rail connection had already been provided from Beerwah to Birtinya.

All three stages confirmed the SCMT corridor, extending from Maroochydore to Caloundra is a high priority for mass transit investment. Further, the staging priorities in the Strategic Business Case were confirmed as:

1. Local mass transit in the SCMT corridor extending from Maroochydore to SCUH
2. Regional mass transit, most likely heavy rail, in the CAMCOS corridor from Beerwah to Birtinya
3. Local mass transit in the SCMT corridor from SCUH to Caloundra
4. Regional mass transit in the CAMCOS corridor from Birtinya to Maroochydore
5. A mass transit connection to the Sunshine Coast Airport.

A detailed analysis was also conducted based on a scenario whereby regional rail had been extended from Beerwah to Birtinya, to establish the best option for connecting Birtinya to Maroochydore. This confirmed the priority for local mass transit in the SCMT corridor.

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LAND USE ANALYSIS

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8. Land Use Analysis

This chapter reports on the development of demographic scenarios to underpin transport and economic modelling in the Options Analysis. It also recaps the relevant findings of the Strategic Business Case with respect to land use planning. It then develops demographic scenarios based on two approaches that enable a robust comparison of all options:

- 2018 QGSO population growth projections relating to urban settlement patterns and the location of employment (i.e. the demographics and city form are fixed by previous analysis outside of the mass transit business case process) and
- Testing the effects of a strategic transport investment with respect to urban change (i.e. the demographics and urban form are free to vary depending on the transport accessibility of the land in the catchment of the infrastructure).

8.1. Strategic business case recommendations

As discussed in Section 7.1.2, the Strategic Business Case provided a clear way forward on the development of an integrated transport and land use strategy to underpin delivery of the Project. It determined that the recommended priorities for investment in the new mass transit system should be in the following order[112:]

1. **The coastal northern sector of the Sunshine Coast Urban Corridor between Maroochydore and Kawana.** Investing here as a priority provides the strongest basis for achieving key policy goals of supporting urban consolidation and employment growth and managing congestion. Since it contains the major employment and business growth centres of the region, this area provides the greatest opportunity to build a connected, lifestyle community with diverse housing and employment choices, all linked by local mass transit.
2. **The growth corridor between Kawana and Beerwah which includes the inland southern sector of the preserved mass transit corridor known as "CAMCOS".** This southern sector of CAMCOS contains significant planned residential and employment growth. Mass transit investment here will link this growth area to Kawana and Maroochydore and also link to the North Coast Railway at Beerwah for service to Brisbane. This southern sector of the CAMCOS corridor should represent a high priority for mass transit investment once connectivity between Maroochydore and Kawana is achieved.
3. **The coastal southern sector of the Sunshine Coast Urban Corridor from Kawana to Caloundra.** This sector provides integrated land use and transport opportunities, and connections from Caloundra to the regional rail services to Brisbane. This is an important area for ongoing urban change that should be progressed as soon as possible after completion of the priorities described inpoints (1) and (2) above.

The Strategic Business Case further recommended[113]:

- The concept for the mass transit system must be based on a technology that offers a high-quality service capable of attracting a significant proportion of passengers out of cars. The mass transit technology must also have a demonstrated capability to engage developers and the broader community in an urban change process that results in a proportion of the Sunshine Coast's urban consolidation being located in the SCMT corridor.
- Although light rail operating in a segregated right of way is a technology with proven capabilities, other more cost-effective options will need to be analysed in the next stage of the business case process.

[112] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case, pp 139-140
[113] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case, p20.

8.2. Testing the effects of a strategic transport investment on land use change

8.2.1 Methodology applied to demographic scenario development for the Options Analysis

To underpin the quantified assessments of shortlisted Project options as required by the BCDF for this Options Analysis, a strategic transport model was run to provide a large range of parameters relating to transport costs and benefits. In turn these outputs are utilised in the assessment process for this Options Analysis.

To do this, the transport model runs a series of "cases", constructed from both demographic and transport system scenarios. In both cases these scenarios can be either a base scenario (i.e. *without-Project*), or an intervention scenario (i.e. *with-Project*).

This chapter establishes the basis for the demographic scenarios used in the Options Analysis. Two different approaches were taken to develop the scenarios:

1. Approach 1 - Adopting the 2018 QGSO population projections for the Sunshine Coast Region to provide a series of Project reference cases. This effectively provides a Project neutral demographic scenario that does not take account of any urban change benefits the Project may produce; or
2. Approach 2 - Developing a series of test cases by investigating land use opportunities that could be supported by a new mass transit system if it can be designed to fit in well with the generally low key urban form. These land use opportunities are quantified as the potential of the proposed SCMT to support increased dwellings, population and employment in the SCMT corridor.

The strategic transport models were then able to measure shifts in relative accessibility across a city, given the addition or withdrawal of the strategic transport infrastructure and the consequent effects on the location of dwellings and jobs.

Having regard to the high priority attached to Priority Areas 1 and 3 adopted in both the Strategic Business Case and Chapter 7 of this draft Options Analysis, the scenarios concentrated on options for a proposed mass transit system in the urban corridor from Maroochydore to Caloundra, as identified by Sunshine Coast Council in its decision of 23 April 2015 (refer to Section 4.2).

8.3. Approach 1 – Utilising QGSO population projections

QGSO 2018 population projections include low, medium and high series projections. The medium series projections were selected and translated into more detailed modelling by TMR. The QGSO medium series projections are typically used for Queensland Government business cases, and are also generally used for planning future Government services including education, health and emergency services. They are updated periodically by QGSO and different QGSO projections may be relied upon. The QGSO projections may also be reviewed when the effects of COVID-19 on population growth become clearer.

While these projections are produced with the greatest knowledge of current and likely future trends, they are still projections, and should not be taken as the planned outcomes in terms of Government policy goals.

Further, QGSO projections do not constitute town planning proposals. Any proposed changes to planning provisions to accommodate the projected population growth will be considered by Sunshine Coast Council in consultation with the community as provided under the *Planning Act 2016*.

8.4. Approach 2 – investigating the potential of the new mass transit system to influence urban change

Although utilising QGSO projections (as per Approach 1) enables a like-for-like analysis of options in the shortlisting and evaluation stages against a single projected demographic scenario, the so called "second round" benefits of land use change and the wider economic benefits attributable to the various mass transit investment options are not able to be properly assessed. This could mean important benefits are not understood and realised in later stages of the Project (refer to Chapter 15 for further detail).

To address this, Approach 2 considers other land use scenarios to test the ability of mass transit investment to influence urban outcomes.

These scenarios test:

- the potential changes in dwelling supply, population and employment
- the potential redistributive effects with respect to the location of dwelling supply, population and employment.

Demographic scenarios were utilised to test the urban outcome benefits of the following project options in the Stage 1 Sunshine Coast Urban Corridor extending from Maroochydore to Birtinya:

- A Base Case, being a no-intervention (trend) scenario
- Urban change effects of a LRT system (noting a wLRT system would also align with this scenario)
- Urban change effects of a BRT system (noting a TT system would also align with this scenario).

Since the other potential mass transit options such as bus upgrades and a QBC are based only on painted kerbside bus lanes and bus stop upgrades which lack the permanence of a dedicated mass transit corridor offered by LRT, wLRT, TT and BRT, they were judged to have minimal ability to influence land use outcomes. Refer to Section 10.3.4 for further discussion.

8.4.1 Urban change effects of strategic transport infrastructure

When an investment is made in new major transport infrastructure, it improves the accessibility of land within its catchment. This can occur irrespective of whether the infrastructure is a road or public transport initiative. For example, a new motorway to an area previously only served by a basic two lane road will reduce the time taken to get to and from the area thereby improving the ability for people to access the area.

When change is planned to occur in an existing urban area is considered, the provision of new transport infrastructure is often required as there will likely be more people and jobs in the area than prior to the redevelopment. This means the capacity of the local transport system will need to be increased, to meet the extra travel demand.

Although existing roads in the area can be widened, this will increase the amount of traffic and reduce the amenity of the area due to noise and air pollution. The widened, busier roads may also impact the ability to realise urban change. Further, more cars result in more parking, which takes up valuable space that could otherwise be utilised for residential, commercial, green space or recreational uses.

An alternative approach to support the change of an existing urban area is to provide an efficient new mass transit system that can move more people in fewer vehicles and fit in better with the local urban character and lifestyle. If such a system integrates well with the locality, is electrically powered and quiet, it will have far less noise and air pollution impacts than a busy road.

The provision of a new mass transit system will increase the accessibility of land in the catchment and increase the potential for development of either dwellings or commercial enterprises thereby creating more jobs.

For a new public transport option to have a clear influence on land use and development, it must meet two key conditions:

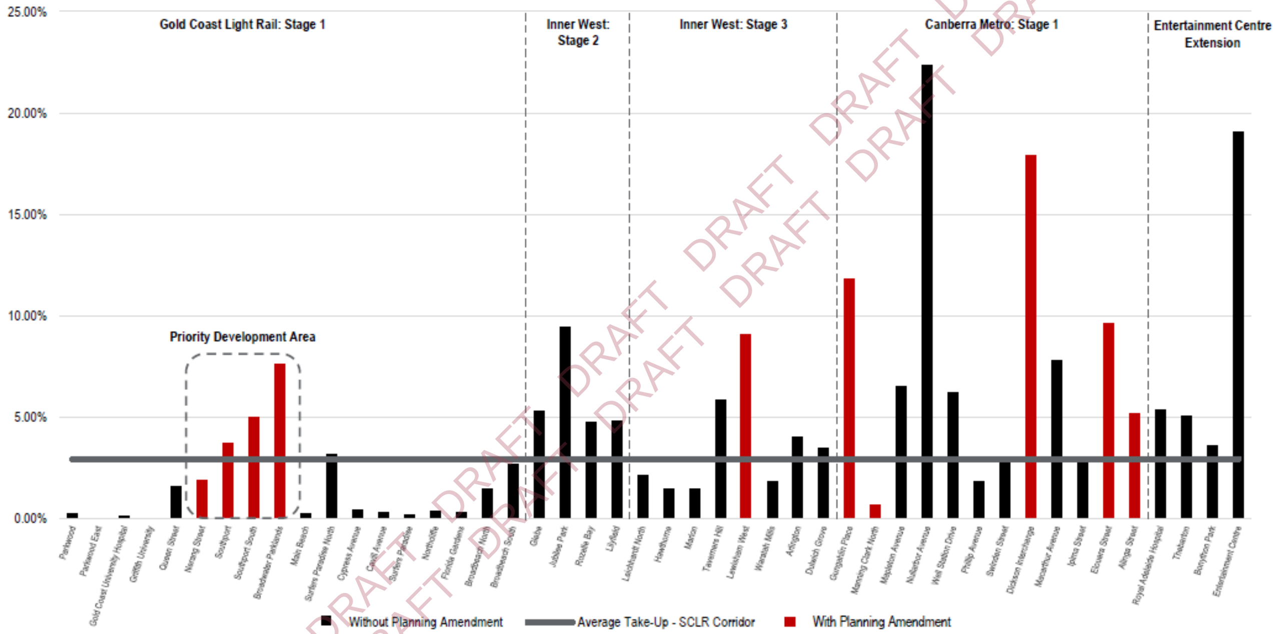
1. It must provide a significant improvement in accessibility (above business as usual) to important destinations such as activity centres, educational facilities and recreational precincts
2. It must be perceived by people as a permanent investment, that is, it can not be easily removed and converted back to a general purpose facility, not have its route diverted by a change of road use management policy or the like.

8.4.2 Benchmark analysis for urban change effects – LRT projects in Australia

Since 2000, Australia has seen five light rail infrastructure projects implemented, aimed at improving accessibility between residential and employment hubs, reducing congestion on major roads, or supporting urban change, often resulting in increased population within the areas serviced by the light rail networks.

To provide context to the potential upper and lower take-up rates that may be achieved within the SCMT corridor, a detailed assessment of the historical market performance of the five identified light rail corridors was undertaken to establish trends in the demographic profile, and take-up rates of urban consolidation opportunities. The benchmarked light rail corridors were:

- Gold Coast Light Rail (GCLR): Stages 1 & 2
- Sydney Light Rail (SLR) Inner West: Stage 2
- SLR Inner West: Stage 3
- Canberra Metro: Stage 1
- Glenelg Tram: Adelaide Entertainment Centre Extension.



The table below provides a high-level overview of the historical take-up rates from project completion date, at the five identified light and heavy rail corridors.

	Gold Coast Light Rail: Stages 1-2	Inner West: Stage 2	Inner West: Stage 3	Canberra Metro: Stage 1	Glenelg Tram: Entertainment Centre Extension
Commencement*	2014	2000	2014	2014*	2010
Average – CAGR	1.6% per annum	6.0% per annum	3.7% per annum	7.8% per annum	8.8% per annum

*2014 marks the date of Project Business Case Approval for Canberra Metro: Stage 1

Figure 43 – Benchmark analysis – take up rates (Combined Average Growth Rate, CAGR – commencement to 2018)

Figure 43 provides an overview of the historical take-up rates of consolidation opportunities in the benchmarked light rail corridors and compares these to the *intervention* dwelling take-up rate. The figure highlights those station catchments where changes to planning provisions (namely the use of the PDA for GCLR Stage 1) have been implemented with sufficient time to enable a market response to the light rail infrastructure, enabling more significant take-up than occurred in locations where no intervention had been undertaken. Each of the benchmark case studies demonstrates that significant land value uplift has occurred since the introduction of the respective light rail projects (despite significant barriers in many cases), and each offers key insights relevant to the Stage 1 of the Project.

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The case studies highlight the need for appropriate planning provisions to realise the desired benefits from urban change opportunities that are enabled in proximity to the transit route.

8.4.3 Benchmark analysis for urban change effects – BRT projects in Australia

As in the LRT take-up rate analysis, to provide context to the potential upper and lower take-up rates which may be achieved within the corridor through intervention (i.e. introduction of a BRT), an assessment of the historical market performance of five identified Australian bus project corridors was undertaken to establish trends in demographic profile, and take-up rates of residential urban consolidation opportunities.

These five benchmarked projects provide the best available evidence for any potential land market response to a BRT transport solution within the local market. Benchmarked bus project corridors included:

- Eastern Busway – Brisbane
- Northern Busway – Brisbane
- Liverpool T-way – Sydney
- Rouse Hill T-way (North-West) Sydney
- Northern Beach B-Line – Sydney.

Findings about the five benchmarks were inconclusive in determining whether or not the projects supported significant urban change or benefited from amended planning provisions.

However, it is typical for BRT projects to be installed to improve the performance of an existing bus network that is under stress due to excess demand, as opposed to installing a new BRT project to support urban change. It could be that, if configured in a similar manner to an LRT intervention, a BRT intervention could achieve similar urban change outcomes. For further discussion on these potential effects, refer to Section 10.3.4 and Section 15.7.

8.4.4 Methodology used in the urban change scenarios

The investigation of the land use effects initially considered the whole Sunshine Coast Urban Corridor, from Maroochydore to Caloundra. If the Project proceeds, this corridor will be fully connected by a major new investment in local mass transit, adopting technology that is appropriate for safe integration within the urban fabric. This study area is shown in Figure 44.

To support the Options Analysis, more detailed investigations of land use effects were then undertaken for Priority Area 1 which would be the catchment of Stage 1 of the Project, initially extending the mass transit system only as far as SCUH at Birtinya.

The methodology used to develop demographic scenarios included:

- Developing a *No-Intervention (trend)* land use scenario up to 2041
- Developing two land use scenarios based on the *Intervention* forecast take-up for both LRT and BRT up to 2041
- Making a comparison of the *No-Intervention (trend)* and *Intervention* land use scenarios in terms of forecast take-up.

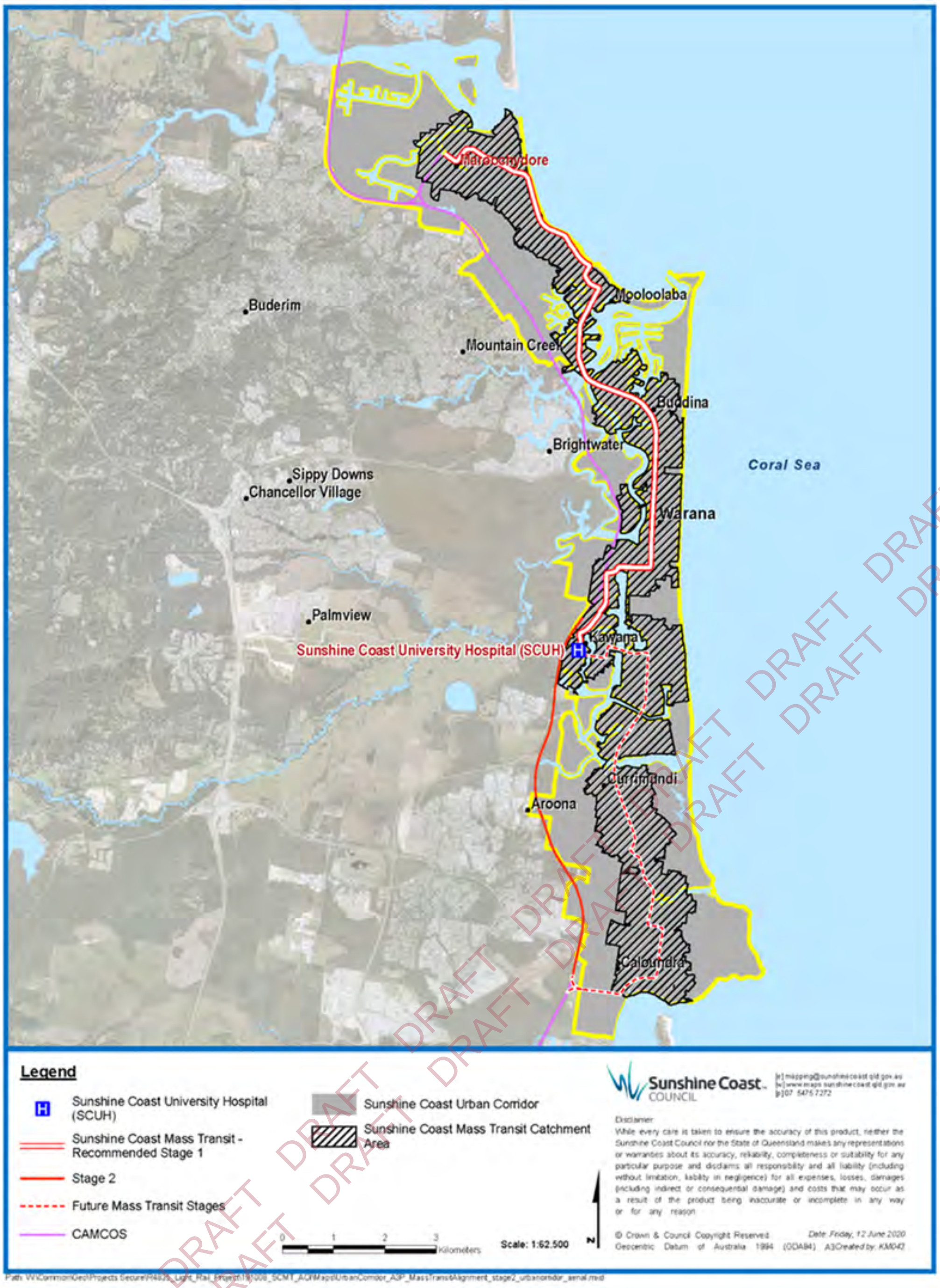

Figure 44 – SCMT potential catchment area – Sunshine Coast Urban Corridor[114].

8.4.5 Development capacity and forecast take up scenarios

The analysis of each scenario typically involves the identification of the **potential** development capacity as well as the **likely** take-up of that potential up to 2041.

The **potential** development capacity scenario is based on the theoretical quantity of development that could occur jn light of the mass transit investment and under the planning scheme if all development opportunities were fully realised. However, in practice, this scenario is unrealistic because of the inherent difficulties involved in assembling all of the potential development sites, given fragmented patterns of property ownership. As a result, the rest of this chapter and the economic assessment on the transport options associated with land use uplift (Chapter 15) do not consider the potential development scenario.

[114] The shaded area relates to the extent of the ten-minute walk-up catchment, and does not necessarily define the actual areas that could be the subject of land use opportunities.

The **likely** take-up scenario is defined as the quantity of development that is forecast to actually be delivered by the market in the specified timeframe (2016 to 2041). This is the key parameter utilised in the economic analysis of benefits of the Project options. The forecast take-up rates under each Intervention land use scenario assumes that market impacts would commence in 2025/26, that is, 12 months prior to the earliest possible completion of construction of Stage 1 of the Project in 2026/27.

Other considerations in developing the take-up scenarios include:

- All demographic scenarios have been compared to the QGSO projections for the Sunshine Coast.
- The QGSO projections have been maintained at 518,000 as control totals at the Sunshine Coast LGA level, meaning where an *Intervention* land use scenario forecasts additional growth in the Sunshine Coast Urban Corridor, this growth has been sourced from the trend scenario outside the corridor.

8.4.6 Land use assessment methodology

A detailed nine-step assessment was used to analyse the scenarios and forecast growth opportunities to 2041. The assessment methodology is set down in Table 26. The methodology is based on evidence of market responses to various mass transit systems in service in Australia, as well as appraisal of the development potential of suitable land along the mass transit route. This appraisal considered the policy frameworks of Council and the Queensland Government in respect of the scale and intensity of development contemplated in the urban areas of the Sunshine Coast Region. However, it is not a town planning process, which would involve more detailed planning work. Further detail is provided in Section 8.4.14.

Table 26 – Urban analysis nine step assessment

Step	Overview
Step 1: Determine thecatchment area	The SCMT catchment area was determined using isochrones generated for two walking catchments – a five minute walk and a ten minute walk (approximately 400 metres and 800 metres respectively). It was assumed that travel time, rather than distance, was a more accurate means of determining the accessibility of the mass transit system, and a number of additional assumptions were applied relating to walking speed, include pathways, open spaces and traffic signal crossings.
Step 2: Constraints analysis	A combined constraints analysis was conducted within the catchment. The constraints were mapped as hard or soft constraints. Soft constraints could be addressed and overcome to enable future development, whereas hard constraints generally could not be overcome. Soft constraints identified were strata lots with less than six titles or lots with low level flooding risk. Hard constraints identified included local or State heritage, open space, special uses, lots with a flood hazard or strata lots with six or more titles. The outcome of this analysis identified the sites in the Sunshine Coast Urban Corridor considered unlikely to be redeveloped by 2041 (i.e. there would be no land use change on these sites irrespective market movements or infrastructure interventions).
Step 3: Existing development	Constraints analysis enabled the identification of sites that could contribute to the change of the locality in response to the Project (Stage 1), also known as 'opportunity sites'. This process was reviewed to identify existing projects either proposed, planned or under construction.
Step 4: Base case capacity	The Base Case capacity is determined by firstly identifying the *No-Intervention (trend)* land use scenario (i.e. the likely scenario that would occur under current planning provisions and without the introduction of the Project (LRT or BRT only). The current planning provisions are as set down in the *Sunshine Coast Council Planning Scheme 2014.* The Base Case capacity considers the existing development on each opportunity site as well as the assessment of the unrealised development potential under existing planning provisions. The resultant potential development outcomes were grouped into urban typologies with Gross Floor Area (GFA) assumptions attributed to each typology. This calculated the maximum capacity of dwellings and jobs permissible under existing planning provisions.

Step	Overview
Step 5: Urban design considerations	This step involved firstly understanding the vision and role of the precinct and then developing an indicative plan for future urban typologies that meet the policy criteria. This produced a possible land use response to the mass transit system and a general indication of the potential development capacity that could be supported by Stage 1 of the Project. The indicative plan was developed on the premise that the incremental changes to planning provisions are made to enable market responses. However, this was overlaid by the policy intent of maintaining the generally low-key look and feel of the urban form as noted in such documents as the Planning Scheme, in particular its Strategic Intent. A future precinct vision and role were established and applied along the Stage 1 catchment to determine the typologies and intensity of development in the *Intervention* land use scenarios. The study drew from current planning provisions, the built form aspirations for key centres, the character of the locality, and the proximity of local amenities and recreation facilities.
Step 6: Intervention case indicative future land use scenario	Indicative Future Land Use (FLU) scenarios were created to optimise the potential capacity (while recognising the planning framework and low key urban form overall) for each precinct catchment given the *Intervention* land use scenario of a new mass transit service. The additional capacity generated in the FLU scenarios is not what is realisable by forecast years (2026, 2031 or 2041) but rather the <u>ultimate theoretical capacity</u> which could be supported by the Stage 1 of the Project. The FLU scenarios were designed using a set of principles that aim to capitalise on the future land use opportunities instigated by a new station by considering the station precinct's existing character, constrained land uses and the road hierarchy. These principles also included existing policies aimed at ensuring a low key urban form that is "typically Sunshine Coast" in terms of scale and site cover.
Step 7: Identify the additional capacity supported	The theoretical additional capacity supported by Stage 1 of the Project is the difference between the capacity of the *No-Intervention (trend)* land use scenario and *Intervention* land use scenario (i.e. *Intervention* minus *No-Intervention (trend)*).
Step 8: Take-up	A detailed market assessment was undertaken to provide forecasts of the likely take-up of both the *No-Intervention (trend)* and *Intervention* land use scenarios. The forecast take-up was identified for years including 2026, 2031 and 2041. The market assessment was a comprehensive analysis of the corridor (and wider Sunshine Coast) to assess conditions in the housing market and trends in house prices and dwelling supply, and to identify the pipeline of future dwellings. The commercial office and retail markets were also thoroughly examined. This involved: • Assessing historical and current performance of these sectors on the Sunshine Coast • Identifying future development pipelines • Conducting a case study and benchmarking exercise which assessed key attributes of successful office and retail precincts around Australia • Conducting a detailed demographic analysis. 'Top-down' and 'bottom-up' approaches were utilised to forecast take-up rates for population, dwellings, and employment within the Stage 1 catchment. This approach involved: **A 'Top-down' projection** including analysis of ABS, QGSO and *ShapingSEQ* data to: • Provide an overview of potential population projections and new dwelling numbers • Analyse historical market trends and market growth trends for the individual precincts • Analyse comparable light rail and heavy rail and BRT benchmarks. **A 'Bottom-up' projection** being a multi-faceted approach that involved making adjustments to reflect sub-market (i.e. precinct-specific) characteristics and development opportunities.
Step 9: Total take-up urban renewal supported by SCMT	The final step involved a comparison of the forecast take-up of both the *No-Intervention (trend)* and *Intervention* indicative land use scenarios. The comparison identified the quantum of dwellings, population and jobs that will theoretically be generated over and above the *No-Intervention (trend)* forecast.

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8.4.7 Current planning framework

The land zoned residential in the Stage 1 SCMT corridor include some medium to high density sites in the centres of Maroochydore, Mooloolaba and Birtinya. There are also low to medium density residential precincts scattered across the SCMT corridor. These are largely made up of townhouses and attached dwellings. The balance of land is mostly zoned for lower density single detached dwellings.

There is a hierarchy of centres which ranges from the Principal Regional Activity Centre at Maroochydore to local and district activity centres including Mooloolaba, Kawana and Birtinya. The majority of retail and commercial office uses in the corridor are located within these centres, with varying degrees of intensity depending on the hierarchy of the centre.

Other employment generating uses range from industrial uses, mixed use fringe business precincts and neighbourhood centres. Employment generating precincts, made up of industrial uses and urban services, are clustered in Buddina and Warana on Nicklin Way and Main Drive. The built form character of these uses is mostly low scale.

8.4.8 Developing the demographics for the *No-Intervention (trend)* scenario

The *No-Intervention (trend)* land use scenario represents a business-as-usual approach to planning and development, and transport infrastructure provision in the Sunshine Coast Region. The assessment identified the likely property market take-up of development opportunities under existing planning provisions. The assessment included a detailed analysis of historical residential and commercial market supply and demand across the Sunshine Coast, including the Sunshine Coast Urban Corridor.

The *No-Intervention (trend)* land use scenario has been developed in response to a ‘do-minimum’ transport network, which does not involve the introduction of Stage 1 of the Project. It takes note of the accelerating trend towards urban expansion. However, having regard to current planning policies, it still assumes a level of consolidation and avoids the introduction of new expansion areas. Accordingly, it is likely to be a conservative trend scenario, and the actual trend could see new urban expansion fronts opened to cater for dwelling demand (refer Section 0 for further detail).

The *No-Intervention (trend)* land use scenario is based on the existing planning provisions including the *Sunshine Coast Council Planning Scheme 2014* and the existing PDA Development Scheme provisions.

Figure 45 presents the *No-Intervention (trend)* land use scenario which is represented by the existing planning provisions applied only to the identified opportunity sites within the catchment area.

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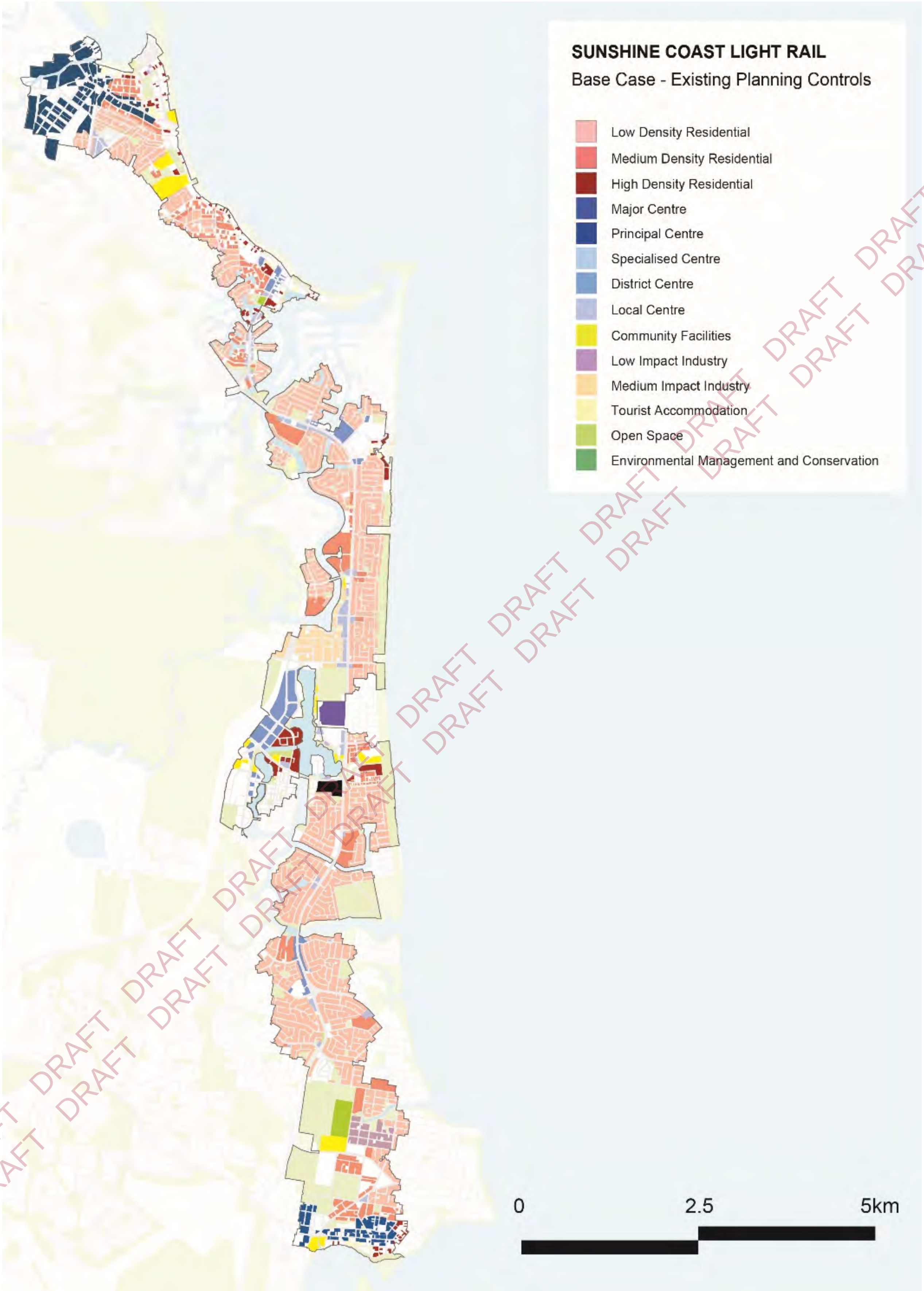

Figure 45 – No-Intervention (trend) land use scenario

8.4.8.1 No-Intervention (trend) – Base capacity

The *No-Intervention (trend)* land use capacity of the SCMT corridor is identified in Table 27. The 2016 dwelling, population and jobs reflect the ABS 2016 Census information.

Table 27 – SCMT Stage 1 No-Intervention (trend) - base capacity[115]

Item	2016 (ABS)	No-Intervention Additional Capacity	No-Intervention Total Capacity
Dwellings	11,209	10,324	21,533
Population	23,222	-	-
Jobs	30,973	30,210	61,183

This demonstrates that there is significant capacity in the current planning scheme for additional dwellings within the SCMT corridor, however in many cases this is at a low-cost level of development yield.

8.4.8.2 Forecast No-Intervention (trend) – base growth

Table 28 identifies the forecast *No-Intervention (trend)* take-up of capacity by 2041 based on historical trends, latent demand and a bottom-up assessment of the corridor.

Table 28 – SCMT Stage 1 forecast No-Intervention (trend) - base growth (2016-2041)[116]

	2016 (ABS)	2026 Total	2031 Total	2041 Total	Total Growth 2016–2041
Dwellings	11,209	14,248	15,634	17,436	6,227
Population	23,222	29,469	32,064	35,475	12,253
Jobs	30,973	39,664	43,004	49,334	18,361

This indicates the number of dwellings in the corridor is forecast to grow by approximately 55 per cent and will reach approximately 81 per cent of the *No-Intervention (trend)* capacity of 21,533 dwellings by 2041.

8.4.9 Developing the demographics for the *Intervention – LRT* scenario

The *Intervention* land use scenario has been developed in response to a 'with Project' transport network, which involves the introduction of Stage 1 of the Project, as well as changes to planning provisions that unlock increased urban change capacity as a result of the Stage 1 investment. Two *Intervention* land use scenarios have been developed based on the LRT and BRT Reference Project options. The detail of these options is described in Chapter 11.

8.4.9.1 Future Land Use (FLU) indicative scenario

An indicative FLU scenario was developed to inform the *Intervention LRT* demographic scenario for the corridor. The scenario represents a possible land use response to the LRT and provides an indication of the potential capacity that could be supported by Stage 1 of the Project. This scenario was developed for business case purposes only and does not represent a town planning proposal. The scenario was premised on the appropriate changes to planning provisions being considered in the future through a planning scheme amendment process.

The indicative FLU scenario is based on the development typologies suitable to the Sunshine Coast's low key form of development, adopting the vision conveyed in *ShapingSEQ* for the Sunshine Coast Urban Corridor of '*a cohesive corridor of distinctive, high quality urban environments that are typically 'Sunshine Coast' in character and optimise access to future passenger services'.*

The FLU scenario was developed to incorporate guiding principles to address the following:

- An appropriate interface with sensitive uses (e.g. schools)
- A transition between new development and retained built form (e.g. heritage places, based on the constraints analysis in Step 2)
- The need for adequate access to public open spaces and private open space
- Alignment between the FLU and feasible development typologies
- Consideration of areas to be retained and reinforced as they have attributes that contribute to the existing and future character of the corridor
- A gradual transition in building height and density reducing as the distance from the mass transit system increases
- Reinforcing key transport corridors with ground floor activity to create mixed-use precincts that provide a suitable interface with busy thoroughfares Beachfront high rise is not suitable for existing lower density residential areas.

8.4.9.2 Building height and skyline character

An important aspect of the station visioning and the indicative FLU scenario process was the careful consideration of building height and the corridor's coastal skyline character. Much of the corridor has a low key urban form, with relatively few areas providing for building heights that are regarded as producing high rise form. Retaining the character of this skyline and avoiding the potential for much higher building development found in other cities was an important planning parameter for the indicative FLU scenarios.

Stage 1 of the Project offers the opportunity to secure urban design outcomes that reinforce the desired unique Sunshine Coast image and urban legibility outcomes. Specifically, the *Intervention* land use scenario provides the opportunity to:

- Create a diversity of housing choice in the urban corridor
- Create diversity and interest in the urban form and character of the corridor
- Reinforce a legible structure of centres and neighbourhoods
- Support the wider image of the Sunshine Coast as a generally low-key lifestyle location in terms of urban structure and the character of the skyline.

8.4.9.3 Forecast take-up for Intervention - LRT land use scenario growth

The forecast take-up is reflective of historical trends and future demands on a catchment-by-catchment basis. It still shows that taken together, the land use changes, and the Project unlock significant opportunities to support the consolidation of dwellings and jobs. Forecast growth in the *Intervention - LRT* scenario across the Stage 1 corridor is outlined in Table 29.

Table 29 – SCMT Stage 1 Take-up forecast for LRT intervention scenario growth (2016-2041)

Item	2016 (ABS)	2026 Total	2031 Total	2041 Total	Total Growth 2016– 2041
Dwellings	11,209	15,126	18,404	27,011	15,802
Population	23,222	31,288	37,778	55,072	31,850
Jobs	30,973	41,013	45,984	55,670	24,697

The LRT *Intervention* scenario is designed to provide greater choice of dwelling types and increased dwelling numbers within the Stage 1 SCMT corridor. By 2041 the *Intervention - LRT* land use scenario is forecast to result in the take-up of an additional 9,500 dwellings in the Stage 1 LRT catchment.

8.4.10 Employment changes for the *Intervention – LRT* scenario

8.4.10.1 Employment context

The Sunshine Coast commercial office market is characterised by a number of individual commercial precincts spread across the LGA. These precincts are predominately fragmented in nature and include standalone assets and strata-titled commercial office suites, typically dispersed amongst other real estate asset classes and mixed-use developments. Instances of pure commercial office precincts are scarce, and mostly confined to the major Sunshine Coast centres within the Stage 1 corridor at Maroochydore, Mooloolaba, Kawana and Birtinya. Outside of the Stage 1 corridor, major employment clusters exist at Caloundra, with secondary precincts at Coolum, Sippy Downs, and Nambour.

Small businesses dominate the Sunshine Coast market, complemented by a selection of larger corporations and Government administrative functions. As the Sunshine Coast population increases over the coming decades, there will be opportunities for existing businesses to grow, supplementing emerging demand from new businesses and start-ups. Increased economic activity will support demand for commercial offices (including professional services), retail and residential development.

It is envisaged that both Maroochydore and Caloundra will continue to remain the focus of the commercial market over the coming years, with the new Maroochydore City Centre likely to support the majority of new commercial office accommodation and professional jobs, alongside significant supporting retail and leisure uses. The recent development of the SCUH will continue to support the growth of the Birtinya precinct, and the continued development of the health sector on the Sunshine Coast more broadly.

8.4.10.2 Forecast employment growth – Intervention – LRT scenario

The potential incremental employment impacts of Stage 1 of the Project are presented in Table 30 for the LRT scenario. Employment growth under the *No-Intervention (trend)* land use scenario is forecast to grow by 18,361 to 49,334 between 2016 and 2041 while employment growth under the *Intervention - LRT* is forecast to grow by 24,697 to 55,670 between 2016 and 2041. The LRT *Intervention* land use scenario contributes 6,336 additional jobs compared to the *No-Intervention (trend)* land use scenario by 2041.

Table 30 – No-Intervention (trend) vs LRT Intervention employment growth to 2041

	2016 (ABS)	2026	2031	2041	Total Growth 2016 - 2041
No-Intervention (trend) Jobs	30,973	39,664	43,004	49,334	18,361
LRT Intervention Jobs	30,973	41,013	45,984	55,670	24,697
Additional jobs increase from Intervention land use scenario	-	1,349 (3.4%)	2,980 (6.9%)	6,336 (12.8%)	6,336 (34.5%)

8.4.11 Developing the demographics for the *Intervention – BRT* scenario

BRT is currently being considered as a technology option for the Project, and a reference project has been developed for the Options Analysis, reflecting a significant level of capital investment (refer Section 11.3). To ensure a robust options analysis, a land use analysis was also performed for the Reference Project – BRT. BRT is a bus based public transport system designed to improve reliability, capacity, and frequency of service relative to conventional bus systems.

This section presents a brief summary of the land use analysis for the BRT Reference Project, including:

- A summary of the methodology employed for the BRT land use analysis
- A summary of the take-up rate benchmarking process.

8.4.12 Methodology for the BRT Scenario

The methodology utilised for the BRT land use analysis is consistent with the nine-step assessment undertaken by the Project Team for the Sunshine Coast Urban Corridor under the LRT scenario with the following considerations:

- Step 6: *Intervention* FLU Scenario, the theoretical *Intervention* capacity for dwellings, population and jobs is the same as the *No-Intervention (trend)* capacity.
- Step 8: take-up analysis has again been informed by a comprehensive variety of sources to establish evidence-based and realistic take-up rates for residential dwellings, population and jobs in response to the improved accessibility benefits that a BRT solution provides. Critically however this benchmarking process identified no real evidence in support for a planning scheme response to BRT, and as such a conservative approach was adopted which assumed no change to the current planning scheme in the BRT - *Intervention* land use scenario.

8.4.13 Summary of BRT land use analysis

The BRT scenario forecast take-up in 2041 for both the *No-Intervention* (*trend)* land use scenario and the *Intervention - BRT* land use scenario are detailed in Table 31. The results demonstrate that the *Intervention - BRT* land use scenario unlocks a small amount of urban change above the *No-intervention (trend)* land use scenario. Specifically, the BRT - *Intervention* land use scenario supports 883 dwellings and 474 new jobs over and above the *No-Intervention (trend)* land use scenario, by 2041.

Table 31 – SCMT Stage 1 corridor No-Intervention (trend) versus Intervention (BRT) land use scenario capacity and take-up

Item	2016 (Abs)	2041 No Intervention Take-up	2041 BRT Intervention Take-up	Additional Growth Unlocked
Dwellings	11,209	17,436	18,319	883
Population	23,222	35,475	37,348	1,873
Jobs	30,937	49,334	49,808	474

The LRT *Intervention* land use scenario is forecast to result in 8,692 additional dwellings and 5,862 jobs above the BRT *Intervention* land use scenario.

The variance between the potential for BRT and LRT to influence land and development markets is the result of several factors including a lack of evidence supporting BRT's ability to integrate with surrounding land markets, and the public sentiment and perception towards bus transit modes as compared with electric rail technology.

It must be noted however, that the BRT solution for the Project contemplated as part of the Options Analysis represents a new standard of BRT offering within Australia. In particular the reference vehicles are electric, not diesel. This presents some difficulties in benchmarking applied take-up rates against local evidence, and so in reality the introduction of a BRT solution of the standard contemplated for the Project may have

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significantly more transformative urban change effects than the outcomes of relevant analysis (Sections 10.3.4 and 15.2 contain further detail). This issue should be further investigated at a future stage of the Project, utilising updated BRT case studies and stated preferences for hedonic pricing (willingness to pay) for development in the BRT catchment.

8.4.14 Status of demographic scenarios used in the Options Analysis

These resultant demographic scenarios developed for this part of the land use analysis do not represent official projections. However, they enhance the robustness of economic assessment in the Options Analysis through exploring the real-world effects of the strategic transport investment. They provide an evidence-based assessment of how effective the proposed mass transit investment may be in supporting existing urban growth management policies and desired outcomes.

It should be noted these are preliminary scenarios and do not represent town planning proposals that are underpinned by detailed planning and consultation processes. Should the Project proceed, these processes would be undertaken in accordance with the provisions of the *Planning Act* 2016.

The land use analysis to determine the demographic scenarios was informed by the existing policy framework set down in the Planning Scheme Strategic Intent and the relevant Sunshine Coast Council strategies. Under this guidance, urban change will be focussed on existing centres and those areas close to the mass transit stations that offer renewal potential.

In future stages of planning, a carefully planned and progressive approach can transform ageing and underutilised development into a modern, generally low-key coastal lifestyle precinct without excessive high-rise development which would be inappropriate for the Sunshine Coast. The market would then dictate the pace of change, which would be likely to occur progressively over several decades[117].

8.5. Summary of land use analysis

The analysis presented in the chapter documents the *Intervention* land use scenarios and demonstrates that the Project, when combined with complementary and appropriate changes to planning provisions, could result in positive urban change in its catchment. In addition, Stage 1 of the Project would create benefits for landholders along the entire corridor. This evidence-based result is particularly strong for the *Intervention – LRT* land use scenario:

- 9,575 additional dwellings in the Stage 1 catchment beyond trend growth without intervention, as a key contributor to the region meeting its 62 per cent urban consolidation benchmark
- 19,597 additional people in the Stage 1 catchment beyond trend growth without intervention
- 6,336 additional jobs in the Stage 1 catchment beyond trend growth without intervention.

Current analysis based on available evidence indicates the BRT Reference Project would have a much more modest impact on the corridor with the *Intervention – BRT* land use scenario forecast producing:

- 883 additional dwellings in the corridor beyond forecast growth without intervention
- A population of 1,873 additional people in the corridor beyond forecast growth without intervention
- 474 additional jobs in the corridor beyond forecast growth without intervention.

There is limited evidence concerning the ability of BRT schemes to influence land use capacity and take up within relevant corridors. However, the BRT Reference Project considered in this Options Analysis includes a dedicated busway and bus equipment that runs fully on batteries, so there is low emission of noise and no air pollution emitted at the source. This type of scheme is almost unprecedented in terms of existing BRT schemes, with the possible exception of Nantes in France.

A scheme such as the BRT Reference Project may have greater potential effects on land use than the evidence base would suggest. At subsequent stages of the business case process, if BRT remains an option, further investigation of its ability to deliver urban change benefits would be undertaken.

[117] Refer to ATAP: https://www.atap.gov.au/framework/integrated-transport-land-use-planning/6-Strategic-or-city-shaping-infrastructure

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THE BASE CASE WITH NO MASS TRANSIT INTERVENTION

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9. The Base Case with no mass transit intervention

This chapter describes the Base Case transport outcomes on the Sunshine Coast in the absence of investment in a mass transit project.

The Base Case has been established and documented under IA guidelines and includes the *Do Nothing* and *Do Minimum* planning and infrastructure works.

The *Do Nothing* scenario includes only committed and funded projects, and the *Do Minimum* scenario includes future works that would be delivered in a business-as-usual environment. The Base Case is specified and modelled on a whole-of-life basis, including expected impacts, benefits and expenditure. It is the benchmark against which the Reference Projects and associated economic merits are assessed.

9.1. Base case demographics

The Base Case demographics are as per the 2018 QGSO population growth projections (medium series) scenario. This section provides a summary of the base demographics for Stage 1 of the Sunshine Coast Urban Corridor (Figure 46) as well as for the wider LGA.

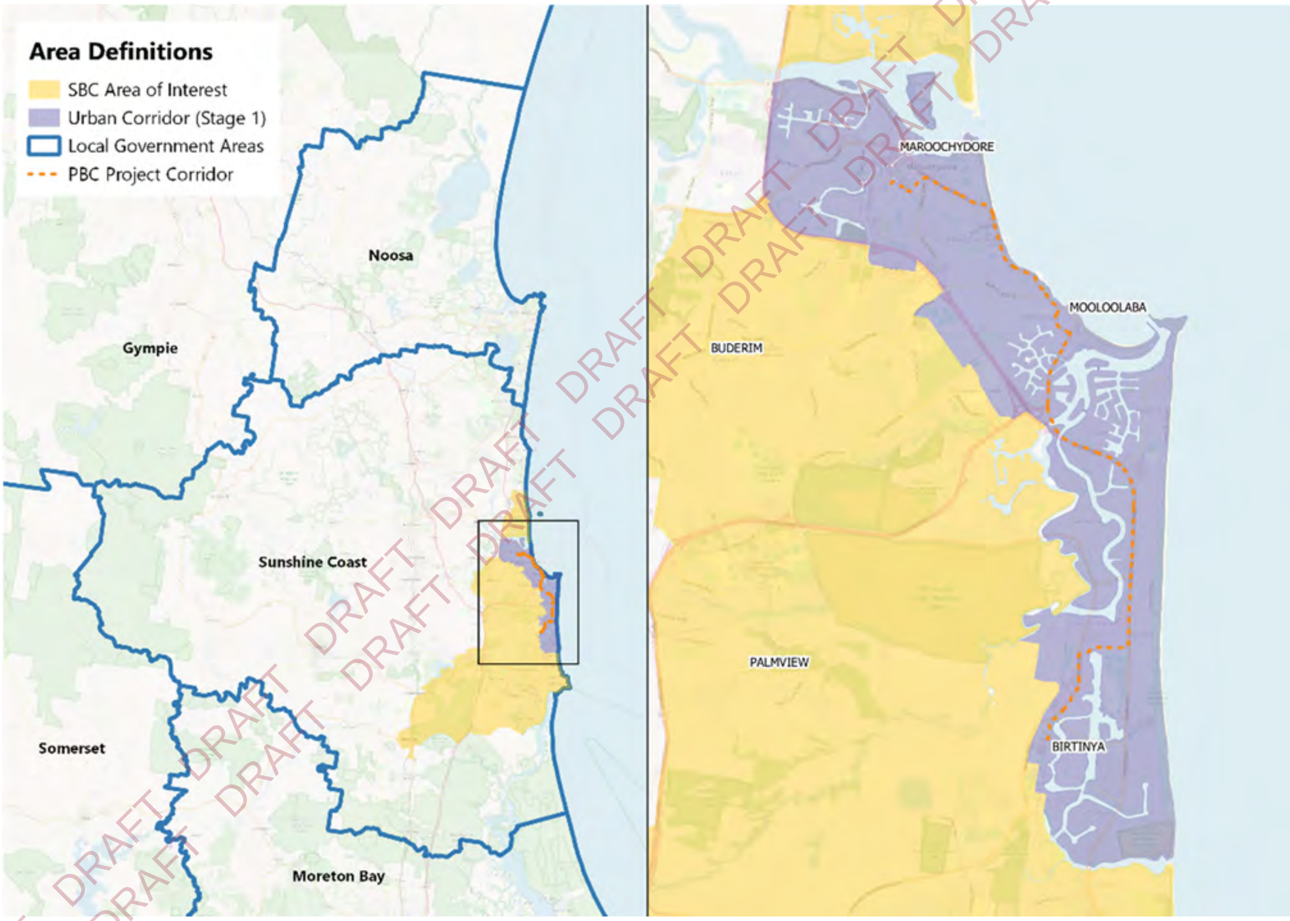

Figure 46 – Sunshine Coast Urban Corridor (Stage 1)

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9.1.1 Population Growth

Table 32 details the QGSO[118] population projections within the *Sunshine Coast Urban Corridor (Stage 1)* and the Sunshine Coast LGA. The population within both the Sunshine Coast Urban Corridor (stage 1) and the LGA is forecast to increase similarly by 69 per cent between 2016 and 2041.

Table 32 – QGSO population in the Urban Corridor (Stage 1) and Sunshine Coast LGA

Year	Urban Corridor (Stage 1) population		Total LGA mobile population[119]	
	QGSO	**% growth rate p.a.**	**QGSO**	**% growth rate p.a.**
2016 (census)	52,866	-	299,785	-
2026	65,388	2.1%	389,394	2.6%
2036	81,227	2.2%	469,166	1.9%
2041	89,524	2.0%	507,307	1.6%

Figure 47 shows the net increase in dwelling density relative to 2016 for each forecast horizon, illustrating how growth is concentrated in the existing urban areas. Within the Sunshine Coast Urban Corridor (Stage 1) area, dwelling growth is generally clustered in activity centres at Maroochydore, Mooloolaba and Kawana without a mass transit intervention.

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118 These projections have been derived (and issued by TMR) from QGSO 2018 edition population projections incorporating the latest available small area resident population and Census 2016 variables. **Source:** Queensland Government population projections, 2018 edition (unpublished); Australian Bureau of Statistics (unpublished); Census 2016; Department of Transport and Main Roads (unpublished).

119 Mobile Population in the transport model accounts for a number of stated residents who do not actually reside in the region or who are not mobile, e.g. residents of nursing homes and is lower than the estimated resident population number referenced by QGSO.

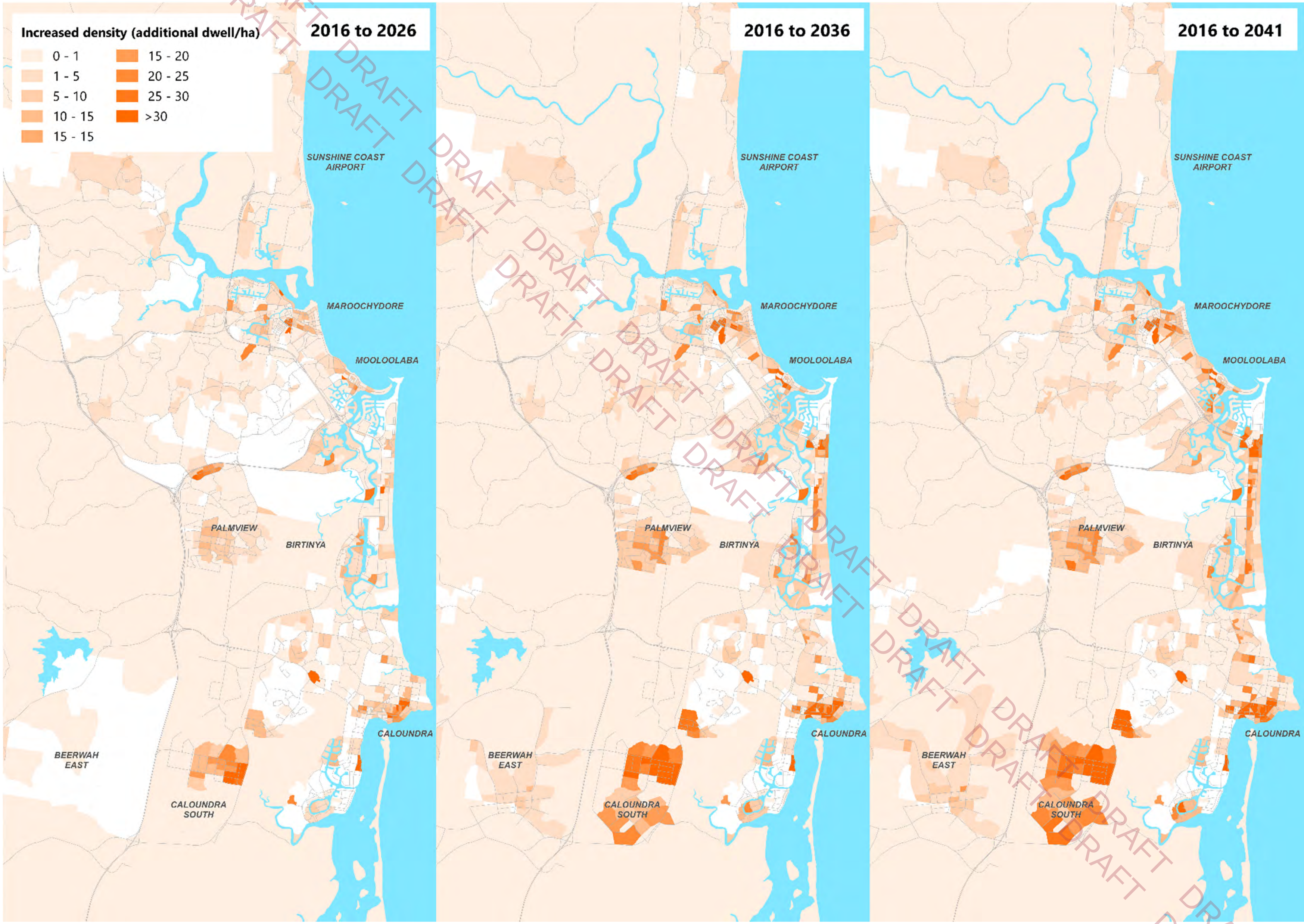

Figure 47 – Net increase in dwelling density 2016 – 2041 under the QGSO land use scenario

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9.1.2 Employment growth

Table 33 details the QGSO employment projections within the Sunshine Coast Urban Corridor (stage 1) and for the broader Sunshine Coast LGA. Employment growth within the urban corridor is forecast to increase faster than the LGA, growing by 69.6 per cent from 2016 to 2041. This is in comparison to the forecast 58.2 per cent increase for employment growth in the LGA across the same period.

As the principal regional activity centre, Maroochydore will continue to be a primary driver for employment growth in the Sunshine Coast Urban Corridor (Stage 1), as well as further expansion of Kawana town centre as a regional employment area for health, education and training.

Table 33 – QGSO employment in the Sunshine Coast Urban Corridor (Stage 1) and Sunshine Coast LGA

Year	Urban Corridor (Stage 1) employment		Total LGA employment	
	QGSO	**% growth rate p.a.**	**QGSO**	**% growth rate p.a.**
2016	40,875	-	129,710	-
2026	52,038	2.4%	158,561	2.0%
2036	63,914	2.1%	189,521	1.8%
2041	69,320	1.6%	205,219	1.6%

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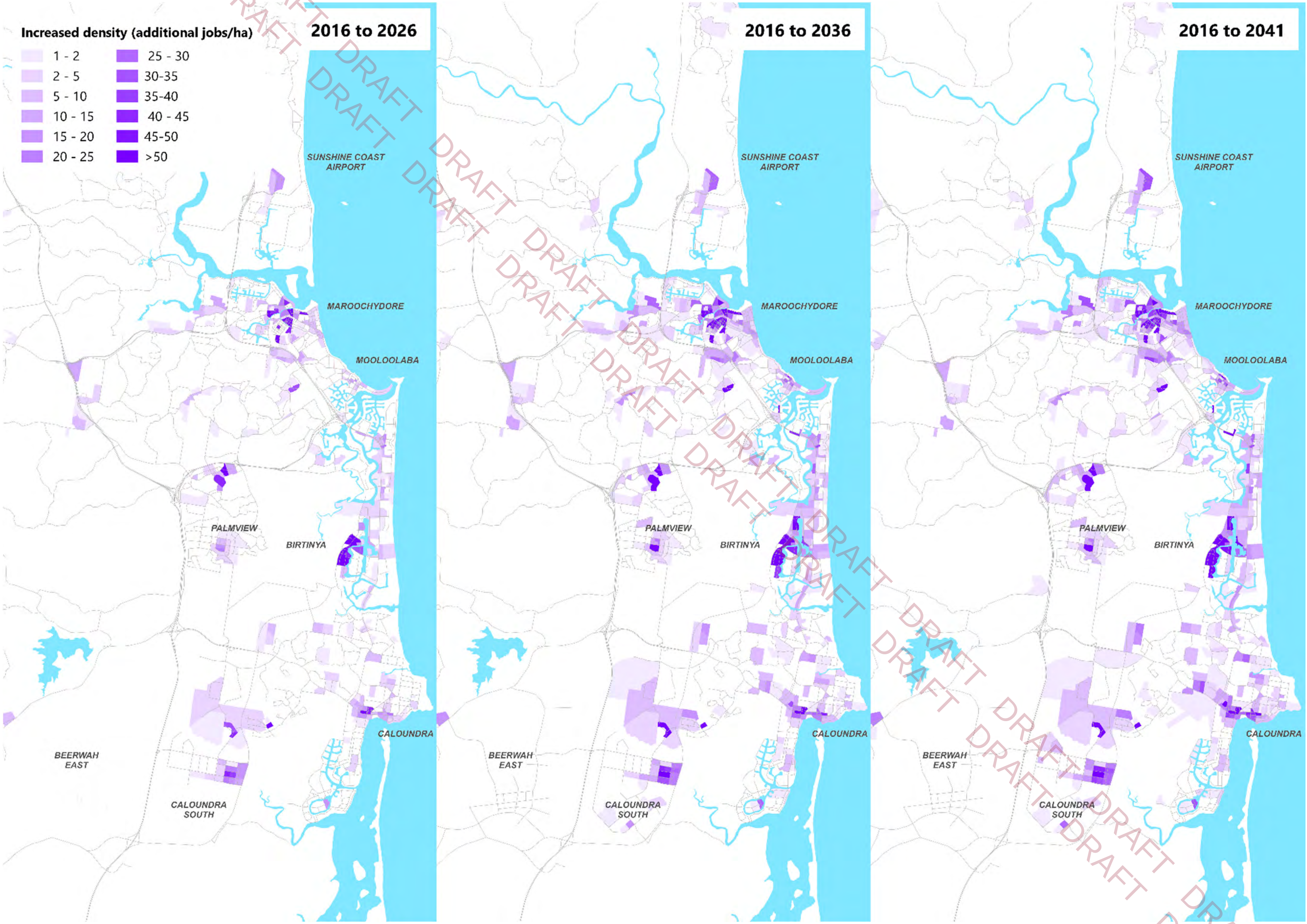

Figure 48 – Net increase in job density 2016 – 2041 under the QGSO land use scenario

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9.2. Base case infrastructure and policy

Transport infrastructure in the Base Case is comprised of the road and public transport network that existed in 2016 plus the *Do Nothing* and *Do Minimum* improvements projected to occur within the 25-year modelled period. Road and public transport network upgrades in the Base Case include the *Do Nothing* (funded and committed works) and upgrades that represent the *Do Minimum* intervention, including minor works and additional road networks in urban expansion growth areas.

9.2.1 Parking policy

Parking demand management in major centres is modelled to accord with the Sunshine Coast Council Parking Management Plan (2017). The plan's short and medium to long term actions are assumed in place by 2026. These actions are represented in parts of Maroochydore, Mooloolaba, Birtinya, and Sippy Downs Town Centre as a cost equivalent to the existing measures in place in Caloundra[120]. It is assumed that parking measures are the same for all future years and scenarios.

9.2.2 Road network

Key major road upgrades included are:

- Brisbane Road, Walan Street, Venning Street upgrade (widening to four traffic lanes)
- Maud Street upgrade (widening to four traffic lanes)
- Plaza Parade upgrade (widening to four traffic lanes)
- Maroochy Collector Distributor Road (new two-lane link from Sugar Road to Dalton Drive)
- Maroochydore CBD PDA internal roads (new links).

The following tables provide a detailed breakdown of road upgrades included in the Base Case:

- Table 34 details State-controlled road projects identified in *the Queensland Transport and Roads Investment Program 2018-19 to 2020-21*
- Table 35 details road network improvements that will be delivered by council through the *Local Government Infrastructure Plan* (LGIP). Table 35 details road upgrades that support major urban expansion areas. Specifically, Palmview, Caloundra South PDA and Beerwah East.

Table 34 – Base case road network assumed upgrades (State Projects)

ID	State Projects	Year
1	Bells Creek Arterial (Caloundra Road to Baringa)	2017
2	SCUH access improvements (Kawana Way upgrade)	
3	SCUH access improvements (Production Avenue link)	2018
4	Bruce Highway Upgrade - Caloundra Road to Sunshine Motorway	2019
5	Bruce Highway - Deception Bay Road Interchange upgrade	2021
6	Bruce Highway Upgrade - Maroochydore Road and Mons Road Interchanges	2022
7	Bruce Highway Upgrade Project (Caboolture – Bribie Island Road to Steve Irwin Way) upgrade to six-lanes	2023
8	Beerburrum to Nambour Rail - road upgrades including level crossing removal	2023
9	Bells Creek Arterial - two-lane at-grade intersections (full length Caloundra Road to Bruce Highway at Roys Road)	2024

[120] Charges applied in Maloolaba are 75% higher, based on advice from SCC.

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Table 35 – Base case road network assumed upgrades (LGIP Projects)

Local (LGIP) Projects	LGIP ID	Year
Bellvista Boulevard	R-20-005	2018
Burke Street	R-18-003	2019
Plaza Parade Stage 1	R-26-004	2019
Queen Street - Stage 1A	R-19-003A	2021
Arthur Street	R-19-005	2021
Sippy Downs Drive - Motorway Interchange to Siena	R-22-001	2021
Sippy Downs Drive - Stringybark Rd to Power Rd	R-22-004	2021
Power Road - Stage 1	R-22-006	2021
Stringybark Road	R-22-007	2021
Goshawk Boulevard - new link	R-22-008	2021
Parklands Boulevard	R-26-002	2021
Maroochy Boulevard - Dalton Drive Intersection Upgrade	R-26-015	2021
Brisbane-Walan - Stage 1, 2, 3 (includes Naroo Court extension) (staged up to 2023)	R-25-005A, R-25-005B, R-25-004	2023
Oval Avenue and Gosling Street	R-19-007	2026
Bunnings Link	R-19-014	2026
Gosling Street Extension	R-19-015	2026
Arthur Street Extension	R-19-015A	2026
Bellvista Boulevard	R-20-005	2026
Racecourse Road Extension	R-20-006	2026
Plaza Parade - Stage 2	R-26-005	2026
Maud Street - Stage 2 - Maud Street, Dalton Drive and Sugar Road Intersection Upgrade	R-26-010	2026
Industrial Avenue Extension	R-19-015B	2031
Creekside Boulevard - Stage 3	R-20-001C	2031
Creekside Boulevard - Stage 3	R-20-001D	2031
Power Road - Stage 2	R-22-005	2031
Meads Road	R-22-010	2031
Maroochy Collector Distributor Road (Sugar Road to Dalton Drive)	R-26-001	2031
Maud Street - Stage 4	R-26-007B	2031
Maleny Bridge	R-02-005	2036
Arundell Avenue - Stage 3	R-11-001C	2036
Windsor Road	R-11-002A	2036

Local (LGIP) Projects	LGIP ID	Year
Baldwin Street - Stage 2	R-18-001B	2036
Pelican Waters Boulevard	R-18-006A	2036
Nicklin Way - Ramps to Queen Street and Sugar Bag	R-19-001	2036
Queen Street - Stage 3	R-19-002	2036
Ulm Street Stage 1 - Queen Street - Bowman Rd Connection	R-19-004	2036
West Terrace	R-19-006	2036
Creekside Boulevard - Stage 4	R-20-001D	2036
Maud Street - Stage 5	R-26-007C	2036
South Coolum Road Link	R-28-001	2036

Table 36 – Base case road network assumed upgrades (Growth Area Projects)

Growth Area Projects	Year
Mon Terre Drive, Little Mountain	2017
Birtinya local roads (Hollows Lane, Fenner Street)	2017
Palmview roads (Peter Crosby Way, Tranquillity Way, Harmony Boulevard)	2018
Peregian Springs interchange (south facing ramps on Sunshine Motorway)	2018
Peregian Springs local roads (Ridges Boulevard, Ridgeview Drive)	2018
Sunshine Cove local roads (Claremont Drive)	2018
Caloundra South local roads (Aura Boulevard extension)	2018
Birtinya local roads (Station Road)	2019
Birtinya local roads (Central Boulevard)	2020
Maroochydore CBD roads	2020
Sippy Downs Town Centre access streets	2021
Pelican Waters local roads	2021
Maroochydore CBD roads	2021
Palmview roads	2026
Caloundra South local roads (including two lanes, Bells Creek Arterial to Bruce Highway)	2026
Maroochydore CBD roads	2026
Caloundra South local roads	2031
Beerwah East roads	2036
Palmview Southern Access duplication (upgrade to four lanes)	2036

The location of road network upgrades identified in Table 35 and Table 36 are shown in Figure 49. The map includes labels for State-controlled road infrastructure upgrades outlined in Table 34.

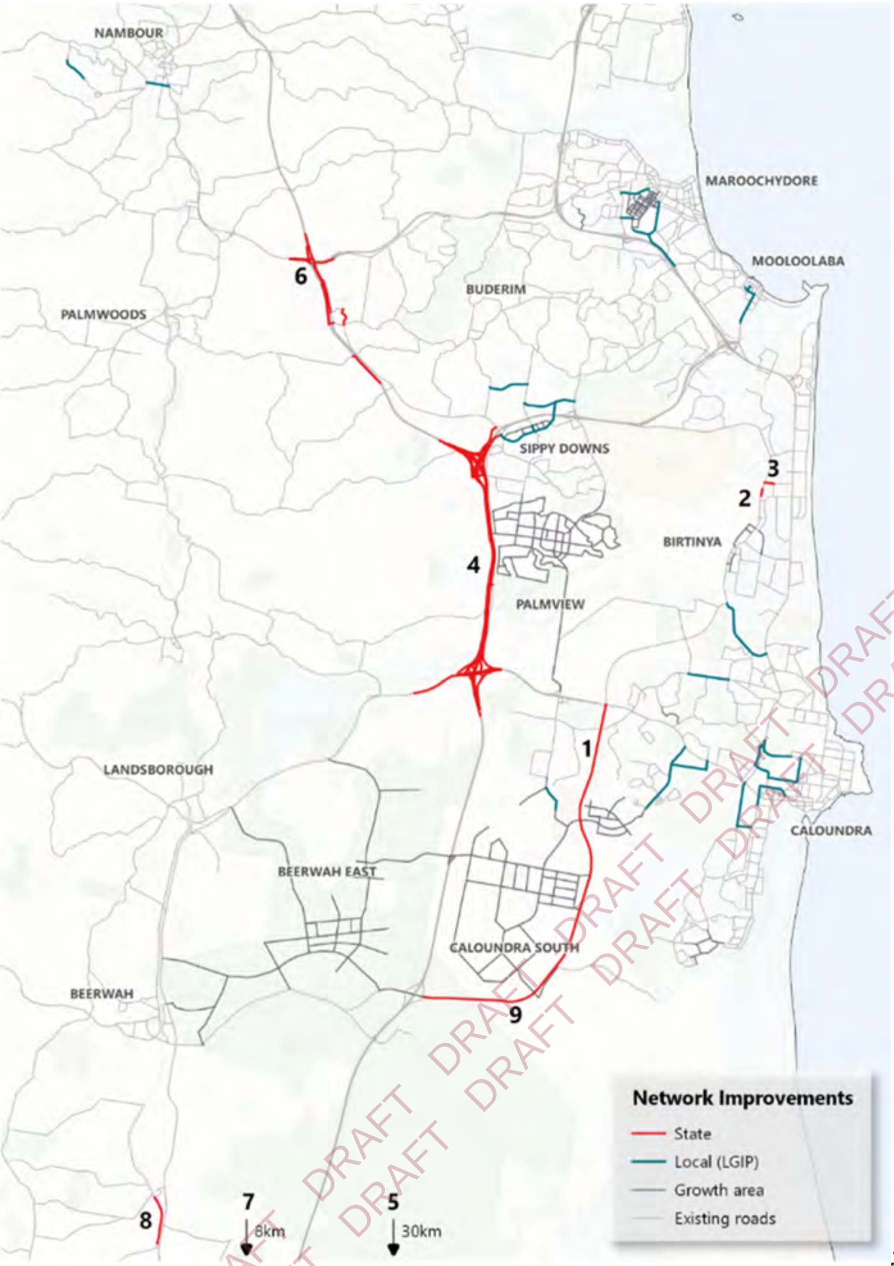

Figure 49 – Base case road network assumed upgrades

9.2.3 MRI Project

TMR is progressing a Detailed Business Case for the planned upgrade of the Sunshine Motorway interchange with Brisbane Road and Nicklin Way, at the Mooloolah River, Mountain Creek. According to TMR[121], preliminary planning has been completed and a preferred planning option has been developed for the future upgrade. This includes:

- Major upgrades to the MRI and connections to the Sunshine Motorway (east-west and north-south links) and Nicklin Way
- A new road connection across the Mooloolah River connecting the upgraded interchange with Kawana Way at Parrearra
- Upgrading the Sunshine Motorway from the MRI to Kawana Way from two to four lanes

[121] https://www.tmr.qld.gov.au/Projects/Name/M/Mooloolah-River-Interchange-Upgrade. Accessed 10 February 2021.

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- New local road links providing a direct connection for northbound traffic on Nicklin Way to Brisbane Road in Mooloolaba, and a new link between Karawatha Drive in Mountain Creek and Brisbane Road.

The Detailed Business Case is planned to be completed in 2021. In the longer term, it is understood that the MRI will provide further grade separation. An extension of the MRI to provide an arterial connection through to Kawana Way Link road at Meridan Plains is also planned, although no business case is currently being developed.

This combination of the MRI and the new arterial connection road will have a strong interface with the planned mass transit route along Nicklin Way, providing positive benefits including reduced through-traffic and improved amenity in the mass transit corridor. However, the MRI is currently not a 'committed project' and accordingly, based on advice from IA, has been excluded from the Base Case road network.

9.2.4 Base Case Public Transport network

The Base Case assumes a *'Do minimum'* public transport network by 2041 that adopts the network operating in 2019 along with minor bus route extensions that provide services to urban expansion development sites. Under the Base Case, public transport within the Sunshine Coast Urban Corridor (Stage 1) can be summarised as follows:

- Major bus stations/interchanges at Maroochydore (on Horton Parade), Kawana (Nicklin Way at Kawana Shoppingworld), and SCUH (off Eccles Boulevard, Birtinya)
- A high-frequency trunk route (600) connecting north–south between Maroochydore and Wurtulla and on to Caloundra, outside the Sunshine Coast Urban Corridor (Stage 1)
- An existing trunk route (611) serving the corridor, from Maroochydore to SCUH via Mooloolaba
- East–west connections to centres outside the Sunshine Coast Urban Corridor (Stage 1) from Maroochydore to Nambour, Buderim, Landsborough, and Sippy Downs (University of the Sunshine Coast), as well as from Buddina to Sippy Downs
- North-south connections from Caloundra, and north to the Sunshine Coast Airport and Noosa
- Low frequency coverage services providing access to the activity centres of Maroochydore, Kawana Shoppingworld precinct (Buddina), and Birtinya/SCUH, operating at typically hourly frequencies
- Buses are not given priority or dedicated lanes anywhere within the Sunshine Coast, except for minor treatments at intersections near the SCUH at Birtinya
- Routes that currently terminate on Horton Parade at Maroochydore would be diverted to terminate at the planned transit centre within the developing Maroochydore CBD (the former Horton Park Golf Course site).

Table 35 –Lists Base Case bus routes that operate in the Sunshine Coast LGA in 2026, 2036 and 2041.

	Route Description	Peak period frequency	Off peak frequency
600	Caloundra – Maroochydore via Mooloolaba & Kawana	4	4
602	Caloundra – Maroochydore via Mountain Creek	1	1
603	Little Mountain to Caloundra	1	1
605	Caloundra to Landsborough[122]	1 / 1.5	0.86 / 0.71
606	Baringa to Caloundra[123]	1	1
607	Caloundra to University via SCUH & Kawana	2	2
609	Pelican Waters to Caloundra	1	1
610	Nambour to Maroochydore via Kunda Park	2	2

[122] Diverted from Steve Irwin Way to serve Beerwah East new development. ** South (Aura)
[123] Extended through the future stages of Caloundra

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	Route Description	Peak period frequency	Off peak frequency
611	Maroochydore to SCUH via Mooloolaba & Kawana	2	2
612	Nambour to Maroochydore via Bli Bli	1	1
615	Maroochydore to Landsborough via University[124]	2 / 1	0.75
616	Maroochydore to University via Alexandra Headland	2	2
617	Maroochydore to Sippy Downs via University	1	1
618	Sippy Downs to Kawana via University***	1	1
619	Kawana to Maroochydore via Alexandra Headland	1	1
620	Noosa Heads to Maroochydore via Peregian Beach	2	2
622	Maroochydore to Noosa Junction via Airport and Coolum	1	1
636	Nambour to University via Buderim	1	1

There are three major urban expansion developments under construction in the Sunshine Coast:

- The Maroochydore CBD at the former Horton Park Golf Course site
- The new urban centre of Aura located in the Caloundra South PDA
- The development in the Palmview Declared Master Planned Area.

Conditions placed on these developments require proponents to construct public transport infrastructure such as bus stops and contribute to the cost of providing bus services. There is also a major growth area called Beerwah East which is currently in early planning. Beerwah East is currently a pine plantation which, according to QGSO, will house 19,558 people in 2041.

The Base Case public transport network includes diversions and extensions to some existing 2019 bus routes. These adjustments are included to provide access to the growth areas discussed above, including Beerwah East. Frequencies and hours of operation of adjusted services remain as per the 2019 network. Changes to the 2019 network are listed in Table 36 and are shown geographically in Figure 50. The 2041 Base Case bus network includes 850 additional service kilometres per day (when compared to the 2019 network).

Table 36 – Bus network changes assumed from 2019 to 2041 - Base Case

Location	Routes affected	Comments
Maroochydore CBD	600, 602, 610, 611, 612, 614, 615, 616, 617, 619, 620, 622	Extended/diverted all routes that currently start/end at Maroochydore Station (Horton Parade) into the new CBD. Nambour/Noosa routes still use old station on Horton Parade, then continue into CBD. Other routes no longer use it, going into the CBD instead.
Palmview	615, 618	Diverted 615 to run through Palmview between Sippy Downs and Landsborough. Extended 618 to provide local coverage.
Caloundra South (Aura)	606	Extended 606 through Caloundra South future stages.
Beerwah East	605	Diverted 605 between Caloundra and Beerwah, to serve Beerwah East.

[124] Diverted/extended to serve Palmview

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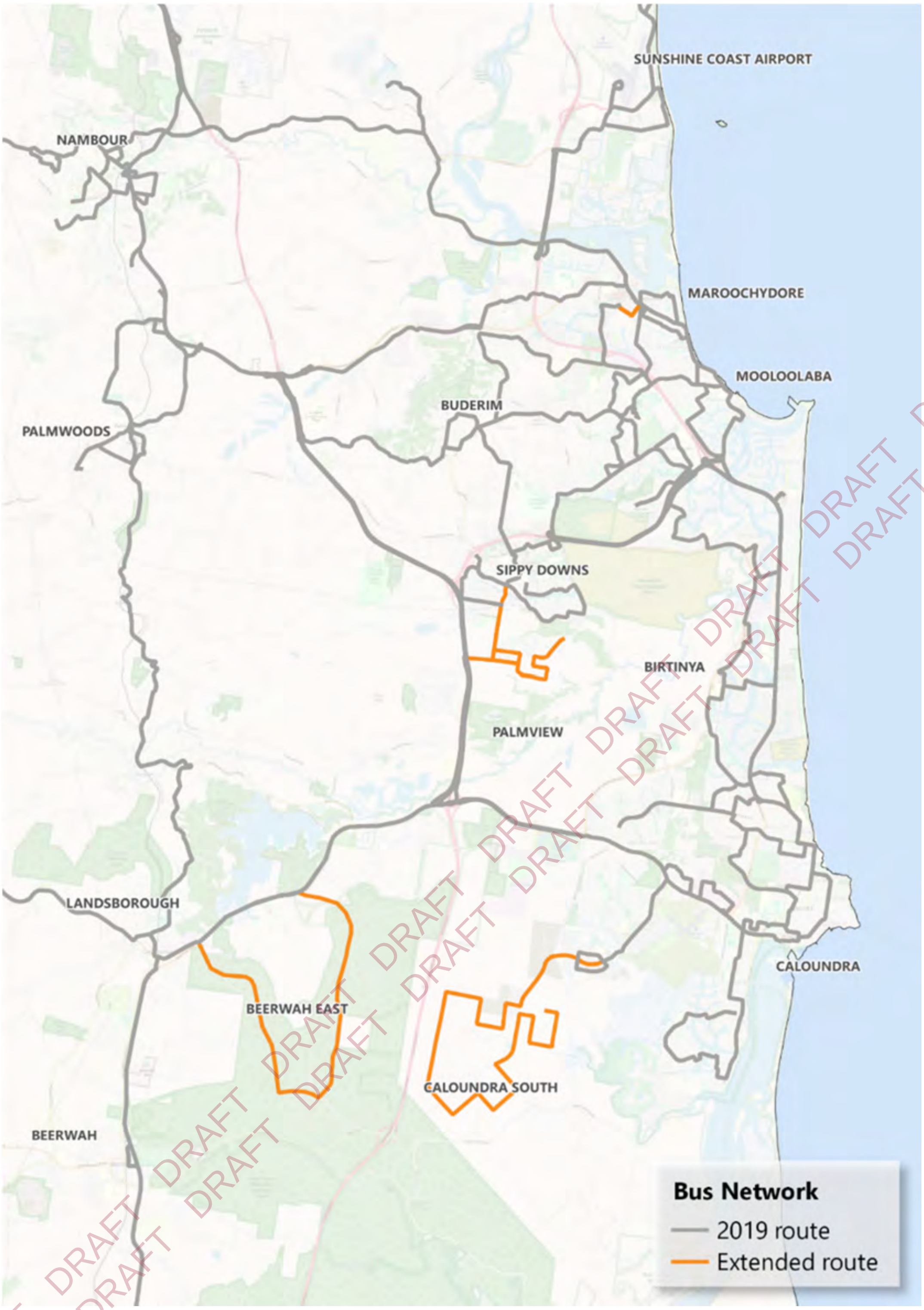

Figure 50 – Bus network changes from 2019 to 2041 - Base Case

9.3. Base case transport outcomes

This section outlines the transport outcomes expected under the Base Case in which considerable urban expansion is expected under a business-as-usual approach to infrastructure planning delivery. The Base Case transport outcomes demonstrate that sustainably accommodating growth on the Sunshine Coast requires investment in a mass transit system that reduces dependence on single-occupant cars and supports dense, compact and mixed-use development. Modelling shows that without an attractive, convenient and competitive mass transit system, the urban footprint will expand, and transport costs will increase.

9.3.1 High levels of car dependence

Table 37 shows an estimated 501,600 additional trips will be made by car and commercial vehicles each day equating to an additional 5.6 million VKT when compared to 2016, an increase of 56 per cent.

Table 37 – Base case demand metrics

Parameter	2016	2026	2036	2041
Person Trips (person car, PT, walk)	1,339,841	1,669,374	1,973,590	2,118,466
Person car trips	1,025,300	1,212,400	1,423,300	1,526,900
Total vehicle trips (car, LCV, HCV)	1,027,300	1,214,400	1,425,300	1,528,900
VKT (total vehicles)	10,091,800	12,534,900	14,703,800	15,729,800

Forecasts under the Base Case show that the community's reliance on cars will not change under a business-as-usual approach and car travel will continue to dominate despite average travel speeds being 15 per cent lower across the LGA[125].

As shown in Table 38, public transport mode share is forecast to stagnate in 2026 at just 1.2 per cent within the LGA and 1.4 per cent within the Sunshine Coast Urban Corridor (Stage 1).

Table 38 – Transport mode share results for the Base Case

Parameter	2016	2026	2036	2041
Sunshine Coast Urban Corridor (Stage 1)				
Person Car Trips	167,500	154,100	182,700	197,700
Person Car Mode Share	63.73%	48.64%	48.14%	48.25%
Walk Trips	92,500	158,200	191,500	206,100
Walk Mode Share	35.19%	49.95%	50.44%	50.32%
PT Trips	2,800	4,400	5,400	5,800
PT Mode Share	1.08%	1.40%	1.41%	1.42%
LGA				
Person Car Trips	1,025,300	1,212,400	1,423,300	1,526,900
Person Car Mode Share	76.52%	72.63%	72.12%	72.07%
Walk Trips	301,400	437,100	527,000	566,500
Walk Mode Share	22.50%	26.18%	26.70%	26.74%
PT Trips	13,100	19,800	23,300	25,000
PT Mode share	0.98%	1.19%	1.18%	1.18%

[125] VKT/VHT in 2041.

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Under the Base Case, the average number of car trips made per person drops as a result of forecast reductions in vehicle ownership rates, increasing congestion and the introduction of parking controls. However, the average number of public transport trips per person does not show a corresponding increase, and remains very low as demonstrated in Figure 51.

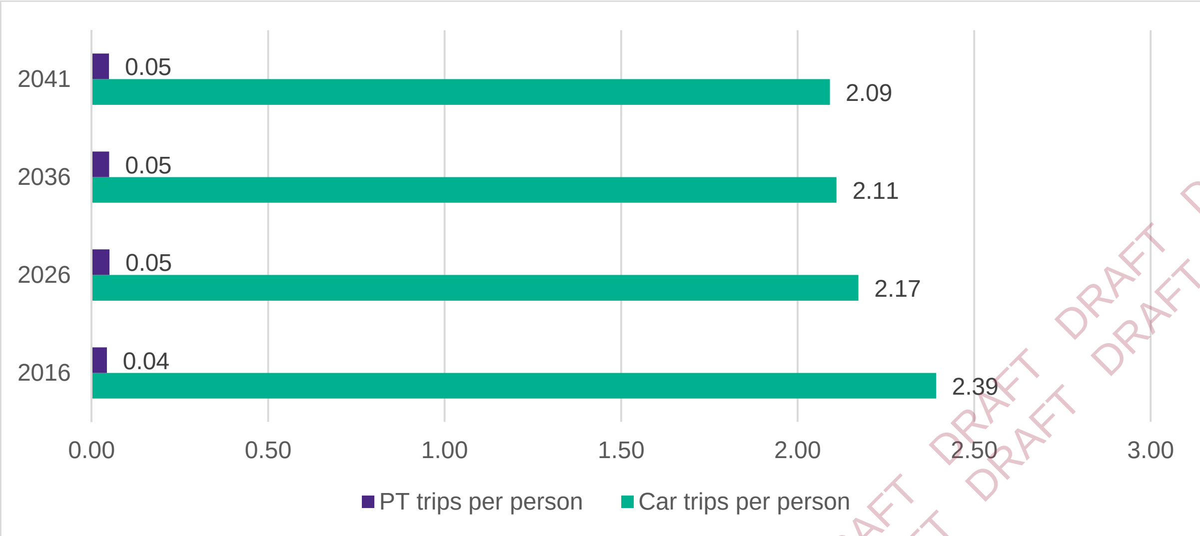

Figure 51 – Average number of trips per person (by mechanised mode

With an additional 501,600 person car trips each day, demand for road capacity on the Sunshine Coast is forecast to increase significantly. A considerable number of trips from urban expansion areas are destined for the Sunshine Coast Urban Corridor (Stage 1) as it contains the greatest concentration of employment opportunities, community facilities and essential services. This demand means links such as Kawana Arterial, Sunshine Motorway, Caloundra Road and Nicklin Way are forecast to experience significant traffic growth. Figure 52 shows the forecast change in daily traffic volumes between 2016 and 2041.

Figure 52 – Change in daily traffic volumes 2016 to 2041

Daily traffic on Nicklin Way, south of the Mooloolah River crossing, is forecast to increase by 62 per cent in some areas (near Kawana Shoppingworld), equating to an additional 30,900 vehicles per day. Of all east-west arterials, Caloundra Road stands out as the link with the highest degree of growth with up to 37,900 additional vehicles using this road every day. The additional traffic on Caloundra Road is more than two additional lanes of traffic per day[126].

[126] Sunshine Coast Council (2014). *Sunshine Coast Planning Scheme, Page SC6-357, Table SC6.17B Urban transport corridors, VPD/Distributor Road.* Accessed at: https://d1j8a4bqwzee3.cloudfront.net/~/media/Corporate/Documents/Planning/Planning%20scheme%20text/Schedule6/Schedule%206%20Section%206_17.pdf?la=en

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9.3.2 Increasing congestion

Congestion is forecast to become significantly worse by 2041 under the Base Case. Across the LGA, time spent in traffic is forecast to grow by 308 per cent from 2016 to 2041, shown in Figure 53.

While the increase in congestion appears to largely occur outside of the Sunshine Coast Urban Corridor, the LGA figure considers major highways and roads, including the Bruce Highway, which accounts for trips accessing areas within the corridor. Total vehicle hours delay within the Sunshine Coast Urban Corridor (Stage 1) still grows significantly between 2016 and 2041, increasing by 169 per cent.

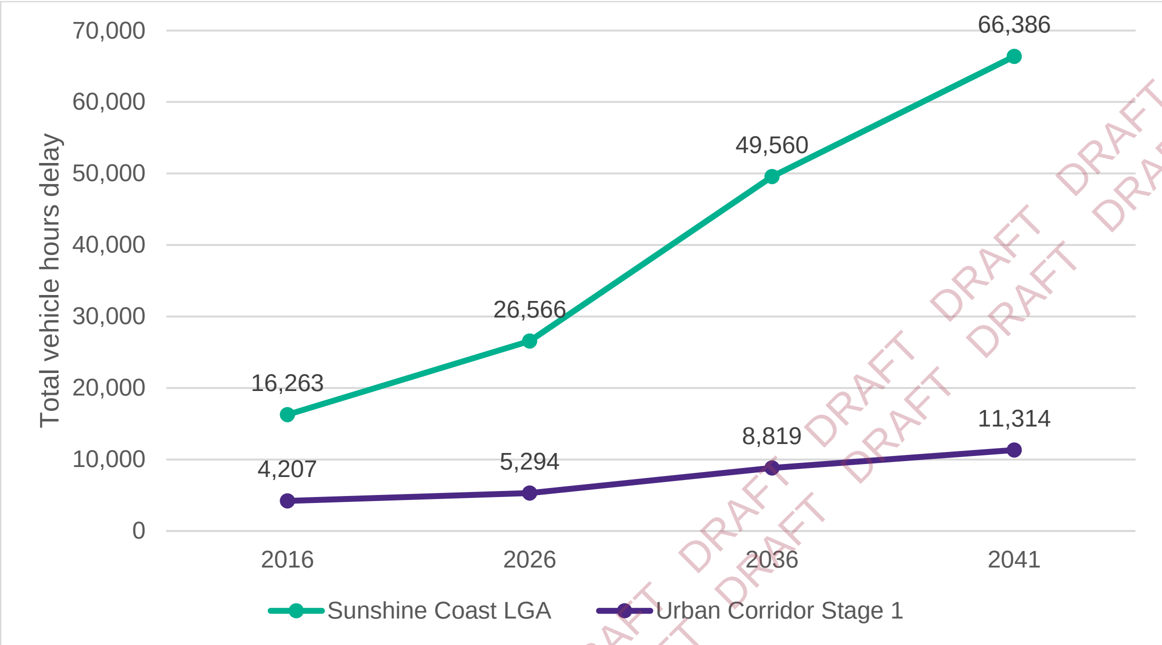

Figure 53 – Total vehicle hours delay

Figure 54 and Figure 55 show the 2016 and 2041 VC ratios for road links within the Sunshine Coast. VC ratios are typically used to evaluate the likelihood and duration of congestion on a section of road. A VC ratio above 1.0 indicates a high likelihood of congestion during peak periods, and possibly even during off-peak periods.

Vehicular trip demands will accumulate within the Sunshine Coast Urban Corridor (Stage 1) and as a result, Nicklin Way and the east-west arterials that feed it will be at or approaching capacity by 2041. Commuters will experience significant delays on sections of the network during peak periods as demand approaches the capacity of key links.

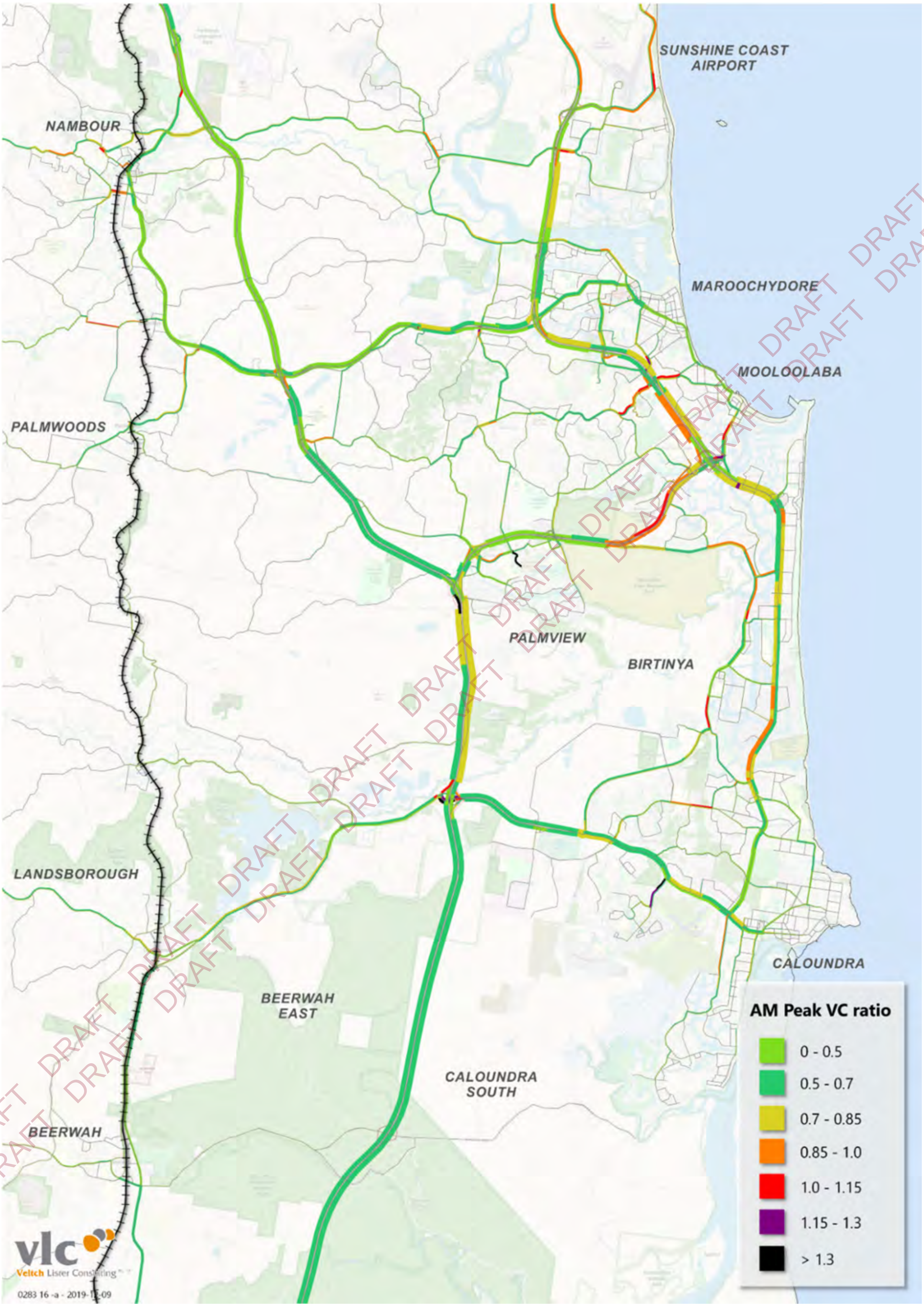

Figure 54 – 2016 VC ratio (AM peak)

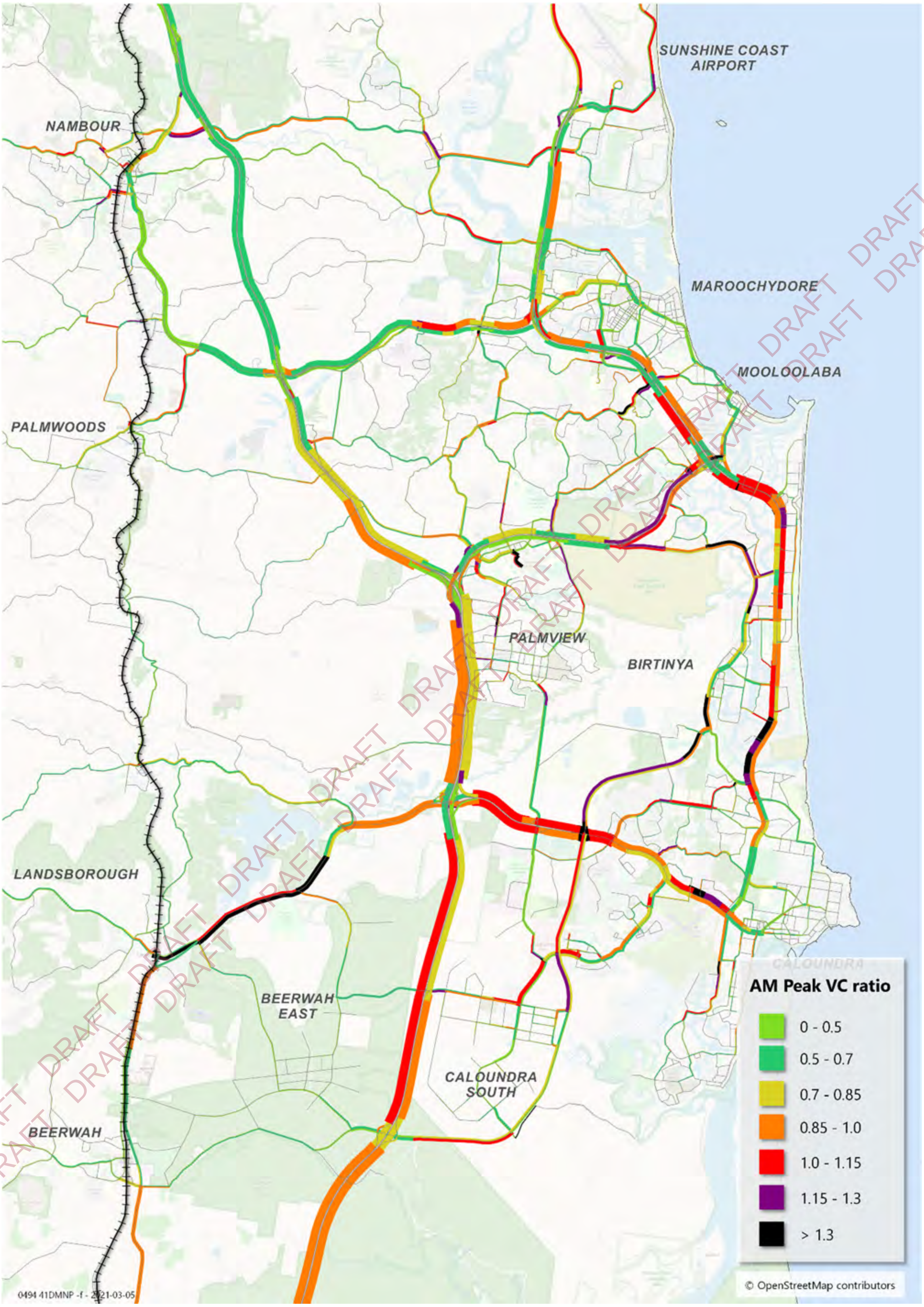

Figure 55 – 2041 VC ratio (AM peak)

9.3.3 Lack of realistic alternatives to car travel

Of all trips that start in the Sunshine Coast LGA in the 2041 Base Case, 95 per cent are forecast to have destinations within the LGA. Of the 2.1 million trips that start and finish on the Sunshine Coast, 28 per cent have destinations within the Sunshine Coast Urban Corridor (Stage 1). However, only 1.5 per cent of these trips are forecast to be made by public transport.

Table 39 shows the average length of trips within the Sunshine Coast. Trip lengths increase slightly but remain quite low. Mass transit on the Sunshine Coast presents an opportunity to facilitate mode share for shorter journeys through more competitive public transport travel times.

Table 39 – Average trip length (kilometres) of trips within Sunshine Coast by mode and year under the Base Case

Mode	2016	2026	2036	2041
Parameter	2016	2026	2036	2041
Person Trips (person car, PT, walk)	1,339,841	1,669,374	1,973,590	2,118,466
Person car trips	1,025,300	1,212,400	1,423,300	1,526,900

The Sunshine Coast Urban Corridor (Stage 1) is book-ended by Maroochydore Town Centre in the north and the SCUH in the south. These two centres will continue to grow in importance as major trip generators in the Sunshine Coast Region. However, with infrequent bus services that run circuitous routes in the same traffic as cars, public transport under the Base Case is not an attractive option for most commuters.

9.3.4 Land use and urban form that supports alternatives to car transport

Figure 56 underlines the uncompetitive nature of the public transport system. It shows public transport is not an effective way to reach these destinations on a homeward commute under the Base Case.

With Beerwah East and Caloundra South accommodating a large proportion of new residents in the future, present trends would see the need for significant investment in roads to maintain reasonable levels of service. This is a major issue in the Base Case where the combined population of these two areas reaches 64,300 by 2041.

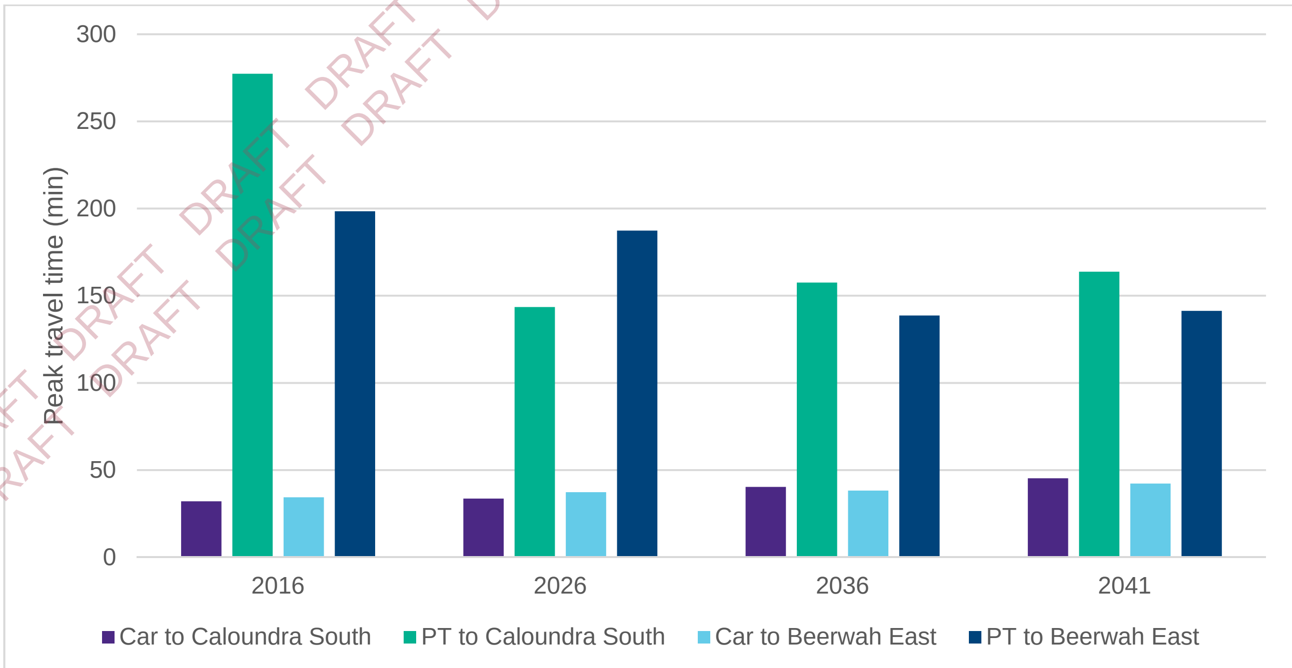

Figure 56 – Forecast journey time from Maroochydore to Caloundra South and Beerwah East under the Base Case

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OPTIONS SHORTLISTING

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10. Options shortlisting

Consistent with the BCDF and IA's Assessment Framework, the purpose of the Options Analysis stage is to:

- Develop potential options (initiatives) to solve the problems or realise the opportunities and assess those options to select those with the highest potential value to the Sunshine Coast, Queensland and Australian communities.
- Narrow the breadth of options for improving the transportation of people by public transport in the Sunshine Coast Region by applying rigorous evaluation criteria, before assessing the viability of any remaining options.

The Options Analysis builds on the assessment of service needs and benefits identified in the Strategic Business Case, and updated in Chapter 6. These service needs and benefits provide a means to test the value of the various options using robust quantitative and qualitative criteria.

This chapter describes the process used to determine the shortlist of options taken forward to the detailed economic and financial analysis.

The options shortlisting process was undertaken over multiple stages, leveraging the options work undertaken during the Strategic Business Case stage, supported additional research and planning undertaken by Sunshine Coast Council as follows:

1. Developing a Base Case (the do-minimum transport investment scenario)
2. Revisiting the option testing from the Strategic Business Case
3. Updating the longlist of mass transit options to capture emerging technologies
4. Using a structured options assessment process whereby the longlist of options is reduced to a robust and defensible shortlist of options.

The shortlist of options is further analysed (refer Chapter 12 – 16) to result in the identification of preferred options which will undergo detailed analysis as part of Stage 3: Detailed Business Case, should the outcomes of this Options Analysis be approved.

10.1. Base case - do-minimum transport investment scenario

The do-minimum transport investment option includes the roads and public transport infrastructure and services within the study area, as described in Chapter 15.3. The future road and public transport network infrastructure upgrades include only those upgrades in the Base Case that are:

- Funded and/or committed projects
- Funded and planned projects, where upgrades are currently planned by the Council and/or TMR and are expected to be funded through recurrent funding
- Projects that represent do-minimum intervention including minor works and maintenance.

More detail on the Base Case infrastructure, population and transport outcomes are included in Chapter 9.

10.2. Option testing from the Strategic Business Case

The Strategic Business Case followed on from the Council's '*A Line in the Sand'* report (2012) which also considered mass transit options for the region. The Strategic Business Case was the first stage of the formal business case assessment of the Project.

The Strategic Business Case identified and assessed 17 current and potential initiatives that are, and could be progressed, by Council or the Queensland Government. The initiatives included:

- ten non-capital initiatives (covering reform and better use)
- Seven capital investment initiatives to improve roads or mass transit.

Table 40 describes the initiatives outlined in the Strategic Business Case which have been reconfirmed as part of this Options Analysis.

Table 40 – Strategic Business Case initiatives identified

Mode	2016
Current Initiatives	
Town planning at Maroochydore	This initiative involves planning, carrying out, promoting, coordinating and controlling the development of land in the Maroochydore City Centre. This initiative will provide a mix of residential, commercial, retail, civic and community uses in order to improve the business district and City Centre, complementing and enhancing Maroochydore's existing business offering.
Town planning at Caloundra South and Beerwah East	This initiative involves planning, carrying out, promoting, coordinating and controlling the development of land in Caloundra South (Aura) and the future major urban area of Beerwah East. This initiative will include developing a compact community supported by PT, housing choice and affordability, employment opportunities, facilities and services in order to service the region's growing population.
Potential planning responses	This initiative involves a potential update of the *Sunshine Coast Planning Scheme 2014* to provide an up-to-date scheme for the Sunshine Coast Region to regulate the way land, buildings and structures are used and developed.
Development of road travel demand management strategies	This initiative involves the implementation of travel demand management strategies to encourage alternative transport mode usage and reduce road network congestion and flow on impacts. Current programs are focussed on voluntary travel behaviour change and managing the supply of parking at the Kawana and Maroochydore centres.
Development and implementation of Integrated Transport Strategy	This initiative involves the implementation of early initiatives identified in the recently adopted Sunshine Coast Integrated Transport Strategy to capture the opportunities and respond to the transport challenges facing the Sunshine Coast Region to achieve a connected, smart, integrated, safe and efficient transport system that contributes to the region's economic viability, sustainability and lifestyle.
Development of Regional Economic Development Strategy	The Sunshine Coast Regional Economic Development Strategy 2013-2033 provides a vision and blueprint for sustainable economic growth. It will help to ensure the region actively participates in the global economy and deliver the lifestyle and opportunities for local residents and businesses alike.
Bus network infrastructure improvements	This initiative entails the progressive extension and increased service levels for the existing bus network, together with the staged installation of the CoastConnect QBC scheme to improve bus running times between Maroochydore and Caloundra. CoastConnect is a 'quality bus corridor' that proposes a staged development of infrastructure improvements including widening of intersections and adding general traffic lanes to assist bus travel, and bus stop upgrades.
Investment in additional road network capacity	This initiative involves the progressive upgrading of existing road infrastructure to address congestion issues and mitigate increased road network demand.
Potential Initiatives	
Reform/Better use potential initiatives	
Land use only solution	This initiative involves additional urban change on the Sunshine Coast Region, beyond land use focused activities covered under current initiatives. This would involve urban consolidation at higher levels than currently envisaged in the *Sunshine Coast Planning Scheme 2014* and *ShapingSEQ*.
Implementation of road travel demand management strategies	This initiative involves additional travel demand management strategies on the Sunshine Coast Region, beyond current voluntary change initiatives. Options could include toll points, congestion charges or further parking management strategies to restrain the growth and supply, and increasing the price of parking an activity centres.

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Mode	2016
Infrastructure-based potential initiatives	
Major upgrades to road network to keep service levels consistent	This initiative involves the delivery of major road infrastructure upgrades beyond those already planned to ensure that performance of the road network does not continue to degrade in the future.
Passenger Rail between Beerwah and Sunshine Coast Airport	This initiative involves delivering a new Queensland Rail passenger rail line from the existing Queensland Rail passenger rail network from Beerwah to the Sunshine Coast Airport via Maroochydore through the CAMCOS corridor.
Fast rail between Beerwah and Sunshine Coast Airport	This initiative involves delivering a new line from the existing Queensland Rail passenger rail network from Beerwah to the Sunshine Coast Airport via Maroochydore through the CAMCOS corridor. The key difference between this initiative and the passenger rail initiative above is the mode of rail is considerably faster than existing Queensland Rail services and the number of stops would be significantly reduced, similar to what has been proposed under the North CoastConnect project.
Local mass transit between Maroochydore and Caloundra	This initiative involves delivering an on-street mass transit system along a SCMT corridor between Maroochydore, Kawana and Caloundra.
Local mass transit between Beerwah and Maroochydore	This initiative involves delivering an on-street mass transit system along a SCMT corridor between Maroochydore and Kawana. The system then extends down to Beerwah through the CAMCOS corridor, with an on-street spur line to Caloundra.
Local mass transit between Maroochydore and Kawana, and passenger rail to Beerwah	This initiative involves an on-street mass transit system between Maroochydore and Kawana, and a passenger rail system from Kawana to Beerwah through the CAMCOS corridor.
Passenger rail between Beerwah and Sunshine Coast Airport, and local mass transit system between Maroochydore and Caloundra	This initiative involves delivering Queensland Rail passenger rail from Beerwah to the Sunshine Coast Airport via Caloundra, which integrates with an on-street mass transit system from Maroochydore to Caloundra. This initiative is a combination of infrastructure initiatives 1 and 4 above.

10.2.1.1 Strategic Business Case assessment of non-capital initiatives

- Eight initiatives are currently being implemented and are not sufficient in their own right to address the challenges of growth management on the Sunshine Coast. They will form the basis of the 'Base Case' or 'without project case' against which any future investment could be measured.
- An initiative based solely on urban change will not adequately address challenges nor fully realise desired benefits. However, in order to achieve urban change policy goals, a suitable strategy must accompany any preferred mass transit solution as the integration of urban form and transport planning is critical to achieving optimal economic and social policy outcomes for the region.
- Implementation of significant road travel demand management and restraint of car parking supply will be insufficient to respond to the major growth in travel expected but would necessarily be required to accompany any preferred mass transit solution.

10.2.1.2 Strategic Business Case assessment of capital initiatives

Major road upgrade

The Strategic Business Case dismissed the option of a major upgrade to the region's road network as the response to cater for future growth in travel demand[127]:

> *"The key concern with major upgrades to the road network is the high level of mismatch with current stated policies relating to the future development of the region. All three spheres of Government are committed to a shift away from car dominated cities in the future. A major upgrade of the road*

[127] Sunshine Coast Council. 2019. Strategic Business Case – Sunshine Coast Mass Transit. P110.

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system would increase the dominance of the car, create more emissions, use more energy and result in diminished amenity in the future.

Providing a major upgrade to arterial roads would not meet key land use objectives, in particular urban change outcomes in the urban corridor, and would undermine the liveability of the region.

While a balanced, moderate program of major road investment will be obviously needed in a growing region, it should not be the sole response, given the long-term impacts of motor traffic and car dependency."

Best performing mass transit options from the Strategic Business Case

Six potential mass transit infrastructure initiatives were selected to undergo further analysis to determine a shortlist for the subsequent business case stages[128]. This analysis concluded the mass transit infrastructure initiatives that performed best were those that provided:

- Coverage along the coastal areas of the Sunshine Coast Region from Maroochydore to Caloundra
- Inland connections through the major urban expansion developments and connections with the existing regional passenger rail network.

Priority staging of capital investment

The Strategic Business Case also recommended a priority staging for mass transit infrastructure interventions. The first stage of mass transit should be delivered in the Priority Area 1 (the northern sector of the Sunshine Coast Urban Corridor), from Maroochydore to SCUH, as the best way to meet the identified project objectives and service needs. This priority staging has been confirmed as set out in Chapter 7.

10.3. Updating the longlist of options

The Options Analysis options identification, development and assessment framework involves capturing where the Strategic Business Case concluded and updates the process based on any emerging trends or stakeholder views.

10.3.1 Updated mass transit options assessment

Options for first stage in the SCMT corridor from Maroochydore to the SCUH have been shortlisted through a rigorous process involving qualitative and quantitative analysis.

To achieve the objective of changing travel behaviour and attracting passengers out of cars, public transport needs to be reliable and efficient, and not be delayed in congestion with other general traffic. A primary element affecting this is the ROW enjoyed by the public transport services. Industry standard terminology for the varying levels of ROW are:

- Category A – the best standard, with full separation from other traffic both horizontally and vertically. The vehicles usually only need to stop to serve passengers, are not affected by congestion and can offer a reliable and efficient travel time.
- Category B – a good standard. Separated from all other traffic horizontally but intersecting at-grade with cross traffic. If there are not too many vehicles using the ROW, traffic signal phasing to suit the vehicle can be advanced and the vehicle also proceeds smoothly through intersections. The service is reliable and travel time competitive with driving, though possibly still slower.
- Category C – the lowest standard. The vehicle generally only runs at the same speed as other traffic, and because it needs to stop to serve passengers, it will be uncompetitive with private car travel. Bus lanes, though offering some priority, must carry other traffic and for variety of reasons, are regarded as Category C standard.

No Category A option is considered viable in the SCMT corridor as it would need to be an elevated structure which would significantly diminish the visual amenity of the area. An underground sub-way option would be prohibitively expensive and is not suited to a regional location.

[128] Sunshine Coast Council. 2019. Sunshine Coast Mass Transit – Strategic business Case. pp 113-119

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The development of feasible options for the Options Analysis was undertaken by the Project Team, considered the technologies and initiatives that could feasibly be delivered to realise the benefits sought from the Project, with a focus on the identified Sunshine Coast Urban Corridor. The options considered in the Options Analysis options assessment were:

- Region-wide bus service enhancements (no infrastructure)
- Region-wide bus network upgrades (with targeted bus infrastructure improvements)
- Road network upgrades in the Sunshine Coast Urban Corridor
- QBC – articulated bus (targeting zero emissions technology)[129] in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor
- BRT (BRT, bronze standard[130]), double-articulated bus, wireless with on-board stored energy in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor
- LRT with overhead power in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor.
- wLRT, wireless with stored on-board stored energy in Priority Area 1, the northern sector of the Sunshine Coast Urban Corridor
- TT, wireless with on-board stored energy in Priority Area 1.

These options reflect a range of transit solutions, technology options and levels of capital investment to understand the incremental benefit that could be realised from various levels of intervention to improve mass transit increasing level of investment and intervention in the Sunshine Coast Urban Corridor.

For the Options Analysis, a comprehensive re-consideration of non-infrastructure options, (other than bus enhancement option), was not undertaken as it was considered the Strategic Business Case undertook a detailed and sufficiently comprehensive assessment. Given the 70 per cent increase in population that is projected for the region, it was considered that non-infrastructure solutions, as stand-alone initiatives, would not in their own right realise the benefits sought or address the scale of the problem. These non-infrastructure options could however complement infrastructure solutions.

For each option, sufficient design effort was undertaken to develop a strategic level cost estimate and enable transport modelling to be undertaken. However, it should be noted that the level of information available for the TT options was limited at the time of this analysis.

All options incorporate the route for Stage 1 from Maroochydore to the SCUH. To ensure a like-for-like comparison, for each of the options, an updated region-wide public transport network including bus service enhancements was used as the basis for the strategic transport modelling. Also, as discussed in Chapter 8 of this report, the QGSO demographics were used for the urban scenario underpinning the options assessment. This provides a like for like comparison of options but does not recognise the differences in potential urban change benefits between the options.

The scoping of the options leveraged previous studies undertaken, particularly for the QBC which was the subject of previous detailed technical investigation and business cases by TMR as part of the CoastConnect project. Previous investigations by the Council and the Queensland Government have also considered LRT and BRT on the Sunshine Coast.

As discussed earlier, the transport options described below have been classified under three ROW categories per international literature[131]:

- Category A – fully separated ROW used exclusively by transit vehicles (e.g. heavy rail)
- Category B – partially separated ROW on tracks or a busway (e.g. LRT, BRT, TT)
- Category C – shared ROW on urban streets with mixed traffic (e.g. current bus services).

Any Category A options would require either tunnelling for a subway, or provision of an elevated system along the entire SCMT corridor. A subway system would escalate costs of a surface system by as much as five times, and is not considered affordable for a regional area outside of a capital city. An elevated system

[129] If these are available to operate commercially at the commencement of the project operating stage
[130] Categorised by its design features as per the Institute for Transportation and Development Policy - BRT Standard.
[131] Vol 1 – Urban Public Transportation Systems – Vukan R. Vuchic

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would also be expensive, and was not considered as it would provide an inappropriate impact on the character and visual amenity of the SCMT corridor, and would not meet the Project objectives[132].

Hence for this Options Analysis, only Category B and C options are being evaluated as applicable for the Sunshine Coast Urban Corridor.

10.3.1.1 Region-wide bus service enhancements

The bus service enhancements in a non-capital option is based on an expanded future bus route network on the Sunshine Coast. This network was developed by TMR as part of the Southern Sunshine Coast Public Transport Study. It consists of a trunk corridor extending from Beerwah to the Sunshine Coast Airport (via Caloundra, Kawana, Mooloolaba, Maroochydore) which is serviced by three high-frequency routes. Connections to other activity centres (including new centres) and the North Coast Rail Line are provided by new and existing connector routes with improved frequencies. Urban expansion growth areas are provided with new coverage services, and frequencies and some existing coverage routes are improved. Services north of the airport and west of the North Coast Rail line remain unchanged. No changes to existing parking policy were assumed.

10.3.1.2 Region-wide bus network upgrades

The bus network upgrades option reflects a low capital solution, providing localised treatments throughout the corridor to improve the current bus network service. It assumes the bus service enhancements in Option 1 with some additional service enhancements, supporting bus infrastructure and parking policy. Features include:

- Improved service frequency based on having two routes on Nicklin Way with a combined service frequency of eight vehicles per hour (7.5-minute headways)
- Vehicles will be standard TransLink branded vehicles
- Bus stop locations as per TransLink future network planning
- Queue jumps on Nicklin Way at:
  - Jessica Boulevard
  - Port Cartwright Drive
  - Palkana Drive
  - Main Drive.
- Bus priority measure at Main Drive to Kawana Way
- Park 'n' Ride at Sunshine Motorway
- Parking charges will be applied in Maroochydore and Mooloolaba based on current charges applied in Caloundra and Birtinya.

10.3.1.3 Road network upgrades in the Sunshine Coast Urban Corridor

The road upgrade option is more modest than the region-wide upgrade dismissed as unsuitable due to policy incongruence in the Strategic Business Case stage. It considers the ability to make amendments and investment in the road network to alleviate congestion and improve the transport functionality within the Stage 1 corridor only. This also incorporates the base bus service enhancements of Option 1. The level of new road infrastructure is consistent with the QBC option which provides a similar scale of investment but only for bus lanes serving mostly public transport. This road option will include road upgrades to provide extra lanes along Aerodrome Road, Venning Street, Walan Street, Brisbane Road and Nicklin Way.

10.3.1.4 QBC – Maroochydore to SCUH

The QBC Reference Project reflects the development of a high-quality bus corridor, with high frequency service provision. It represents a significant capital investment in bus technology and corridor level treatments, as compared to the bus network upgrades, to attract passengers and increase public transport mode share. The design leverages previous detailed investigations undertaken by TMR on the

[132] For further discussion on the unsuitability of an elevated system, see Sunshine Coast Council. 2015. Shaping our future. p 34

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CoastConnect*:* Caloundra to Maroochydore Quality Bus Corridor study undertaken in 2010-11. Key features of this option include:

- Up to 20 improved vehicles - higher specification branded vehicles, articulated or double decker buses. The target is for these to be powered by zero emission technologies noting that current bus operations are for low emission diesel engines. Zero emission electric or hydrogen fuel cell buses are being trialled in a number of jurisdictions in Australia.
- High frequency bus services as specified by TransLink in future network. Minimum of two overlapping services on Nicklin Way and deviating to SCUH with frequency of eight services per hour and headways of 7.5 minutes. These services will be pre-paid only (no cash fares, however the next generation TransLink go card works on credit and debit cards, and since COVID-19 TransLink services have not been handling cash)
- Infrastructure as per drawings in CoastConnect reports
- Dedicated bus lanes along Aerodrome Road - Rose Street to Horton Parade
- Dedicated bus lanes along Main Drive and Nicklin Way (two road lanes plus one bus lane plus active transport)
- Quality bus stops along corridor
- Brisbane Road, Walan Street, Venning Street - upgraded to four lanes of general traffic. Cost excluded from Project as works being undertaken by Council in 2019/2020
- Park 'n' Ride at Sunshine Motorway
- Parking charges will be applied in Maroochydore and Mooloolaba based on current charges applied in Caloundra and Birtinya.

10.3.1.5 BRT – Maroochydore to SCUH

A BRT Reference Project was developed to reflect a significant level of capital investment to create a dedicated high quality bus-based spine in the corridor. The solution includes high quality vehicles and stations with features as described by the BRT Standard[133].

The reference vehicles were based on the Brisbane Metro vehicle ordered by Brisbane City Council and expected to be trialled on Brisbane's busways once a pilot vehicle arrives. These are fully electric and rely totally on energy stored on-board through batteries.

Key features of the BRT option include:

- Identical alignment to the LRT alignment across the corridor with aligned station locations and function
- 14 modern battery electric buses 24 metres long
- Flash-charging of the batteries from overhead pantographs at termini and some intermediate stations, deep-charging overnight in the depot
- Cashless pre-paid boarding, tag on platform, all doors, no contact with driver
- Dedicated ROW corridor but not grade separated
- Eight services per hour, 7.5-minute headways
- Priority at traffic signals
- Journey time of 30 minutes from Maroochydore to Kawana
- Park 'n' Ride at Sunshine Motorway
- Parking charges assumed to be applied in Maroochydore and Mooloolaba based on current charges applied in Caloundra and Birtinya.

[133] ITDP (2017*). Bus Rapid Transit Standard*. Accessed at: https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/

10.3.1.6 LRT – Maroochydore to SCUH

The LRT Reference Project was developed for the Options Analysis, and as for the BRT design intention, represents a significant level of capital investment to create a dedicated high-quality dedicated public transport corridor. The LRT option reflects the highest specification, largest infrastructure intervention and highest cost solution considered. Features of the design include:

- 14 modern Light Rail Vehicles (LRV) similar to Gold Coast and Canberra light rail
- Identical alignment to the BRT alignment across the corridor with aligned station locations and function
- Cashless pre-paid boarding, tag on platform, no contact with driver
- Dedicated ROW corridor but not grade-separated
- eight services per hour, 7.5-minute headways
- Priority at traffic signals
- Journey time of 30 minutes from Maroochydore to Kawana
- Park ‘n’ Ride at Sunshine Motorway
- Parking charges assumed to be applied in Maroochydore and Mooloolaba based on current charges applied in Caloundra.

Overhead power supply – LRT - overhead

The most common LRT systems around the world use reticulated electricity delivered through 750 v DC overhead power lines. This was evaluated as the LRT – overhead power option. This is a proven technology, and meets all safety and operation requirements.

There is a disadvantage in that the overhead power lines are seen by some as having a detrimental effect on visual amenity. This effect is usually mitigated by the removal and placing underground of some pre-existing overhead power lines that deliver electricity for general purposes[134].

Stored on-board energy supply – wLRT - wireless

With the improvement of battery technology, a number of LRT systems are relying on use of batteries for on-board stored energy rather than having overhead power lines. The batteries are flash-charged through overhead pantographs at stations and at the end of each run, and deep-charged at depots overnight. This option was evaluated as wLRT. It addresses concerns associated with the visual amenity of the overhead wires, and may prove feasible in the case of a Sunshine Coast LRT system. The Project Team liaised with Canberra and Newcastle light rail counterparts to understand the effectiveness of wireless technology as an on-board stored solution.

Variants using hydrogen fuel cells to power LRT are also being tested overseas. As with all hydrogen powered technology, an issue to be overcome is the availability of “green” hydrogen produced without fossil fuels. Hydrogen fuel cell for all vehicles, including LRT, may become feasible for future stages of the Project.

10.3.1.7 TT

Due to recent trends and stakeholder interest across Australia, this Options Analysis has evaluated an additional option called TT. A trackless tram is an emerging technology solution that is a rubber tyred vehicle that is longer than a bus and may provide a smoother ride. As with all mass transit technologies, TT could, in the future, be autonomously guided via measures including optical video, magnetic beacons or radio service guidance system.

The best known form of TT is the *Autonomous Rapid Transit* (ART)[135] which is currently operating on a 17 kilometre line that has recently been opened for revenue service in Yibin in the south-eastern part of Sichuan province, China. These are fully electric and rely totally on energy stored on board through batteries.

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[134] High voltage power supply lines for urban electricity reticulation are incompatible with the lower voltage LRT power system, and if a high voltage power line was brought down on the low voltage line it could cause major damage.

[135] The ART is a proprietary product of the Chinese rail company CRRC. It is understood to offer a smoother ride than a conventional bus due to the application of air ride suspension and an axle configuration that mimics rail bogies.

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TT options in three operating ROW were considered:

- Operating Category B – dedicated busway, similar to the BRT option
- Operating Category C – kerbside bus lanes, similar to the QBC option
- Operating Category C – median bus lanes.

TT on busway Category B – assessed as an option

As discussed under section 10.3.1, the ability of a public transport system to offer a reliable and efficient service that can attract passengers out of cars is significantly affected by the type of ROW it enjoys. The TT option evaluated here reflects a high specification major infrastructure intervention. Features of the design include:

- Identical alignment to the LRT and BRT alignment across the corridor with aligned station locations and function
- 14 modern battery electric TT 32 metres long
- Flash-charging of the batteries from overhead pantographs at termini and some intermediate stations, deep-charging overnight in the depot
- Cashless pre-paid boarding, tag on platform, no contact with driver
- Dedicated ROW corridor but not grade-separated
- Eight services per hour, 7.5-minute headways
- Priority at traffic signals
- Journey time of 30 minutes from Maroochydore to Kawana
- Park 'n' Ride at Sunshine Motorway
- Parking charges assumed to be applied in Maroochydore and Mooloolaba based on current charges applied in Caloundra.

TT in kerbside bus lane and general traffic lane Category C

Some of the literature discussing TT suggest the technology is equivalent to LRT, can be installed quickly and is much cheaper. This version of TT suggests it can be installed on existing roadways by simply painting a guide-line on the existing road surface. To do this in the existing kerbside lanes would result in an option analogous to the QBC Reference Project. This version would need to address the following technical issues if it were to be considered a feasible option:

- The vehicles are 150 millimetres wider than any vehicle allowed on Australian roads with special approvals (2,650 millimetres vs 2,500 millimetres).
- The longest bus permitted in Australia is an 18 metre articulated bus. The TT vehicle as specified as operating in China in the literature is at least 32 metres long.
- An eight or nine axle B double heavy freight vehicle is limited to 26 metres and requires special approvals to operate on roads.
- The vehicles will be heavy due to the need for battery banks, and are said to be capable of carrying in excess of 200[136] people. Axle loads and weight distribution would need to be examined in detail to establish safe operations, and to ensure axle load requirements of the law are met.
- To maintain a level of ride quality comparable to the BRT option would likely require replacement of the existing road pavement due to the heavier loads and frequency of loading of the TT vehicles compared with general traffic.

The feasibility of TT operating under general traffic conditions (as would be required by this option) will need to be subject to further analysis in the next stage of the business case, should a Category C option be seen as a preferred approach to providing public transport in Sunshine Coast Region. It is not considered a feasible option at this time, as there are too many unresolved technical and regulatory issues.

[136] ATAP Guidelines however suggest a more modest capacity of 177.

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TT in median bus lane and general traffic lane Category C

The ART TT vehicle differs from conventional rubber tyred public transport vehicles in that it has passenger doors on both sides. Accordingly, a scenario could be imagined in which the existing lanes closest to the median (the inside lanes), were widened, designated as bus lanes to cater for the TT.

This approach would have the same limitations as the kerbside bus lane example above. Further, there are no examples of median bus lanes in Queensland, so it difficult to know whether the operation of the bigger TT vehicle would be compatible with movements by other vehicles, for example vehicles crossing the bus lane in front of it to execute a lawful right turn.

The feasibility of TT operating in a median bus lane under general traffic conditions (as would be required by this option) will need to be subject to further analysis in the next stage of the business case, should a Category C option be seen as a preferred approach to providing public transport in Sunshine Coast Region. It is not considered a feasible option at this time, as there are too many unresolved technical and regulatory issues.

10.3.2 Reducing the longlist of options to a shortlist.

This section uses a structured process to reduce the longlist of options to a robust and defensible shortlist of options. It details:

- An assessment of the ability of the longlist of options to meet the service needs, specifically the requirements of a quality public transport system; and
- A quantified MCA to rank the options against the Project objectives

10.3.3 Assessing the ability of the options to meet the service needs

The service needs for the Project identified in Chapter 6 include a strong focus on a quality public transport system for the region:

1. Transform suitable parts of existing urban areas into **lifestyle communities clustered around mass transit**, and closer to jobs and attractions.
2. Develop an **efficient mass transit system** connecting population and employment centres that is accessible and offers a viable alternative to using cars
3. Move **more people in less vehicles** through efficient mass transit that is easily accessed by active transport
4. Maintain and enhance the **sustainability and the liveability and environmental quality** of the region as it continues to experience rapid growth by reducing urban expansion and reducing the amount of energy used and emissions made by transport in the region

10.3.3.1 Service needs one and four not evaluated

Service Need one relates to the positive impact of encouraging **lifestyle communities clustered around mass transit**.

As discussed in Chapter 8, the provision of a new mass transit system will increase the accessibility of the land in the catchment, and increase the potential for development of either dwellings or commercial enterprises thereby creating more jobs.

The ability of the various options to encourage new dwellings and businesses is dealt with more comprehensively under the “urban outcomes criterion” in the next section, quantified MCA hence will not be further evaluated here.

Service need four, **sustainability and liveability** aims to achieve a positive impact of the option with respect to air pollution, noise pollution, water pollution, greenhouse gas emissions, impact on nature and landscape, urban separation and urban amenity. The impact on sustainability of each of the options was assessed in the quantified MCA below by monetising the environmental impacts of each of the options, based on the outputs of the transport modelling for each option. It will not be further evaluated here.

This leave service needs two and three to be evaluated in this section. Taking these two service needs into consideration, establishing the requirements for a quality public transport will include a focus on two key questions:

- Will people use it, especially those who have choice to drive?
- Will it operate efficiently, considering the need to run services at reasonable frequencies and over a large span of the day?

10.3.3.2 Will people use it? Attracting passengers out of cars

Service needs two and three aim *inter alia* to provide a mass transit system that can move more people and attract passengers out of cars. Assessing these needs requires an understanding of the needs of passenger who may use the system.

Passengers on a public transport system may fall into one of two broad categories:

- "Pre-elective" riders – they have previously elected to use public transport no matter how well it meets their needs. By design or for other reasons, they do not have access to private car transport, and other modes like active transport are not feasible, so they elect to rely on public transport, even if it does not serve all the destinations they desire.
- "Choice" riders – they can use an alternative mode of transport, and can access a range of destinations, most usually by driving and parking. They will only use public transport if there is a reason to change from using a car. Typically this will be because using public transport is better than driving, when all parts of the journey, including walking, parking and in-vehicle time are weighed up.

Meeting the needs of "Pre-elective" riders

Catering for the so-called "pre-elective" riders is a mainstream task of public transport, and often referred to in terms of its social justice objectives, serving those who choose to use public transport, or who may be permanently or temporarily unable to access car transport (e.g. because they are too old, too young to drive, cannot afford a car, may be permanently or temporarily unable to drive etc.).

Since they have no real choice, serving these "pre-elective" riders entails providing a basic level of service, with accessibility (mostly how far away the service stops from them) being the most important parameter, since the rider will most likely have to walk or use another form of personal mobility to access the service.

Meeting the needs of "choice" riders

When car ownership in a place is very high, as in the Sunshine Coast Region, most riders have a choice whether to use public transport, or to drive and park. In this case, public transport needs to meet additional attributes to attract and keep passengers. Modern public transport system design aiming to attract and keep new passengers is underpinned by the concepts conveyed in "nudge theory"; *if you want people do something, make it easy*[137].

Some of the attributes that will attract people to use public transport are related to system-wide features like fares and ticketing, meaning they will not vary in relation to the vehicle and ROW conditions of any option being considered. Most attributes however can vary significantly between options depending on the technology and the ROW it runs in.

The attributes that are most important to choice riders are shown below in Table 41 alongside an assessment of whether their impact varies depending on the mass transit option (i.e. the vehicle technology and running way) provided:

[137] See for example Richard H. Thaler, Cass R. Sunstein. 2009. Nudge - Improving Decisions About Health, Wealth and Happiness. Penguin publishing.

Table 41 – Attributes to attract and keep public transport riders[138]

System attribute	Riders' requirements	Varies depending on the technology adopted
Legibility of the system to new users	It's easy to use and understand. I know where it goes and when.	Yes
Reliability of the service and total travel time	I can avoid delays due to congestion and it's a good use of my time	Yes
Ride quality and journey comfort	It respects me in the level of safety, comfort, amenity I expect. Air-con; smooth ride (Will I get a seat, and can I work online?)	Yes
Accessibility; walk up access, waiting environment	It's easy, close and safe to get to and from the service	Possibly (pathways, safe waiting environment, stop fitout are often higher quality in Category A and B systems)
Frequency/wait time and service hours	I don't have to wait long, it takes me when I want to go, and is flexible so I can change my plans	Possibly. (Vehicles running in Category C are delayed by congestion and can "platoon" in some circumstances)
Destinations	It takes me where I want to go. I can transfer between services easily and at no cost	No

Key point: Reliability and total travel time are affected by the ROW

Reliability is perhaps an over-riding attribute in an area that is facing forecast congestion as in the case of the Sunshine Coast Urban Corridor. For public transport to be more attractive than driving, it has to be "protected" from regular delays due to congestion. This does not necessarily mean it must actually be faster than driving. It just needs to be more reliable, since driving can be subject to large variations in travel time depending on congestion conditions that day[139].

This is best conveyed by the mantra: "nothing should get in the way" of the public transport services. Underpinning this mantra is the concept of ROW; the level of priority running a public transport route enjoys. Categories A and B have unrestricted or partially protected ROW respectively, whereas Category C generally operates in mixed traffic and is subject to any regular delays caused by congestion. As noted by the public consultation draft ATAP guidelines[140]

> *"street bus services operating in mixed traffic do not meet the definition for BRT, even if the service levels and buses are consistent with other BRT characteristics. This includes cases where on-road bus lanes are provided. While bus lanes provide some priority to buses, these do not function as a dedicated running way due to many legitimate and de facto uses of the bus lane by other modes".*

Categories of ROW are explained further in Section 3.1.2.1.

Key point: Waiting time is possibly affected by the technology and running way

Another important attribute in terms of modern public transport quality relates to the frequency of the service; how many services per hour run on each route, and by implication, what the "headway" time is between those services. The current desirable high frequency headway paradigm applied in Queensland by TransLink is underpinned by the mantra "turn up and go", meaning that services run so frequently, there is no need to consult a timetable. This is typically taken as meaning a minimum of four services per hour on each high frequency route, or a maximum headway of 15 minutes[141].

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[138] After Walker, J. 2012. Human Transit. p 24.
[139] See Walker, J. 2012. Human Transit. pp97-99
[140] ATAP p 10
[141] See translink.com.au/travel-with-us/bus-train-ferry-tram/high-frequency-services

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Closer headways, a low as 7.5 minutes or even six minutes, are desirable for “turn up and go” in busy public transport corridors. However it is generally possible to serve these headways with any public transport technology and running way.

One issue that does occur in Category C bus systems with low headways is bunching of services or “platooning”, where one service catches up with the other, and runs early. This is because the bus in front is stopping to pick up passengers, and as the services converge, now new passengers have arrived at the stop to catch the second service, so it does not have to stop. Running early is a ‘cardinal sin’ of public transport operations because the rider expects it to run to schedule. If it’s a little late, that can be acceptable because the rider is already at the stop. If the service is early, the rider may see the service come and go before they can arrive at the stop.

Category A and B systems with dedicated ROW systems often have mandated stopping at all stations and are almost always controlled by real time headway monitoring from a control centre, and hence they will not experience platooning.

Passenger attraction attributes relevant to comparing public transport technologies

Based on Table 41, the following attributes need to be evaluated when comparing public transport technologies and ROW options in determining how well they will attract choice riders:

- Legibility of the system to new users
- Reliable service and travel time
- Ride quality.

10.3.3.3 Ability of the public transport system to operate efficiently

Service need two also relates to **efficient mass transit** operations. Public transport is expensive to operate, and often needs to run services in off-peak times when there is little demand. While individual riders often picture a public transport system in terms of the one vehicle they will need to ride, system design needs to consider how all the system elements work together, and how the expensive resources deployed to running public transport services can be optimised. Important attributes that need be optimised in scheduling and running public transport are shown in Table 42.

Table 42 – Attributes that support efficient public transport operations

System attribute	Riders’ requirements	Varies depending on the technology adopted
Minimising travel time and achieving **reliable, consistent running times** on the route. This avoids the need to build extra time into the timetable and means vehicles are better utilised	ROW over general traffic, and priority at on-grade traffic signals if these are encountered	Yes. Full separation (category A) ideal. Horizontal separation (Category B) with signal priority also proven to work very well in urban environment where Category A is not achievable
Minimising **layover** time between services, or the time it takes between finishing one service and starting the next.	Time taken to re-head the service at its terminus, driver changes, recharge batteries if required etc.	Yes. If flash charging of on-board power storage is required at the terminus, this can delay the service
Ensuring the vehicles have sufficient passenger **capacity** to meet the peak task without leaving passengers behind. Minimise number of drivers needed	Vehicles can carry the peak passenger loads with a suitable headway, not requiring excessive numbers of vehicles and drivers which can congest the running way	Yes. A larger vehicle means less vehicles drivers needed over the system to carry the load, and allows for more long term passenger growth
Minimising **dead running** between services. If services have to travel somewhere else to start a new service, it adds time and cost	Minimise any running distance and time from a depot or from another route that does not carry passengers	Possibly. Potential dead running varies due to proximity of depot to the first and last service point

System attribute	Riders' requirements	Varies depending on the technology adopted
Serving more concentrated passenger demands to conserve resources. Trip origins and destinations are **clustered** close the service corridor	If the public transport system has only to cover a relatively dense concentration of passenger demands, a better level of service can be achieved efficiently by concentrating resources	Possibly. Some technologies have potential to shape urban form, as they are more permanent and more legible, especially Category A and B having their own ROW
Reducing **energy** costs; fuel, lighting	Public transport vehicles are big and consume energy both in-service and running to start a new service	Possibly, if vehicles running in Category C are caught in regular congestion, they will waste fuel

Key point: Reliability allows for better utilisation of services and saves resources

As with passenger attraction, **reliability** is an over-riding attribute for efficient operations in an area that is facing forecast congestion as in the case of the Sunshine Coast Urban Corridor. If schedulers can accurately predict how long the vehicle will take to run the service, they do not need to build in fat or "way points' to the timetable, meaning the vehicle can run more services in any given shift without stopping along the way to re-make the timetable. Underpinning this mantra is the concept of ROW; the level of priority running a public transport route enjoys. This is explained further in Section 3.1 and Section 10.5.

Key point: Minimising layover time between services can ensure much more efficient utilisation of vehicles and drivers

Another important attribute in terms of efficient public transport quality relates to the time taken between services. If a vehicle is turning to return on the same route, it needs to be "re-headed". In a LRT or BRT system, this typically three to four minutes, allowing for a six or 7.5 minute headway schedule to be maintained without the need to queue vehicles at the terminus. However if the vehicle needs to be "flash" charged at the end of the run, as may be the case with wireless systems where energy is stored on-board through batteries or supercapacitors, it may take up to ten minutes, meaning the vehicle is still charging when the following service arrives. This will require queuing of the vehicles, and if not managed by providing queuing facilities, extra vehicles and drivers, these delays can propagate quickly through the system.

Key point: Higher capacity vehicles to carry peak loads mean more efficient operations

Public transport operations on any given corridor are generally more efficient when a good, but not excessively high number of vehicles is required to meet passenger demand. This is the case no matter what category of ROW is provided. If there are too many vehicles using the corridor, they cause their own congestion and also require a larger number of drivers, whose costs can represent over 60 per cent of the operating cost of the service.

ATAP[142] estimates the practical peak capacity of vehicles involved in the various options being considered, and their predicted maximum peak direction capacities as shown in Table 43.

[142] Transport and Infrastructure Council. Australian Transport Assessment and Planning Guidelines (ATAP). BRT and LRT options assessment and cost-benefit analysis – Public Consultation Draft 2021. p 36

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Table 43 – Peak direction passenger capacities of the options[143]

Vehicle type	Option	ROW category	Vehicle length (metres)	Practical passenger capacity (pax/vehicle)	Predicted peak direction pax per hour/direction
Rigid bus	Bus upgrades, road upgrade	C	12	57	456 – 1,140
Single articulated bus	QBC	C	18	78	624 – 1,560
Double articulated bus	BRT	B	24	104	832 – 2,080
TT	TT	B	32	177	Not provided
Light Rail Vehicle	LRT wLRT	B	43.5	273	2,104 – 5,260

It should be noted that as per the findings of transport modelling, the total daily passenger demand in the Stage 1 corridor is forecast to be about 30,000 passengers in 2041. This translates to a peak period per direction passenger requirement of approximately 2,000 passengers per hour. This would suggest only the BRT, LRT and TT[144] can meet this task in 2041.

Further, these forecasts may prove conservative, for example if the system proves more popular or population growth exceeds projected rates used in the model. In addition, an investment in such a new mass transit system will need to last more than the 20 years between 2021 and 2041. It will need a life of at least 30 years, and ideally more.

The peak direction passenger volumes shown in Table 43 vary depending on the headway that can be practically achieved. However, there is a strong interface between headway and the ability to provide priority for the vehicles at traffic signals. Signal priority is important in Category B systems because it smooths the delays caused by red lamps, improving reliability and reducing overall travel time.

Specifically, this means granting approaching services the ability to interrupt the normal traffic signal stage to advance the public transport priority stage. However, for two-way operations, with very low headways that are close to two signal stages (about four to six) minutes may not be able to be provided with traffic signal priority. This is because there is not enough time left in the signal phasing cycle for the other legs of the intersection to recover the "green time" delays derived from the advancement of the public transport priority stage before the next service arrives[145].

Efficiency attributes relevant to comparing public transport technologies

Based on Table 42, the following attributes need to be evaluated when comparing public transport technologies and running way options in determining how efficient the system will be:

- Minimising travel time and achieving reliable, consistent running times on the route
- Minimising layover time between services
- Ensuring the vehicles have sufficient passenger capacity to meet the peak task.

[143] Note: this table is based on ATAP estimates for an "open" system which may underestimate capacities, hence it is conservative
[144] The Trackless Tram vehicles are not operating anywhere where they can be reviewed, and the weight of batteries required may limit their passenger loads, given the need to comply with Australian axle load limits.
[145] Transport and Infrastructure Council. Australian Transport Assessment and Planning Guidelines (ATAP). 2021. BRT and LRT options assessment and cost-benefit analysis – Public Consultation Draft p 29

10.3.3.4 Evaluating the long list of mass transit options against their ability to deliver quality public transport

Since the service needs relating to urban change and sustainability will be assessed as part of the MCA, only those service needs relating to quality of public transport will be assessed in this section. The discussion above establishes those attributes that will be most important in distinguishing between the ability of the various mass transit options to attract passengers out of cars, and maintain efficient operations.

These attributes are:

- Legibility of the system to new users
- Reliability of service and the total travel time
- Ride quality
- Minimising travel time and achieving reliable, consistent running times on the route
- Minimising layover time between services
- Ensuring the vehicles have sufficient passenger capacity to meet the peak task.

Effectively, these attributes comprise the criteria a quality public transport system would have to meet to attract passengers and operate efficiently. To assist the evaluation of the options in the long list, Table 44 provides a rating of each option against the attribute criteria[146].

Scores are out of ten, on the following basis:

1. Assign a value of ten to the best performing option, and
2. Assign a value out of ten to the performance of each other option against this criterion.

[146] For further detail on LRT, BRT comparisons, see Transport and Infrastructure Council. Australian Transport Assessment and Planning guidelines. BRT and LRT Options Assessment and Cost Benefit Analysis. pp 11-15

Table 44 – Qualitative MCA comparison of options against certain attributes of quality public transport

Attribute	Region-wide bus upgrade Category C	Region-wide bus upgrade + infrastructure Category C	Road network upgrade Category C	QBC Category C	BRT Category B	LRT Category B	wLRT Category B	TT Category B
Legibility of the system to new users	3	4	3	7	10	10	10	10
Reliability of service and the total travel time	3	4	3	7	9	10	10	9
Ride quality	3	3	3	3	8	10	10	9
Minimising travel time and achieving reliable, consistent running times on the route	3	4	3	6	9	10	10	9
Minimising lost time (layover) between services	3	3	2	9	7	10	7	7
Ensuring the vehicles have sufficient passenger capacity for the peak	5	5	4	6	7	10	10	8

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10.3.3.5 Ranking of options resulting from the analysis of service needs relating to quality public transport

Based on scores shown in Table 44, the ability of options to attract people out of cars and to operate efficiently is as follows:

1. LRT
2. wLRT
3. TT
4. BRT
5. QBC
6. Region-wide bus network upgrades
7. Region-wide bus service enhancements
8. Road network upgrades in the SCMT corridor

10.3.4 Quantified MCA to rank the mass transit options

This section details the quantified MCA including:

- The option shortlisting criteria (i.e. the Project objectives)
- The scoring rational – how the criteria were applied
- A quantitative MCA that compares and scores all options using the shortlisting criteria.

10.3.4.1 Option shortlisting criteria

The eight shortlisted options for Stage 1 were assessed against a range of criteria chosen to link directly to the service needs and Project objectives developed in the Strategic Business Case (refer Chapters 1 and 6). This represents the best way to test each options' ability to deliver the benefits desired for the Project. The criteria used for the quantitative MCA and assigned weightings are outlined in Table 45.

Table 45 – MCA criteria

Criteria	Description	Core Assessment Weighting
Transport outcomes	Impacts of the option on mode share, travel times, congestion, PT reliability, future transport network development. Focused on PT impacts.	45%
Land use outcomes	How the option impacts on the land use outcomes in the corridor and enables urban change and promotes urban consolidation. This criterion considered the amount of development likely to be generated by each respective mode and its ability to satisfy the urban consolidation criteria of *ShapingSEQ* and Council.	30%
Cost and risk	Comparative whole of life costs including capital and operating cost estimates over 30 years for each of the scoped options, discounted at 7 per cent real (economic discount rate).	15%
Sustainability and liveability	This criterion aims to achieve a positive impact of the option with respect to air pollution, noise pollution, water pollution, greenhouse gas emissions, impact on nature and landscape, urban separation and urban amenity.	10%

10.3.4.2 Option scoring rationale

For each criterion, the highest performing option is scored a ten, with the other options scored on a pro-rata basis of how they perform compared to the best option. The scoring directly reflects the quantitative results and analysis from the assessment undertaken, reducing the potential for subjectivity in the assessment.

Figure 57 shows how the demographics assumptions and transport modelling outputs inform both the MCA and the subsequent CBA.

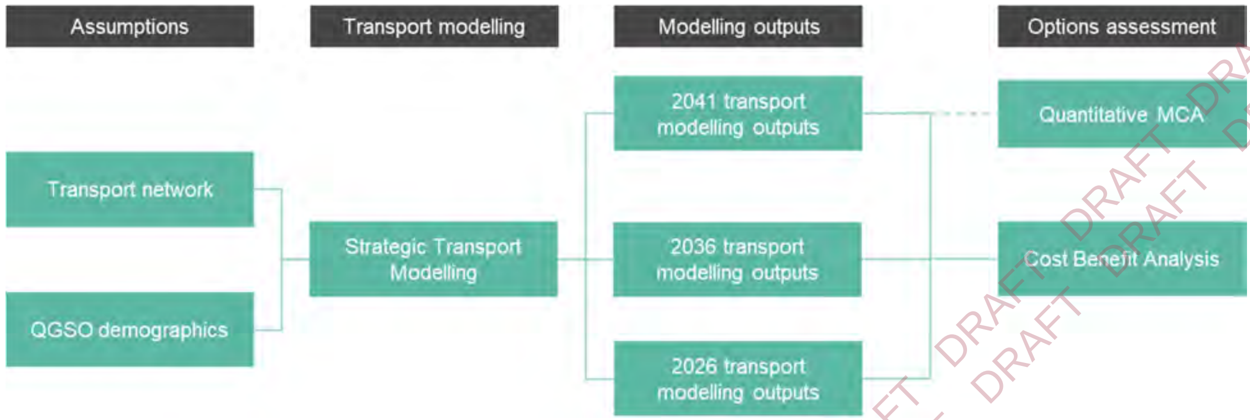

Figure 57 – Transport modelling inputs flow

Transport outcomes criterion

The transport outcomes criterion measures the relative impact of each option on the transport network in the Sunshine Coast and its ability to deliver the required transport outcomes, as defined by the service needs. The transport outcomes were quantified using metrics produced primarily from strategic transport modelling of each option. Table 46 outlines the scores for each of the sub-criteria and the average of the sub-criteria and Table 47 outlines the metrics used for the options assessment.

For the assessment, it was considered, based on advice from the land use and transport advisors, that the BRT and TT options would generate the same level of change in transport amenity and demand, and therefore adopted the same transport modelling outputs were adopted. wLRT adopts the same transport modelling outputs as the LRT option.

Table 46 – Transport outcomes scoring

Criteria	Bus service	Bus network	Road network	QBC	TT	BRT	wLRT	LRT
Transport Outcomes	**7.2**	**7.5**	**5.4**	**8.4**	**9.6**	**9.6**	**9.7**	**9.9**
PT Travel time	7.4	7.8	0.4	8.6	9.6	9.6	10.0	10.0
PT Travel Time difference (PT v Car)	7.0	7.7	0.3	8.8	9.6	9.6	10.0	10.0
Time spent in excessive congestion	9.8	9.8	10.0	9.5	9.7	9.7	10.0	9.7
Boardings	7.1	7.1	5.5	7.5	10.0	10.0	10.0	10.0
Person km travelled	8.9	8.9	9.3	9.0	10.0	10.0	9.9	10.0
Mode share LGA	9.1	9.1	8.8	9.3	9.9	9.9	9.8	9.9
Journey to Work PT mode share LGA	8.2	8.2	8.0	8.4	9.7	9.7	10.0	9.8
PT reliability	0	1.0	1.0	6.0	8.0	8.0	8.0	10.0

Table 47 – Transport outcomes - modelling sub-criteria and outcomes

Criteria	Description	Result	Source
Maximise travel time competitiveness	The difference in minutes between PT and private car door-to-door travel times between SCUH and Maroochydore CBD in the AM and PM peaks.	• LRT is the highest performing and reduces PT travel time by 21 minutes • Road upgrades is the worst performing and reduces PT travel time by one minute	Transport Model
Minimise PT travel times	SCUH to Maroochydore Transit Centre in AM and PM peaks.	• LRT is the highest performing and improves PT trave time competitiveness by 22 minutes • Road upgrades is the worst performing and improves PT trave time competitiveness by 0.6 minutes	Transport Model
Time spent in excessive congestion	Hours of additional delay due to travel in excessive congestion conditions, defined as links where travel speed less than 70 per cent of posted speed.	• Road upgrades is the highest performing with 13,074 hours of excessive delay • Bus service upgrades is the worst performing with 13,374 hours of excessive delay	Transport Model
Maximise PT Boardings	Measures the total number of PT boardings within the Sunshine Coast LGA.	• LRT is the highest performing with 75,900 boardings • Road upgrades is the worst performing with 41,800 boardings	Transport Model
Maximise PT Mode Share	Measures the total mode share for trips within the Sunshine Coast LGA.	• LRT is the highest performing with a PT mode share of 2.3% • Road upgrades is the worst performing with a PT mode share of 1.2%	Transport Model
Number of PT passenger hours and VKT	Total in-vehicle PT passenger km within the Sunshine Coast LGA.	• LRT is the highest performing with 282,000 PT PKT • Road upgrades is the worst performing with 246,000 PT PKT.	Transport Model
Maximise the number of people choosing PT for travel to work	Percentage of journey to work trips made by PT within the Sunshine Coast LGA.	• LRT is the highest performing with a PT journey to work mode share of 7.5% • Road upgrades is the worst performing with a PT journey to work mode share of 2.6	Transport Model
PT Reliability	Level of dedicated PT running within the corridor.	• BRT, TT, wLRT and LRT all scored the highest as they have dedicated right of way • Bus service enhancements and road upgrades result in no change compared to the Base Case	Technical Design

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Land use outcomes criterion

As discussed in Chapter 8, the provision of a new mass transit system will increase the accessibility of land in the catchment and increase the potential for development of either dwellings or commercial enterprises thereby creating more jobs.

Also, as noted in Chapter 8 and assessed through an economic lens in Chapter 15, for a new public transport option to have a clear influence on land use and development, it must meet two key conditions:

1. It must provide a significant improvement in accessibility (above business as usual) to important destinations such as activity centres, educational facilities and recreational precincts; and
2. It must be perceived by people as a permanent investment, that is, it will not be easily removed and converted back to general purpose facility, not have its route diverted by a change of road use management policy or the like.

Not all the options considered will meet these conditions to influence urban change. Those running in mixed traffic, or in bus lanes are not considered to have urban change abilities. These options are not likely to provide a major improvement to the accessibility of the area, nor are they in any way permanent. Bus routes can easily be shifted, and bus lanes can easily be converted to general purpose lanes.

The ability of the technology options that are more permanent Category B ROW, with formal stations and special mass transit vehicles, to influence land use is clearer. These options provide considerable improvement in accessibility, by virtue of their ROW. By the same token Category B facilities are unlikely to be easily removed or repurposed for general traffic.

The Public Consultation Draft ATAP guidelines published in January 2021 suggest[147]:

> *"There is unlikely to be much disagreement that LRT would be seen as more permanent that regular on-road street bus services in mixed traffic.*
>
> *On the other hand, a comparison with BRT in a dedicated right-of-way (rather than street bus services) is quite different. The perceived permanence (and subsequent land value impacts) of a BRT project is highly dependent on the specific project.*
>
> *Features influencing perceived permanence include track design (i.e. fixed guide way and separate rights-of-way), system branding, as well as substantial stations.*
>
> *These factors are design choices rather than something necessarily inherent to BRT. In principle, a BRT can be designed with most of the characteristics of LRT"*

It follows from this proposition that both the BRT and TT options, operating on a dedicated ROW (a busway) that cannot be easily re-purposed, can be considered as potentially having some considerable ability to influence land use. However for a business case, there is limited empirical evidence this would be as strong as LRT[148]. Chapter 15 discusses the potential land use change to achieve higher economic outcomes for BRT and TT options through an assessment comparing level of transport quality and capacity to LRT/wLRT.

An assessment was also undertaken on the projected impact of each option on the take-up rate in the corridor. Analysis was based on evidence in Australia and internationally and indicates that land use potential of an area is greater for LRT than BRT type options. Bus options, such as QBC and bus network upgrades have significantly less impact on the land use potential of an area. Further discussion regarding the urban change effects of options is contained in Chapter 15.

The land use outcomes criterion was assessed through quantification of the number of additional dwellings supported in the corridor as a result of land use and market response to the option. This was considered as a function of the take-up land use response to transit infrastructure.

Each option has a different take up response that is reflected in the range of additional expected dwellings in the corridor. An assessment was undertaken on the projected impact of each option on the take-up rate in the corridor.

[147] Transport and Infrastructure Council | Australian Transport Assessment and Planning Guidelines (ATAP). 2021. Draft BRT and LRT Assessment and Cost-benefit Analysis. p 43. Public Consultation Draft

[148] It is also common for opponents of BRT busways to argue they will eventually be converted to a road, although there are no examples of this actually having happened.

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For the land use assessment, given the updated service needs and Project objectives, the options were assessed out of 100 on a pro-rata basis against the option with the strongest land use response, which by virtue of evidence available is LRT. Table 48 outlines the outcomes of the assessment.

Table 48 – Land use scoring

Option	Take up
Bus service enhancements	0%
Bus network upgrades	2%
Road network upgrades	-10%
QBC	50%
TT	75%
BRT	75%
wLRT	100%
LRT	100%

Cost criterion

Comparative whole-of-life costs were developed for each of the options assessed. Costs developed included:

- Risk adjusted capital costs for all options
- Vehicle purchase costs for QBC, BRT, TT, wLRT and LRT
- Operation costs for additional bus service kilometres
- Operational costs for BRT, TT, wLRT and LRT.

A cash flow of costs for each option was developed and discounted at 7 per cent (real) to develop a Net Present Cost for each option. The cost outcomes for each option are outlined in Table 49. The lowest cost option, the road network upgrades, was given the highest score with the other options pro-rated based on this. While LRT is more expensive than the other Category B mass transit options, the significant cost of all these options above the others assessed resulted in a similar score using a pro-rated, quantitative method.

Table 49 – Cost information for the technology options

Cost	Total CAPEX (Discounted)	Bus OPEX (Discounted)	OPEX (Discounted)	Cost total
Bus service enhancements	-	$346,580,420	-	$346,580,420
Bus network upgrades	$99,645,784	$346,580,420	-	$446,226,204
Road network upgrades	$103,240,801	$178,736,199	-	$281,977,000
QBC	$260,736,507	$346,580,420	-	$607,316,927
TT	$822,926,107	$381,100,219	$196,258,478	$1,400,284,804
BRT	$817,440,297	$381,100,219	$196,258,478	$1,394,798,994
wLRT	$936,772,262	$381,100,219	$215,197,582	$1,533,070,063
LRT	$949,632,376	$381,100,219	$215,197,582	$1,545,930,177

Sustainability and liveability criterion

This criterion aims to assess the impact of the option with respect to air pollution, noise pollution, water pollution, greenhouse gas emissions, impact on nature and landscape, urban separation and urban amenity. Impacts can be either benefits arising from the reduction in externalities from reduced car use or positive contributions made by the mass transit option e.g. improved street scaping. Dis-benefits associated with the

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public transport system (e.g. emissions from diesel buses or emissions of greenhouse gas by electrically powered technologies at the power generation stage) need to be accounted for.

The impact on sustainability and liveability of each option was assessed by monetising the environmental impacts of each of the options, based on the outputs of the transport modelling for each option. The environmental and sustainability aspects considered were:

- Air pollution
- Greenhouse gas emissions
- Noise impacts
- Water impacts
- Nature and Landscape impacts
- Urban separation
- Upstream and downstream costs (e.g. power generation at a remote source).

It should be noted that in practice all electrically powered options will have the choice of purchasing renewable energy off the power grid to either power them directly or recharge their battery storage.

The monetised environmental externalities of each option are outlined in Figure 58. The Category B mass transit options all result in the highest mode shift to public transport and therefore the greatest reduction in VKT and therefore externalities, as compared to the Base Case.

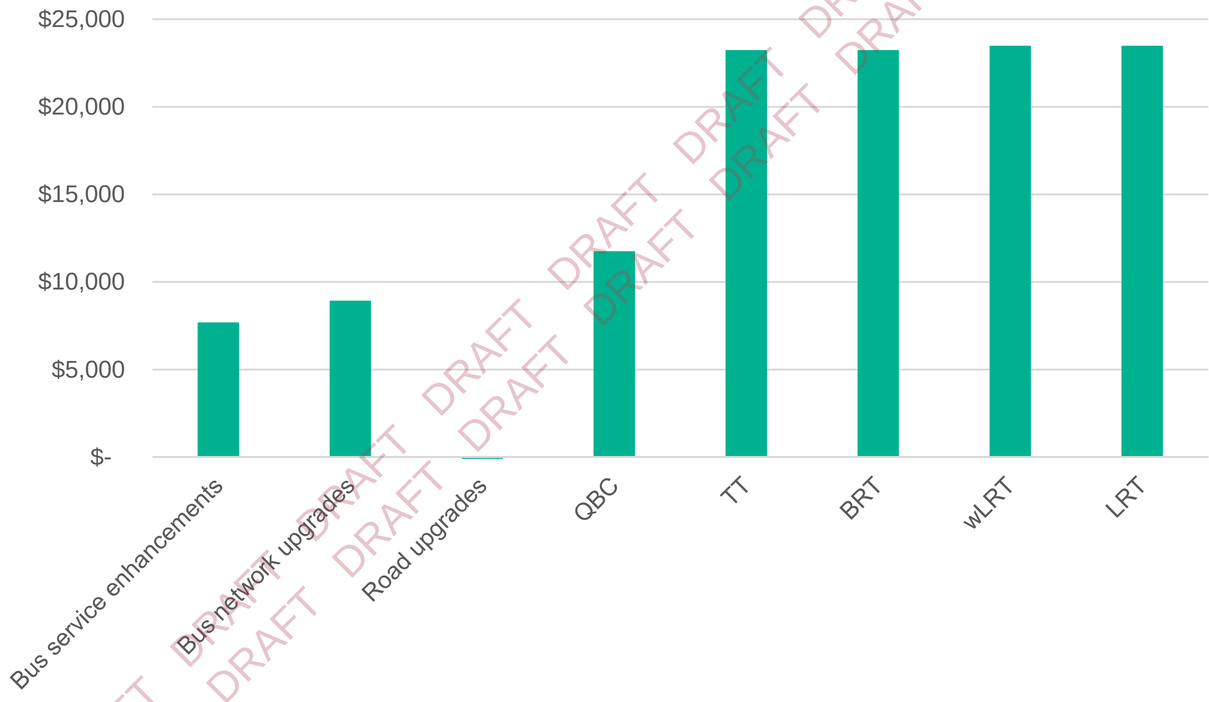

Figure 58 – Environmental externalities – Difference from Base Case

10.3.4.3 Quantified MCA

Weighted scoring

Table 50 presents the outcomes of the MCA, and the assessment of each option against the criteria. These scores were determined based on the quantitative data described above.

Table 50 – Quantitative MCA outcomes

Criteria	Bus service	Bus network	Road network	QBC	TT	BRT	wLRT	LRT
Transport outcomes	7.2	7.5	5.4	8.4	9.6	9.6	9.7	9.9
Land use outcomes	0.0	0.2	0.0	0.5	5.6	5.6	10.0	10.0
Sustainability	3.3	3.8	0.0	5.0	9.9	9.9	10.0	10.0
Cost	8.1	6.3	10.0	4.6	2.0	2.0	1.8	1.8
Progress to next stage	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

TT, BRT, wLRT and LRT all realise similar transport and sustainability outcomes. Based on empirical evidence, wLRT and LRT, however, have stronger land use response in terms of both take-up and capacity as compared to all other options. However, this needs to be investigated further during the DBC as recent literature suggests BRT/TT options could also trigger stronger land use responses[149]. After the Category B mass transit options (TT, BRT, wLRT and LRT) the QBC option was the next highest scoring option due to its relatively strong transport and sustainability outcomes. However, as noted in Section 10.3.4.2, it has very limited or no potential to influence land use outcomes.

Sensitivity to weightings

To test the robustness of the results from the MCA, several sensitives were run using alternative scenarios across these criteria, shown in Table 51. These sensitivities considered:

- An equal weighting, to test the outcome if all criteria are considered to be equally important
- Cost criterion greater than land use, to test the outcome if cost and transport are considered more important
- Only the transport outcomes, land use and cost criteria, as these act as a proxy for an economic assessment.

wLRT, LRT, TT and BRT remained the highest performing options under all sensitivity tests undertaken.

Table 51 – Quantitative MCA results and sensitivities

Sensitivity		Bus service	Bus network	Road network	QBC	TT	BRT	wLRT	LRT
Core result Rank	Score	4.8	4.7	3.9	5.1	7.3	7.3	8.6	8.7
Equal weightings on all criteria	Score	4.6	4.4	3.9	4.6	6.8	6.8	7.9	7.9
Cost weighting > land use weighting	Score	6.0	5.7	5.4	5.7	6.7	6.7	7.4	7.5
Transport, land use and cost criteria only	Score	5.1	4.7	5.1	4.5	5.7	5.7	7.2	7.3

149 Transport and Infrastructure Council | Australian Transport Assessment and Planning Guidelines (ATAP). 2021. Draft BRT and LRT Assessment and Cost-benefit Analysis. Public Consultation Draft

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10.3.4.4 MCA option shortlisting summary

The quantitative MCA results presented in Table 50 and Table 51 demonstrate that a LRT solution from Maroochydore to SCUH at Kawana Town Centre is the highest performing option when assessed against a range of criteria and alternative transport infrastructure investments. LRT and wLRT performed the strongest in the core scenario as well as across all sensitivities. BRT and TT ranked third and fourth and this result is also consistent across all sensitivities.

Overall, the MCA demonstrated that the Category B mass transit options of TT, BRT, wLRT and LRT all provide the potential to realise significant benefits, with LRT technologies scoring higher. The QBC option was the next best performing.

The options assessment process concluded that LRT options were considered to have the most significant benefits in achieving the important land use outcomes criterion. The analysis indicates TT and BRT would have a more modest influence on land use outcomes based on best available evidence. However, this could be updated with the gathering of further evidence, as recommended by the draft Australian Transport Assessment and Planning guidelines[150]. The QBC option performs well in terms of transport and cost. However, it cannot achieve the full range of land use and urban change benefits sought for the Project in the Sunshine Coast Urban Corridor.

Based on the results of the quantitative MCA, the following options were recommended for progression to economic analysis and more detailed assessment through development of a CBA:

- BRT – wireless with on-board stored energy
- TT – wireless with on-board stored energy
- QBC – articulated bus (targeting zero emissions technology)
- LRT – overhead reticulated power
- wLRT– wireless with on-board stored energy.

10.3.5 Assessment of risk and uncertainty

As recommended by the ATAP guidelines, the assessment of all options should include an assessment of risk and uncertainty, in order to ensure that the recommended option is robust[151].

This has been factored into the cost estimates under the quantified MCA cost criterion above at Section 10.3.4.1.

Further discussion regarding risk is provided in Chapter 14.

10.3.6 Overall shortlisting results

10.3.6.1 Attracting and keeping passengers and operating efficiently

Based on the ability of the options to attract people out of cars, and to operate efficiently, the following options ranked highest:

- LRT – overhead reticulated power
- wLRT – wireless with on-board stored energy
- BRT – wireless with on-board stored energy
- TT – wireless with on-board stored energy
- QBC – articulated bus (targeting zero emissions technology).

[150] Transport and Infrastructure Council | Australian Transport Assessment and Planning Guidelines (ATAP). 2021. Draft BRT and LRT Assessment and Cost-benefit Analysis. p 43. Public Consultation Draft

[151] (see Transport and Infrastructure Council | Australian Transport Assessment and Planning Guidelines (ATAP) Part T2 Chapter 11, and forthcoming ATAP Part T7 Risk and Uncertainty).

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10.3.6.2 Quantitative MCA using the project objectives as criteria

Based on the results of the quantitative MCA, the following options were ranked highest:

- LRT – overhead reticulated power
- wLRT – wireless with on-board stored energy
- BRT – wireless with on-board stored energy
- TT – wireless with on-board stored energy
- QBC – articulated bus (targeting zero emissions technology).

Combining both the qualitative and quantitative MCAs, the options shortlisted and recommended for progression to economic analysis and more detailed assessment through development of a CBA are:

- LRT – overhead reticulated power
- wLRT – wireless with on-board stored energy
- BRT – wireless with on-board stored energy
- TT – wireless with on-board stored energy
- QBC – articulated bus (targeting zero emissions technology).

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SHORTLISTED REFERENCE PROJECTS

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11. Shortlisted Reference Projects

11.1. Reference Project – QBC

This section outlines the process undertaken to develop the Reference Project – QBC. It documents the Reference Project – QBC and presents an overview of the technical features that comprise the proposed solution.

11.1.1 QBC general specifications

A QBC typically applies a range of bus upgrade elements in a high passenger demand corridor operated by buses, with an emphasis on those measures that will attract choice riders (i.e. people who may otherwise have driven). Effective elements in this regard are those which boost the quality of service, which is the overall measured or perceived performance of a transit service from the passenger's point of view. These elements are summarised in Table 52.

Table 52 – Measures to improve the quality of bus services in a QBC

Category	Performance improvement examples
Travel time and cost	• Value for money integrated fares • Competitive in-vehicle and wait and walk time vs car travel and parking • Minimise lost time at bus stops (dwell time) by pre-paid fares • Priority ROW and at signals
Service availability	• Service coverage/distance to stops • Maximum headway between services of 15 minutes to minimise waiting time • Optimise span of service hours • Maximise opportunities but reduce the need to transfer between services
Service reliability and legibility	• Provide priority ROW and at signals • Minimise percentage of skipped services • Ease of understanding fares, routes and timetables • Passenger comfort • Comfortable waiting and in-vehicle environment
Safety and security	• Security measures including cameras and staff • High safety standards to minimise accident rate

11.1.2 QBC ROW

A fundamental consideration with respect to achieving many of these improvements is "what gets in the way" therefore the level of priority the QBC vehicles enjoy over general traffic and other incidents which can delay the service. The QBC running way assumed is a mix of kerbside bus lanes and shared running with general traffic. This qualifies as Category C ROW, as discussed in Section 10.3.1. Bus lanes are however better than forcing the vehicles to operate wholly in a mix of general traffic, in that it reduces the potential for congestion and delay to services. However as noted by the draft ATAP guidelines, buses operating in bus lanes do not constitute BRT[152].

11.1.3 Limitations of kerbside bus lanes

Kerbside bus lanes are generally much cheaper to provide than a dedicated BRT or LRT ROW, often fitting within the existing cross section of an arterial roadway with widening required only at major road intersections. The lanes are sometimes painted with special line marking and threshold pavement markings. If matched with improved services and waiting environments, kerbside bus lanes can potentially offer a considerable improvement in quality of service for bus passengers.

[152] Transport Infrastructure Council. 2021. Australian Transport Planning ad Assessment Guidelines. O8 BRT and LRT options assessment and cost-benefit analysis (Public Consultation Draft). P10.

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However, as confirmed by the Public Consultation Draft ATAP guidelines[153] they are not a substitute for a dedicated ROW, as they have the following limitations:

- Bus lanes in Queensland can be lawfully used by taxis, limousines, bicycles and left turning traffic, meaning there can be considerable volumes of authorised vehicles in the bus lane.
- Taxis can stop in a Queensland bus lane at any time to pick up and set down passengers.
- Violators are relatively easy to detect however, enforcement is always resource intensive hence bus lanes typically carry additional high volumes of unauthorised traffic, especially in times of congestion when the priority of the bus lane is most needed.
- Any broken-down vehicle, on-street delivery vehicle or roadworks are most likely to block the kerbside lane.
- Unlike BRT and LRT options, due to the kerbside bus lane and shared running operations, pre-emptive priority at traffic signals is not feasible for kerbside bus lanes due to the risk of both authorised and non-authorised vehicles occupying the lanes in front of the buses, and the high number of vehicles using the lane.

11.1.4 Features of the QBC option

The key transport objective of the Reference Project – QBC is to provide an increased level of service by giving priority to buses in the Project corridor. This priority infrastructure reflects, as closely as possible, the CoastConnect: *Caloundra to Maroochydore Concept Design* and includes a mix of bus lanes and running in general traffic lanes.

The Reference Project – QBC has been developed using the most cost-effective of these improvement measures as applied to the arterial road network in the Stage 1 corridor. As such it constitutes a lower cost and lower quality of service option than the Reference Projects for LRT and BRT.

However, by improving the quality of service offered to passengers well above the present standard route buses operating in the Sunshine Coast Urban Corridor, it provides a cost-effective option that could potentially meet some Project objectives. In particular, it will aim to attract and keep a significant number of passengers who may otherwise drive.

The Reference Project – QBC leverages previous planning studies undertaken for the CoastConnect project for the route, alignment, and specifications, and also draws on the more recent experience of the B-Line route that has been successfully implemented in northern Sydney.

The Reference Project – QBC is a corridor level solution that extends from Maroochydore to the SCUH. The primary configuration of the Reference Project – QBC is to form a highly legible public transport spine within the corridor that is easy to understand and use based on key elements adopted from Table 53 including:

- About 20 uniquely branded buses would aim to match the legibility of the BRT and LRT options
- Kerbside bus lanes or bus queue jumps would improve the priority of the services over general traffic and reduce travel times
- All stops would be provided with quality shelters sized to match peak demands
- Buses would stop in the bus lane, with no by-pass facility for other buses
- Cashless (pre-paid) fares collection would eliminate interaction with driver to reduce dwell times, although unlike the Reference Projects for LRT and BRT, passengers would still need to tag on when boarding the vehicle
- Buses will stop on-demand only, not predetermined at all stops as per the LRT and BRT options
- Minimum service frequency of eight services per hour for most of the day (7.5-minute headway), so there would be no need to consult a timetable
- Security cameras and patrols on vehicles and bus stops to improve personal security
- Some limited route buses, operating as 'rocket[154]' bus services emanating from the more remote urban areas, may also utilise the bus lanes in peak periods

[153] Transport Infrastructure Council. *Ibid*.

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- A 1000 space Park ‘n’ Ride at the Bundilla location near the Sunshine Motorway at Mooloolah River.

Unlike the LRT and BRT options, due to the kerbside bus lane and shared running operations, pre-emptive priority at traffic signals is not feasible for the QBC. This is attributable to the risk of both authorised and non-authorised vehicles occupying the lanes in front of the buses. Instead, bus lane queue jump stages at lights could facilitate left turning general traffic to clear, allowing the bus lane to remain relatively free of congestion.

11.1.5 Scope of the Reference Project – QBC

The route is from Maroochydore CBD to SCUH and is shown in Figure 59.

The alignment for the Reference Project – QBC is different to the LRT and BRT options, as the QBC uses kerbside bus lanes in the outside travel lanes in place of the dedicated median or side running of the LRT and BRT solutions.

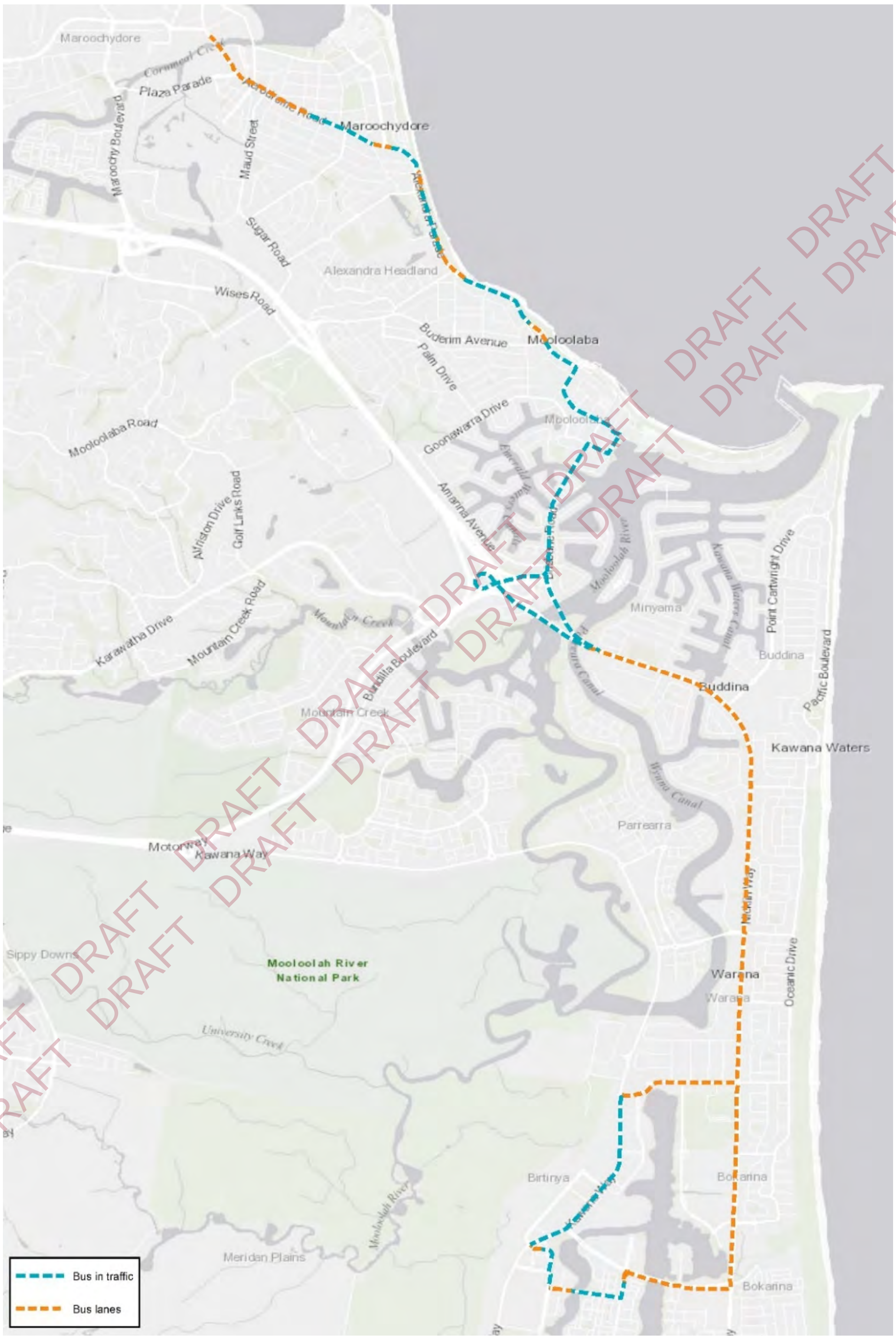

Figure 59 – Reference Project – QBC route

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11.1.5.1 BRT Alignment and corridor configuration

The Reference Project – QBC utilises two alignment types, kerbside bus lanes, and shared running with general traffic lanes. These two running alignments each constitute about 50 per cent of the corridor (see Figure 59). The alignment options have been chosen to mostly fit within the existing public road corridor, which balances transport outcomes and the potential impacts on adjacent properties and road users. The alignment options used within the corridor are described in Table 53.

Table 53 – Reference Project – QBC alignment types

Segment/Road	General Configuration	Traffic Lanes
Aerodrome Road	• Kerbside bus lanes • Bus stops adjacent to bus lanes • Median maintained where space permits • Kerb line alterations.	• two general traffic lanes in each direction • two bus lanes.
Alexandra Parade	• Shared running with general traffic • Bus queue jumps at most intersections, mixed traffic mid-block	• two general traffic lanes in each direction
Esplanade/Venning Street, Walan Street, Brisbane Road	• Shared running with general traffic • Bus queue jumps at selected intersections	• two general traffic lanes in each direction • Road upgrade being undertaken by Council in 2020/2021.
MRI	• Shared running with general traffic	• two general traffic lanes southbound • Northbound services required to use Sunshine Motorway off ramp • The Reference Project – QBC does not include dedicated bridges at the Mooloolah River.
Nicklin Way – north of Lutana Street	• Kerbside bus lanes • Bus stops adjacent to bus lanes • Median maintained where space permits • Kerb line alterations minimised.	• two general traffic lanes in each direction • two bus lanes.
Nicklin Way – Lutana Street to Minkara Street	• Kerbside bus lanes • Bus stops adjacent to bus lanes • Median maintained where space permits • Kerb line alterations minimised.	• two general traffic lanes southbound • three general traffic lanes northbound • two bus lanes.
Nicklin Way – Minkara Street to Main Drive	• Kerb-side bus lanes • Bus stops adjacent to bus lanes • Median maintained where space permits • Kerb line alterations and property impacts minimised.	• 2 general traffic lanes in each direction • 2 bus lanes.
Main Drive	• Kerb-side bus lanes • Bus stops adjacent to bus lanes • Road widened to accommodate bus lanes.	• 1 general traffic lane in each direction • 2 bus lanes.
Kawana Way	• Shared running with general traffic • Bus queue jumps at selected intersections.	• 2 general traffic lanes in each direction

A summary of the design parameters that are applicable to the Reference Project – QBC is provided in Table 54.

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Table 54 – Summary of SCMT Options Analysis design parameters

Design element	Design requirements
Nicklin Way	Re-purposing of Nicklin Way as multi-modal transport corridor catering for local traffic with origins and destinations within the corridor.
Horizontal and vertical geometry	To allow for the mass transit system based on the current road levels and adopting applicable design standards determined by passenger comfort, travel time and maintenance.
Intersection layouts	Generally maintain existing traffic turning manoeuvrability where possible.
Active transport network	Provide active transport through the Stage 1 corridor and connection to and from stations based on the TMR Principal Cycle Network Plan and other 'trunk' pathways.
Supporting PT networks	Supporting PT bus kilometres coincident with the mass transit route (e.g. the existing 600 bus route) could be redeployed to feed the mass transit system.
Property impacts	Optimise the Stage 1 corridor to limit property impacts to a minimum, including impacts on existing property access.
Bridge structures	Undertake sufficient design of impacted and new bridge structures to enable risk allocation as per TMR Project Cost Estimating Manual (PCEM).
PUP impacts	Optimise the Stage 1 corridor to limit PUP impacts to a minimum and 'space proof' the Stage 1 corridor to allow for future PUP assets.
Streetscape	Make spatial provision for trees and other streetscape items in accordance with Council and TMR infrastructure standards.
Flood mitigation and drainage impacts	Ensure adequate flood immunity and mitigate flooding and drainage impacts.
Bicycle parking	Make spatial provision for bicycle parking facilities at, or in the vicinity of stations.

11.1.5.2 QBC Stations/Stops

Stations and stops, along with the bus vehicles, are the key interface points between the travelling public and the public transport system. The Reference Project – QBC will include premium stops throughout the corridor, and significant interchanges with connecting services at the Mooloolah River, the SCUH, and Maroochydore. It is intended that the stops will have a consistent design across the network to improve legibility and will be designed to meet TransLink standards.

11.1.5.3 QBC Vehicles

The Reference Project – QBC includes provision for higher quality bus vehicles operating as a trunk service within the Project corridor. These vehicles could include either double decker buses similar to the B-Line in Sydney or articulated buses commonly found in most major Australian cities. Each of these vehicle types would provide a uniquely branded service within the corridor that would improve legibility to intending passengers. Examples of the vehicle types are shown in Figure 60 and Figure 61.

Figure 60 – Double decker bus - Sydney B-Line

Figure 61 – Articulated bus

11.1.6 QBC Construction stage

11.1.6.1 Constructability

The key constructability issues to be addressed during the delivery stage of the Reference Project – QBC are consistent with those outlined in the Reference Project – LRT section.

11.1.6.2 Public utilities

Public utilities considerations for the Reference Project – QBC are the same as those outlined in the Reference Project – LRT section. Physical identification of all utilities within the corridor is recommended before releasing the Project to market. High risk and high-cost utilities should be investigated in the Detailed Business Case stage. Detailed consultation with utility owners should occur in the DBC stage to coordinate any proposed upgrade of utilities to limit reworks occurring in the corridor.

11.1.7 QBC operations

The Reference Project – QBC includes a higher frequency of bus services within the Project corridor than the existing network as shown in Table 55.

Table 55 – QBC public transport services

Item	Description
QBC Vehicle	• Approximately 20 Double Decker buses (12 metres long) or 20 Articulated buses (18 metres long) to be determined in future studies
QBC service frequency	• 8 services per hour delivered as overlapping services
QBC Effective headway in Sunshine Coast Urban Corridor	• 7.5 minutes
Fares	• QBC services will be included in TransLink fare network • QBC services will be prepaid services with no cash sales • Next TransLink Smart Ticketing expected to be in place by 2022, whereby passengers have the option to pay with credit/debit card or phone app.
Priority corridor	• Kerbside bus lanes with areas of shared running. • Bus queue jumps at signals where required • No traffic signal pre-emptive priority.

In addition to the dedicated services within the corridor, the Reference Project – QBC includes significant increases to the broader public transport network on the Sunshine Coast including new routes to growing suburbs and increased frequency of services. The changes to the PT network are outlined in Chapter 12.

The Reference Project – QBC could also operate differently than the Reference Projects for the LRT and BRT with a limited number of peak hour express or 'rocket' bus services within the corridor able to use the bus lanes and bus stops.

It would be possible for the uniquely branded QBC vehicles to be garaged, operated and maintained by the existing public transport service delivery partner on the Sunshine Coast under the current or next generation of bus service contracts. Alternatively, the Government may consider specific contracting provisions.

11.1.8 Summary of Reference Project - QBC

The Reference Project – QBC has been developed and included in the Options Analysis as a lower cost, and consequently lower quality of service option than the Reference Projects for the LRT and BRT. It is based on the CoastConnect project previously planned by TMR.

The Reference Project - QBC is a corridor-level solution that extends from Maroochydore to the SCUH. The primary configuration of the Reference Project – QBC is for kerbside bus lanes and/or bus queue jumps where required, and higher quality uniquely branded buses to form a public transport spine within the corridor.

In addition to the dedicated services within the corridor, the Reference Project – QBC includes significant increases to the broader public transport network on the Sunshine Coast including new routes to growing suburbs and increased frequency of services.

The QBC is aligned with the principles of the SIP as it seeks to make better use of existing assets including roads and existing bus operations rather than investing in a new mode of transport for the Sunshine Coast.

If the Reference Project – QBC is taken forward, areas for future investigation in the Detailed Business Case include:

- PUP investigations
- Refinement of corridor impacts, and the detailed location of bus lanes and intersection treatments to reduce and/or mitigate the property impacts
- Confirmation of the vehicle specifications including emerging technology

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- Detailed engineering design and costing to comprehensively review the 2010 CoastConnect designs
- Delivery model including whether existing service delivery partner or separate contract required
- Depot requirements including area required, location and size, if a free-standing depot is necessitated by the delivery model
- Refinement of the journey time and intersection performance using an advanced simulation tool
- Adoption of cashless boarding through the Smart Ticketing Project
- Refinement of the construction schedule.

11.2. Reference Project – LRT

This section outlines the process undertaken to develop the Reference Project - LRT. It also presents an overview of the technical features that comprise the proposed solution. This is based on current power supply technology applied to most LRT systems around the world, which rely on a continuous feed overhead mains supply, usually at 750 v DC.

The final section reports on the possible reference project option of a wLRT (wireless) system. This is an emerging power system technology for LRT utilising stored battery power or hydrogen fuel cell electric power.

The key components of the Reference Project – LRT are described in Table 56.

Table 56 – LRT components

Component	Description
System	Stand-alone Light Rail system from Maroochydore to SCUH • Northern Terminus at Maroochydore CBD Transit Centre • Southern Terminus at SCUH bus station.
Route length	13.6 kilometres
Stations	16 stops • 9 central island stops • 5 side platform stops • 2 terminus stops.
Cross section	Dual track, combination of centre running and verge running
Track type	Embedded steel rail track, with electrical isolation
Vehicles	14 light rail vehicles (LRVs), 8 services per hour in both directions, plus spares
Vehicle specification	• Maximum 45 metres long vehicles • Standard gauge, low floor, accessible • Expected seated capacity of 80 • Expected standing capacity of 220 • Total capacity of approximately 300.
Bridges and structures	5 new bridge structures and one new pedestrian bridge
Key traffic interactions	66 at grade intersections, including major intersections at Aerodrome Road/Sixth Avenue, Walan Street/Brisbane Road, Nicklin Way/Jessica Boulevard, Kawana Island Boulevard, Wyandra Drive, and Kawana Way
Active transport	Active transport consideration for the length of the corridor
Electric traction Power	This reference option assumes continuous power fed from overhead lines with pantograph collection on the vehicles (750 v DC). Nine sub-stations at approximately 2 kilometre spacing. Battery power and flash charging also to be investigated in Detailed Business Case

Component	Description
Bus network	Bus interchanges at Maroochydore CBD Transit Centre, SCUH, Main Drive and MRI
Park n Ride	A Park 'n' Ride near the MRI at the Bundilla station
Running time	An expected journey time of approximately 30 minutes
Service hours	Weekday services • Peak and between peak service frequency: 7.5 minutes • Off peak service frequency: 15 minutes • Weekend service frequency: 15 minutes.

The key objective of the Reference Project – LRT is to provide a high-quality reliable customer experience, ensuring travel time is maintained by providing a dedicated LRT ROW with traffic signal priority at all intersections. This will enable it to attract and keep passengers who would otherwise drive.

Figure 62 depicts an artist's impression of possible LRT design outcome.

Figure 62 – LRT impression

11.2.1 Scope – Reference Project LRT

11.2.1.1 LRT Alignment options

The design process considered seven alternatives for the alignment within the corridor: ranging from shared running (similar to the older Melbourne tram routes) to dedicated trackways either centre or verge running. Three have been shortlisted for use in the Reference Project – LRT as shown in Table 57.

Table 57 – Alignment options considerations

Alignment Option	Description	Shortlisted	Rationale
Dedicated urban	Light rail tracks without any road vehicle access and can be combined with pedestrianised access.	Yes	Adopted for a short section at the southern end of the route.

Alignment Option	Description	Shortlisted	Rationale
Median - narrow	Light rail tracks located in a dedicated median in close proximity to adjacent road lanes.	Yes	Adopted.
Verge	Light rail tracks located on one side of the road. Consideration of safe clearances and use of soft landscaping to manage oncoming vehicle headlight glare risk required. Opportunities to minimise traffic disruption.	Yes	Adopted.
Dedicated corridor	Light rail tracks in a dedicated corridor away from road reserves.	No	There are no long sections of dedicated corridor within the route, therefore removing the dedicated corridor as a viable option.
Median – wide	Light rail tracks in a dedicated median with available space for adjacent soft landscaping treatments.	No	The mass transit route does not have wide median areas, generally greater than 15 metres. Major acquisition of freehold properties would be required.
Kerbside	Light rail tracks located on kerbside. Allows for integrated footpath and stops.	No	Kerbside operation has been eliminated due to the impact that this option has for access to both sides of the corridor. Kerbside generally has sections of shared running, to allow for left hand turns and property access. This does not support the objective of safety and would not provide reliable and efficient travel times.
Shared running	Light rail tracks located in road lane with the LRV operating in the lane with road vehicles. Potential impacts on journey time if the road is congested.	No	Shared running of the mass transit corridor with other road traffic has been disregarded as a viable option for any long segments of the proposed route. This decision is based on the impact that shared running has on travel time and reliability of the system. There may be isolated short sections along this route where this option may be viable however this option would not be considered as a desirable outcome for the alignment.

11.2.1.2 LRT Technical parameters

The technical criteria prepared for the Reference Project – LRT have been based on parameters used in recent Australian projects and standards prepared. The input documents reviewed include:

- Transport for NSW (TfNSW) Technical Note – TN 078:2016 Principles, standards and high-level design parameters for the development of light rail systems
- TMR Interim Guide to Development in a Transport Environment: Light Rail
- Previous project experience including GCLR, Canberra Metro and Sydney CBD and South East light rail
- Local requirements.

The key aspects of the rail criteria are identified in Table 56.

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Table 56 – Rail criteria

Design Parameter	Units	Value
LRVs	vehicles	14
Length	metres	45.0 metres
Static cross section	metres	2.65 metres
Track gauge		Standard
Design speed – close to adjacent road (narrow median or verge running)	kilometres per hour	Match posted road speed
Horizontal alignment radius (minimum)	metres	Desirable 35 metres Absolute minimum 25 metres
Vertical alignment (maximum)	per cent	3.5 per cent preferred 7 per cent absolute (for short distances only)
Trackform (excluding long bridges)	criteria	Slab track with embedded rail
Trackform (long bridges)	criteria	Exposed rail with discrete fastenings
Flood immunity	criteria	Match adjacent road

Road criteria are based on TMR and Council requirements.

11.2.1.3 Provision for future extensions

Previous studies on the mass transit corridor identified future stages to extend the route south from the SCUH and possibly north from the Maroochydore CBD depending on planning and chosen technology.

The alignment developed for the reference project terminus stations allow for future extension.

11.2.1.4 LRT stations

Stations, along with the LRVs, are the key interface points between the travelling public and the light rail system. The stations need to provide facilities and information which make the user experience as inviting and convenient as possible. It is intended that the stations will have a consistent design across the network to improve legibility and will be designed to suit the Sunshine Coast. Stations have been located where they:

- Will allow the convenient movement of people between the light rail system and surrounding origins and destinations
- Allow interchanges with other forms of transport to occur at convenient locations
- Provide a safe and inviting environment
- Can be made to safely and effectively fit with and integrate into the surrounding urban landscape and traffic network
- Meet geometric design standards including being located on a straight section of track and flat grade at the station.

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Facilities at LRT stations

The facilities to be provided at each station (at a minimum) are depicted in Figure 63.

Figure 63 – Station design elements

A standardised arrangement of these facilities will lead to customer familiarity and ease of maintenance. However, each station platform needs to be designed in relation to its local context. As an example, access points and pedestrian storage provisions on each platform will vary.

LRT Station layouts

Four physical station typologies have been identified. They are:

- Island platform
- Side platforms
- Terminus
- Intermediate intermodal.

All stations are located on straight track with minimum grades along the alignment for passenger comfort and safety. The straight track extends beyond the station to allow for any movement of the LRV sideways as it enters a curve.

Island platform

Island platforms are located between the tracks with the track centres widened at each end of the station to provide the clearance for the station between the tracks. Facilities are centrally located on the station to provide safe access and movement paths to both platform faces. Island platforms are generally preferred as they allow the shared location of facilities for the station when compared with a side platform.

Side platforms

Side platforms require two platforms located outside the light rail tracks. Side platforms adjacent to roads with speeds over 50 kilometres per hour have not been identified in the design due to the significant requirements for crash barrier protection along the back of the platform.

This station configuration requires more width at the station location, but the impact is limited to the station length along the corridor as the track centres are not widened.

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There is the need to duplicate facilities on the station so that passengers do not need to change platforms to reach help points, top up go cards, or use other facilities on the stations.

Terminus

Terminus stops are located at the end of the alignment when LRVs complete their journey in one direction. The driver changes ends of the vehicle and returns the other direction. For the benefit of passengers, it is desirable for terminus stops to be an island platform as the LRV they are waiting to catch may depart from either platform. An island platform means they can wait on the platform and move to either platform to face as needed. Side platforms generally result in passengers waiting at the end of the platforms to see which platform they need to use for the next service.

Driver facilities are required at terminus stops for comfort breaks and rest breaks. At Maroochydore and SCUH, drivers' facilities are proposed to be shared with other public transport driver facilities however this will require confirmation with TransLink. If not suitable, driver facilities should be located in close proximity to the station but not on the station due to space impacts the facilities have on the operation of the platform.

Terminus stops require additional facilities for passengers as there are normally more passengers using these stops. The terminus platforms are proposed to have 100 per cent shelter and additional top-up machines, touch on/off points and seating.

Intermediate intermodal

Intermediate intermodal stops are provided where passengers are able to transfer to or from the bus network. These stops generally have more passengers using them so require additional shelter and facilities. The intermediate intermodal stops are proposed to have 100 per cent shelter.

It is important for passengers that the transfer between modes is as efficient as possible. This is achieved by having the platforms located side by side or shared platforms with buses located on one side and LRVs on the other.

Intermediate Major

Particular stops are likely to experience occasional high passenger demands, principally related to significant events. This is expected to be the case for the stop near the Sunshine Coast Stadium and Mooloolaba stops.

11.2.1.5 Urban design and landscape

The SCMT is envisioned as a world class, urban and landscape infrastructure public transport system that is designed as an alternative green mode of transport that will allow residents and visitors to be more sustainable and better connected.

For the reference project, the following key design principles have been adopted:

- Build a strong design character to each of the station precincts through the use of specifically chosen materials and planting species associated with the place and station locations along the alignment.
- Maximise shade and planting in areas associated with the public realm and immediate interfaces of the new station nodes.
- Ensure a clear hierarchy and legible approach to pedestrian connections are embedded into the design of each station precinct.
- Where the opportunity arises, design additional new open spaces that complement and enhance the existing open spaces for the public to enjoy.

11.2.1.6 Public bus operations

Three key bus/LRT transfer points have been identified along the corridor; Maroochydore CBD Transit Centre, Bundilla station at MRI, and the SCUH bus station.

For passengers travelling to and through Maroochydore, the proposed Maroochydore CBD Transit Centre will connect the light rail corridor with buses from the north and west using the interchange. The design also provides for interchange with future regional rail services proposed in the CAMCOS corridor. The light rail terminus has been integrated at ground level with the bus stops to provide direct connectivity for passengers. The regional rail station is proposed to be elevated and will have vertical transport to ground adjacent to the light rail terminus. The transit centre will become a hub for passenger movements into and through Maroochydore.

To provide a benefit for passengers who are not directly located on the light rail corridor, the Bundilla station will integrate bus services from the west with the light rail corridor. The Bundilla station will allow direct interchange between buses and the light rail at a shared platform. Buses from the west using the Sunshine Motorway will be able to access the stop through a dedicated bus lane at the intersection of the Sunshine Motorway and Brisbane Road. This will allow buses on routes using the Sunshine Motorway to complete their journey at the interchange. Bus layover facilities and a driver's amenity building are included in this location.

The SCUH bus station currently has bus services operating from it to the south, west and north. SCUH is the southern extent of the Reference Project – LRT (Stage 1). SCUH will form an important interchange for passengers from bus services from the south and west to the light rail corridor. The terminus of the light rail has replaced the eastern side of the bus station, with direct interchange between buses and the light rail at the entrance to SCUH.

11.2.1.7 Active transport provisions

Pedestrian movements

The design has considered suitable active transport facilities either within or adjacent to the light rail route. Pedestrian movements across the light rail corridor are facilitated through the use of signalised crossings. Pedestrian crossings are provided at road intersections with the light rail and dedicated pedestrian crossing where there are long distances between intersections and there is a desire for pedestrians to cross the light rail corridor midblock.

To provide access for pedestrians from the west of the road to the beach accesses and facilities along Alexandra Parade, additional signalised pedestrian crossings are proposed. Urban design treatments are proposed to be introduced along Alexandra Parade to direct pedestrians to designated crossing points.

To improve access to stops located in the median of the road additional pedestrian crossing have been provided at the opposite end of the stop. These signalised pedestrian crossings will be coordinated with the adjacent traffic lights to minimise impact on road traffic flow.

Cycling facilities

On-road cycle facilities have been included in the reference project cross section along all existing cycle network routes. Along Alexandra Parade, the light rail alignment has been designed to consider the location of the future Mooloolaba to Maroochydore (M2M) separated cycleway although it is possible that some localised sections of the M2M cycleway will require reconstruction as part of the introduction of the light rail.

On Nicklin Way, the reference project has included on-road cycle lanes and a high-level feasibility investigation into separated cycle lanes has been completed. The investigation found that one-way separated cycle lanes on each side of the road would be the preferred option however the introduction of this treatment will require further design investigation in subsequent stages of the Project.

Cycle boxes to allow cycle hook turns are proposed at all intersections that interface with the light rail. The hook turn facility provides on-road cyclists turning right across the light rail corridor with the opportunity to safely cross the tracks at 90 degrees. They consist of marked cycle turning boxes on the left side of the road in front of the side traffic hold line.

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An active transport path crossing Mooloolah River is proposed. This will extend the existing Brisbane Road facility and connect to existing paths on the banks of the river.

11.2.1.8 LRT Signalling

The Reference Project – LRT is proposed to be operated as a line-of-sight system. Drivers of the LRVs operate their vehicles in the same way as a road vehicle driver would by responding to the environment in front of them.

All interactions between LRVs and road vehicles will be managed by traffic signals. The only change from standard traffic signals is the replacement of the green indication for LRVs replaced with a white ‘T’ light. Additional road intersection signals are required at a number of additional intersections along the alignment.

Where there is the ability for LRVs to change tracks or routes, the movement of the LRV will be controlled through rail signalling. Rail signalling detects the location of the LRVs, provides signals with guidance to confirm the route has been set and allows the vehicle to proceed. Rail signalling is required for control of LRV movement at both termini and the depot entrance. Rail signalling detection is also provided at emergency cross overs along the alignment.

11.2.1.9 LRT - Traction power

In the Reference Project – LRT, the LRV will be supplied power via a low voltage direct current overhead wiring system. The LRV will be fitted with a pantograph to interface with the single wire overhead system.

Power to the 750-volt DC overhead system will be provided from dedicated feeder stations positioned at approximately 2 kilometres intervals along the alignment.

The feeder station for the depot and stabling yard will provide traction power for the facility and supply for the maintenance and operational functions of the facility.

Design features to eliminate the risk of electromagnetic radiation from the power supply system affecting vital medical equipment in the SCUH medical precinct should be incorporated in the detailed design stage.

11.2.1.10 Public utilities

Identification of public utilities that may be affected by the Project are important for determining cost and construction timeframes for the Project. Public utility investigation has been desktop only for the Options Analysis stage. Assessment of utilities within the corridor and impacted area has been undertaken through Dial Before You Dig searches along with collating further information from utility owners.

Utilities in the corridor have been categorised into the following groups:

- Identify and retain
- Protect
- Relocate.

Under the light rail corridor, the treatment is based on the depth of the top of the utility from the surface level of the track slab. The closer to the surface, the more likely the service will need to be relocated. Any service crossing (overhead) over the track slab has been identified to be placed underground for electrical safety.

Services running along the corridor have been assessed based on their location and if they have been impacted by the Project. Services along the light rail corridor have been identified for relocation outside the LRT ROW to allow safe access for maintenance. In areas where the existing kerbs are being moved, services that are under new road are identified for relocation into the new verge. Where there is a change in the use of a traffic lane to bring the through traffic closer to power poles, they have been assessed for appropriate clearances and relocated if needed.

Where relocation of a service has been identified, the cost allowed has been based on relocation from pit to pit rather than a mid-section joint. This aligns with the expectation of most utilities’ owners for relocation of their service.

Experience in light rail projects currently in the procurement stage in Australia indicates construction contractors are unlikely to accept risks associated with public utility relocations and encountering of identified services. Physical identification of all utilities within the corridor is recommended before releasing the Project to the market. High risk and high-cost utilities should be extensively investigated in the stage Detailed Business Case stage. Detailed consultation with utility owners should occur in the DBC stage to coordinate with any proposed upgrade of utilities to limit reworks occurring in the corridor. Third party agreements with public utility owners should also be in place prior to releasing contracts to the market. Liaison with other light rail projects, notably GCLR, Parramatta and Canberra, is also recommended to include the latest best practices in relation to managing public utility risks.

11.2.2 LRT Construction stage considerations

11.2.2.1 Constructability

This section provides a summary of the key constructability issues to be addressed during the delivery stage.

11.2.2.2 Traffic management

The Reference Project – LRT will be provided in several key transport corridors for the Sunshine Coast. Maintaining traffic access and flow along these routes during construction will be important for stakeholder management and ensuring the corridor remains functional. The impact on traffic during construction and traffic management measures will need to be a key focus of the Detailed Business Case and subsequent construction stages.

The requirement to keep roads operational will in some instances require out of hours works to be undertaken when demand for the road is at its lowest.

All of these factors have been considered in the cost estimate.

11.2.2.3 Safety management

Safety management plans for the construction stages will need to be developed and approved before the commencement of works. The safety management plan will include consideration for road users, bus users, pedestrians and cyclists who may interact with the construction works.

11.2.2.4 Staging and sequencing of works

For the Reference Project – LRT a high-level construction sequence has been prepared based on the resourcing constraints that are likely to impact the construction and to minimise the impact to the traffic flow through the Project. The programme is based on an effective 8 hour per day, five day week. The working calendar has all Queensland public holidays and a two-week shutdown over each Christmas period. The program has been structured based on a single Design and Construct (D&C) contract. Significant portions of the pavement works will be undertaken at night to enable closure of lanes to provide safe working environment. The night works are based on an effective four hour period available 7 days a week.

A construction methodology was prepared for the Reference Project – LRT as follows:

- Zones were identified by the construction method to be implemented along sections of the Project and divided into 11 zones. These construction zones are based on the characteristics of the corridor cross-section and not necessarily the Project segments.
- Each zone was broken into two to four construction stages, highly depending on traffic management.

Based on this staging the overall construction duration used for the development of the estimate is 39 months.

11.2.2.5 Stakeholders during construction

A comprehensive and coordinated approach to stakeholder engagement will be adopted throughout the life of the Project. The Project is a significant investment in the Sunshine Coast and will attract interest and feedback through all stagestages. Key messaging about the Project should be shared with the community.

Management of the interaction between stakeholders along the corridor during construction will be important to manage perception of the Project. The construction of the Project will have an impact on surrounding

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stakeholders through changed access, construction noise, and permanent changes to the corridor. Strategies should be developed as part of the Detailed Business Case stage to reduce the impact on stakeholders without adverse effects on the time and cost to deliver the Project. Strategies could involve scheduling construction activities in certain areas outside peak times such as holidays for Mooloolaba and Alexandra Headland, staging to target small sections and complete all works at one time, or changing lane positions to provide construction areas without reducing the number of through lanes.

Field communications officers should be employed to maintain regular contact with business stakeholders in commercial centres along the corridor.

11.2.2.6 Early works

No early works have been identified as part of the Options Analysis. Further investigation into potential early works packages should be considered during future stages of the Project.

11.2.3 LRT Operations

Operation of the network will be controlled from the Operations Control Centre (OCC) located within the depot precinct. The OCC will provide real-time management, centralised control and monitoring of operations in the corridor including:

- Position of each LRV to ensure journey time and spacing between vehicles
- The status of traffic prioritisation and other network control systems
- Security at all stops
- Monitoring and updating of announcements and passenger information displays.

11.2.3.1 LRT Service frequency

The proposed service frequency has been developed to support the operational assessment of the Reference Project – LRT. The frequency of services will be refined during future stages to provide frequency of service that is improved from current bus routes along the alignment and aligns capacity with demand. Table 58 provides the frequency based on the day of week and time of day.

Table 58 – LRT operations schedule

Day	Period	Times	LRVs per hour	Headway (minutes)
Monday to Friday	Early	5:00 am to 7:00 am	4	15
	AM Peak	7:00 am to 9:00 am	8	7.5
	Interpeak	9:00 am to 4:00 pm	8	7.5
	PM Peak	4:00 pm to 6:00 pm	8	7.5
	Evening	6:00 pm to Midnight	4	15
	Overnight	Midnight to 5:00 am	No LRT services	
Saturday and Sunday	Early	5:00 am to 7:00 am	4	15
	Daytime	7:00 am to 6:00 pm	4	15
	Evening	6:00 pm to Midnight	4	15
	Overnight	Midnight to 5:00 am	No LRT services	

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11.2.3.2 LRT Traffic signal priority

The interaction between the proposed light rail service and the traffic signal network will have a significant impact on the journey time for the light rail and has the potential to disrupt the road network. The light rail will require a high level of signal priority at traffic signals to reduce the delay for the light rail and thereby improve the journey time, and ultimately patronage on the light rail.

11.2.3.3 LRT Journey time

The journey time for LRT is estimated to be just under 30 minutes from the Maroochydore terminus to the SCUH terminus.

11.2.3.4 LRT Depot and stabling

A number of depot sites have been investigated during the development of the reference project. The location needs to be determined through the Detailed Business Case. Given the level of uncertainty regarding the final depot location and design, appropriate contingency in the cost estimate has been applied for this stage of planning. The depot will require the following facilities:

- Stabling tracks for the reference project number of LRVs (14)
- Train wash
- Allowance for future expansion of the facility for increased service frequency or expansion of the network
- Storage of spare parts
- Sheds and space for maintenance equipment and vehicles
- OCC
- Staff facilities for the operation of the network and training
- Car parking for operational and maintenance staff.

11.2.3.5 LRT Remote stabling

No requirement for remote stabling has been identified in the Reference Project – LRT. The depot and stabling facility have sufficient stabling for the Stage 1 fleet requirements.

11.2.3.6 Special events arrangements - LRT

The Sunshine Coast holds many special events along the Reference Project – LRT corridor. The light rail corridor has been developed to allow spectators and competitors to use the light rail to access their events. The number of LRVs proposed for the reference project would allow, with planning of fleet maintenance, to operate an approximate five minute headways to cater for event demands.

To allow some events to operate efficiently, there may be the need to only operate part of the corridor. Mid-corridor turnbacks have been identified for incident response and they can also be used for modified operations of the corridor for special events.

11.2.3.7 LRT Mid-corridor turnbacks

Potential mid-corridor turnback locations have been identified. Mid-corridor turnbacks are introduced into the network to allow the light rail corridor to minimise the impact on operations of planned events, unplanned incidents, and maintenance activities. They allow sections of the corridor to be closed while allowing operations to continue on the adjacent sections.

11.2.3.8 LRT Ticketing

It is expected that the Reference Project – LRT will be operated under the standard TransLink SEQ fare system.

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11.2.3.9 LRT overhead continuous feed power- Summary

The Reference Project – LRT has confirmed it is technically feasible to deliver a light rail project from Maroochydore to the SCUH and has assessed the potential impacts and benefits of the Project. There are areas for future investigation during development of the Detailed Business Case including:

- Public utility plant (PUP) investigation
- Refinement of corridor impacts, particularly the station locations
- Refinement of the journey time and intersection performance using an advanced simulation tool
- Identify depot size and location
- Incorporate measures to eliminate the risk of electromagnetic radiation on medical equipment
- Refinement of the construction schedule.
- Design refinement (such as lane widths) to optimise corridor width.
- Confirmation of the preferred Nicklin Way cycle facility and completion of the design of this facility
- Confirm the preferred Main Drive cross section, having regard to the preferred cycle facilities.

11.2.4 Reference project - wLRT

The evolution of light rail technology has seen the advent of wireless LRT systems that operate either partially or fully without direct feed from overhead powerlines. There are three primary design solutions being utilised:

- third rail power continuous power
- stored battery power
- hydrogen fuel cell on board power cell fuelled by hydrogen.

11.2.4.1 Third rail powered wLRT

Light rail systems using third rail power whereby the power is delivered continuously through a third rail laid on the ground in between the two guiding rails are operated in Bordeaux, France and Sydney, Australia. In both cases the third rail is only utilised for those parts of the network where overhead wires are undesirable, historic precincts or central city precincts. The technology works but has not seen rapid deployment worldwide, suggesting it may be being overtaken by systems having on-board power storage.

11.2.4.2 Battery powered LRT

Several major rail manufacturers are developing options for battery powered trains, aimed either at eliminating diesel passenger trains, or providing light rail without overhead power supply.

Battery powered LRT relies on storage of electricity through batteries and/or supercapacitors on board the vehicles. Flash charging occurs at stations in service, and deep charging in the depot overnight.

Wireless free LRT is already in operation in Newcastle, New South Wales, as well as other cities in Europe. At only 2.7 kilometres, the Newcastle LRT is a relatively short line, meaning the application of on-board power supply in longer lines such as the 13.6 kilometre Reference Project (which could be extended to over 23 kilometres if the connection to Caloundra was constructed) will require further evaluation and evidence. This is likely to emerge in Australia through Canberra light rail which is adopting the battery storage wireless technology for its future stages.

One potential disadvantage of the battery power is the need for regular flash charging at the end of each run, which can take up to eight minutes. This could impact operations. These impacts would be addressed during development of the DBC and/or during the procurement phase of the project.

Further technological advances are expected to occur with respect to wireless battery power for LRT systems over the next decade. It seems likely that with the advances in technology being seen around the world in a variety of transport technologies, wireless LRT using on-board storage will be a realistic option for the Project by the time procurement is undertaken.

11.2.4.3 Fuel cell powered LRT

Several equipment manufacturers are developing prototype rail vehicles powered by on-board fuel cell technology. Like all electric vehicles, fuel cell electric vehicles use electricity to power an electric motor. However fuel cell vehicles produce electricity using a fuel cell powered by hydrogen, rather than drawing electricity from a battery. When used within a fuel cell, hydrogen is part of a catalytic process that generates electricity without combustion, eliminating greenhouse gases and air pollutants.

Rail manufacturer Hyundai Rotem is developing prototype fuel cell light rail vehicles for trial in Korea, and has flagged potential commercial operational by 2023[155].

Fuel cell technology is promising for clean public transport power because it generates only water as an emission from the power source and eliminates the need for regular "flash" charging required in battery operated electric vehicles.

One issue is the availability of hydrogen fuel at a cost that will support economic operation of the vehicles. The Queensland Government is implementing its Hydrogen Industry Development Strategy 2019-2024 so that by 2030, Queensland is at the forefront of renewable hydrogen production in Australia, supplying an established domestic market and export partners with a safe, sustainable and reliable supply of hydrogen. The strategy will promote the development of "green" hydrogen fuel in Queensland, which is hydrogen produced from water electrolysis and renewable energy.

The combination of fuel cell technology to power light rail, and the availability of clean, locally produced hydrogen could offer a formidable option for future mass transit systems in Queensland. However the commercialisation of this power technology may still be some years away, and may not match procurement timelines.

11.3. Reference Project – BRT

This section outlines the process undertaken to develop the SCMT Reference Project – BRT. It documents the preferred option for the BRT and presents an overview of the technical features that comprise the proposed solution.

The Reference Project – LRT was used as the benchmark against which to develop the Reference Project - BRT. This approach was to ensure the Reference Project – BRT was commensurate to the Reference Project - LRT in order to provide a suitable basis for comparison between the technologies, and to ensure a bus solution had the ability to attract and keep passengers who may otherwise have driven.

The key components of the Reference Project – BRT are shown in Table 59.

Table 59 – BRT components

Component	Description
System	Stand-alone 'Bronze Standard' BRT system from Maroochydore to SCUH • Northern Terminus at Maroochydore CBD Transit Centre • Southern Terminus at SCUH bus station • Exclusive right of way for BRT vehicles only, not used by regular bus services.
Route length	13.6 kilometres
Stations	16 stops • 14 side platform stops • 2 terminus stops.
Cross section	Two-way dedicated busway separated from general traffic, combination of centre running and verge running. Width varies from 8.2 metres to 11.2 metres.

[155] https://www.railjournal.com/technology/ulsan-and-hyundai-rotem-agree-hydrogen-tram-project/. Accessed 3 March 2021.

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Component	Description
Vehicles	14 Battery Electric BRT vehicles
Vehicle size/length	Based on Brisbane Metro for reference. Approximate values: • 24 metres long bi-articulated vehicles • Static Width – 2.55 metres • Passenger capacity – 60 seated, 70 - 90 standing • Attractive modern appearance.
Key traffic interactions	66 at grade intersections, including major intersections at Aerodrome Road/Sixth Avenue, Walan Street/Brisbane Road, Nicklin Way/Jessica Boulevard, Kawana Island Boulevard, Wyadra Drive, and Kawana Way
Bridges and structures	5 new bridge structures and one pedestrian overpass
Active transport	Active transport provisions for the length of the corridor
Power System	Conductive energy supply type on 5 stations along the line, 600 kVA, 20k/370Veff Flash Charging capable with end of the line charging, and overnight deep charging at the depot.
Bus network	Bus interchanges at Maroochydore CBD Transit Centre, SCUH and MRI
Park n Ride	A Park 'n' Ride adjacent the Bundilla Station at the MRI for 400 spaces
Running time	An expected journey time of 30 minutes
Service hours	Weekday services: • Peak and between peak service frequency: 7.5 minutes • Off peak service frequency: 15 minutes. Weekend services: • Service frequency: 15 minutes.

The key objective of the Reference Project – BRT is to provide reliable customer experience, with excellent ride quality and ensuring travel time is maintained by providing a dedicated busway ROW with traffic signal priority at all intersections. This will enable it to attract and keep passengers who would otherwise drive. Improved ride quality is expected (compared to a standard bus) owing to the absence of gear changes for electric vehicles, better suspension system, and higher quality pavement finishes.

11.3.1 Review and refinement of the Reference Project – BRT

The process for developing the Reference Project – BRT was broken into three distinct project stages. The stages and their key activities are described in the following sub-sections.

11.3.1.1 Project initiation and review of previous information

- Reviewed and analysed previous project information
- Reviewed relevant recent and proposed projects along the corridor
- Collected and collated other inputs including survey and utilities
- Prepared a basis of design for project agreement.

11.3.1.2 Critical cross sections options assessment

- Assessed the proposed stop locations identified by the Project Team
- Confirmed urban change objectives for the corridor
- Assessed alternative alignment positions within the corridor based on existing property access arrangements, urban strategy, road user requirements, active transport, and parking

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- Confirmed alignment through a MCA selection process
- Assessed layout of stops to integrate with surrounding environment enhancing the passenger experience.

11.3.1.3 Preliminary Design

- Developed design drawings
- Identify key Project risks
- Prepared a preliminary cost estimate.

Figure 64 depicts an impression of the BRT vehicle and station.

Figure 64 – BRT impression

11.3.2 Scope – Reference Project BRT

As a general principle, the Reference Project – BRT t is analogous to the Reference Project – LRT in terms of route and alignment.

11.3.2.1 BRT Alignment options

A detailed assessment of the alignment options was completed for the Reference Project – LRT and is documented in earlier in Chapter 11.2. As a general principle, the BRT alignment options are analogous to the Reference Project – LRT.

Most BRT systems in Australia are fully segregated systems, or ROW Category A[156], where buses operate in a dedicated corridor and do not integrate with general traffic or other road users. In the case of the Project (Stage 1), a fully segregated corridor is not feasible, nor would it meet the overall Project objectives. Therefore, a potential BRT system that operates like an LRT system, or ROW Category B, has been considered for the Reference Project.

There are several examples of this type of BRT system in Europe, China, South America and the United States that have been successfully delivered. These examples have been referenced during the development of the design.

The options considered for the BRT alignment have been limited to:

[156] Right-of-Way (ROW) Category as defined by Vukan R. Vuchic in Transportation Engineering and Planning – *Vol. 1 – Urban Public Transportation Systems*. Accessed at: https://www.eolss.net/Sample-Chapters/C05/E6-40-02-02.pdf

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- Narrow median
- Verge.

Unlike the LRT option, an unprotected ROW is not considered feasible for the BRT option on the basis that the BRT vehicles are not track guided and therefore vehicle tracking, and body swing are more variable, increasing the risk of collision with surrounding areas and other road users. As a result, the BRT corridor design has adopted some form of separation between the BRT running way and other road users. This separation varies depending on the maximum operating speed of the buses, and will be subject to review in the future detailed design stage.

11.3.2.2 BRT busway configuration

The majority of the corridor is within existing road reserve excepting the southern side of the canal within the Maroochydore CBD and at Birtinya between Kawana Way and Bragg Street through open space.

The Reference Project – BRT includes four cross section configurations based on the speed environment:

1. Type 1 – narrow median, speed environment less than 50km/h
2. Type 2 – narrow median, speed environment less than 60 km/h
3. Type 3 – narrow median, speed environment 70km/h and greater
4. Type 4 – verge running.

Each of the configurations will consist of two dedicated BRT busway lanes to facilitate the BRT vehicle movements in both directions. The busway lanes will be independent of road traffic lanes except at intersections.

Type 1 Narrow median – Constrained locations with low operating speeds (<50km/hr)

The Type 1 configuration has been adopted in constrained locations and requires the operating speed to be restricted to less than 50km/h.

The BRT corridor is positioned between the road carriageways and is segregated from adjacent road lanes through the use of standard line-marking or textural surface treatments such as rumble strips or coloured asphalt.

The overall width of the Type 1 configuration is 8.2 metres, with 2 x 3.5 metre wide BRT lanes, and a narrow 1.2 metre median to provide separation between the two BRT vehicles travelling in opposite direction as shown in Figure 65.

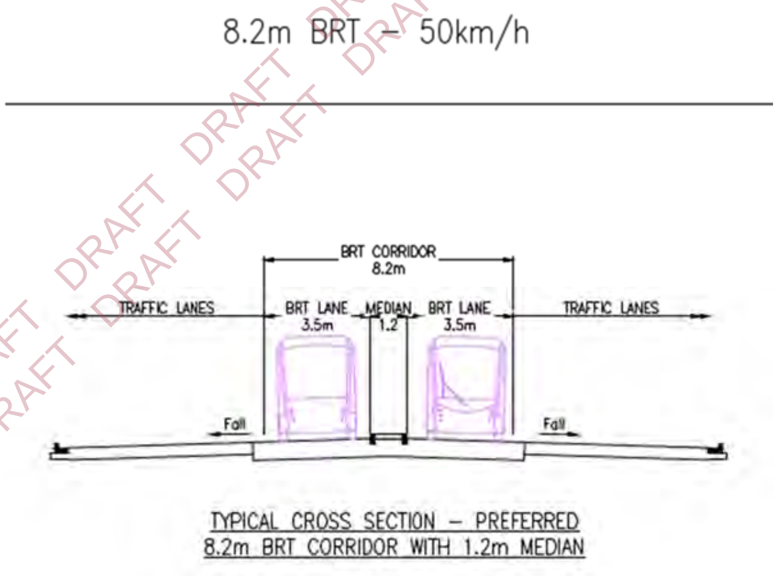

Figure 65 – BRT typical cross section type 1

This configuration is used when the BRT corridor is in the median and there is limited width within the existing road reserve.

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Type 2 Narrow median – Unconstrained locations with low operating speeds (<60km/hr)

The Type 2 configuration has been adopted in less constrained locations with a speed limit of 60km/h or less. The BRT corridor is positioned between the road carriageways and is segregated from adjacent road lanes with wide line marking (600 millimetres), textural surface treatments or by a narrow kerb separator.

The overall width of the Type 2 configuration is 10.2 metres, with 2 x 3.5 metre wide BRT lanes, and a 2.0 metre wide median to provide separation between the two BRT vehicles travelling in opposite direction as shown in Figure 66.

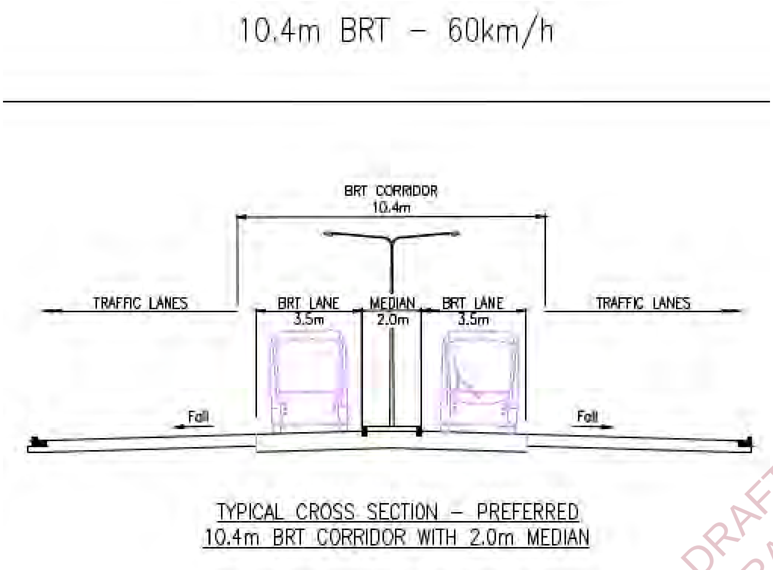

Figure 66 – BRT typical cross section type 2

This configuration is used when the BRT corridor is in the median and there is enough width in the existing road reserve to accommodate the BRT running way, median, separators plus adjacent traffic lanes.

Type 3 Narrow median – Unconstrained locations with high operating speeds (>70km/hr)

The Type 3 configuration has been adopted in less constrained locations with a speed limit of 70km/h or more. The BRT corridor is positioned between the road carriageways and is segregated from adjacent road lanes through the use of a rumble strip or physical separator such as a kerb or median.

The overall width of the Type 3 configuration is 11.2 metres with 2 x 3.5 metre wide BRT lanes with a 0.5 metre wide shoulder, 0.6 metre narrow median type physical separator between general traffic and the BRT and a 2.0 metre median to provide separation between the two BRT vehicles travelling in opposite direction and to allow for central placement of road lighting as shown in Figure 67.

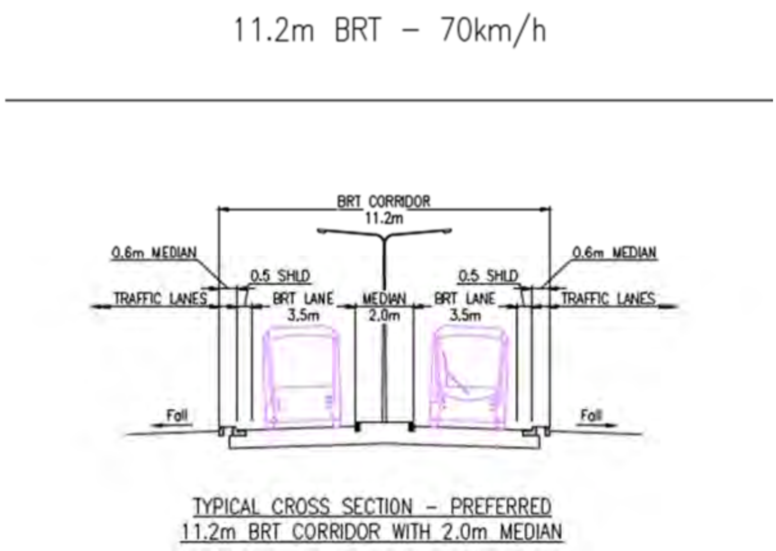

Figure 67 – Typical cross section type 3

This configuration is used when the BRT corridor is in the median and there is a wide road reserve combined with a requirement for a high operating speed, 60 to 70km/h.

Type 4 Verge alignment

In the Type 4 – verge running cross section, the BRT corridor is positioned to the side of the road carriageway and is segregated from the adjacent road by a change in height and buffer zone. Within the buffer zone, appropriate planting or other infrastructure should be provided to limit the interaction of BRT vehicle headlights with road vehicle drivers. The buffer zone is to be a minimum of 1.0 metre with desirable spacing greater than 2.0 metres.

11.3.2.3 BRT Running Way Locations

The locations of each typical cross section option are shown in Table 60.

Table 60 – BRT running way locations

Typical Section	Location
BRT Typical Section 1 (8.2 metres wide)	• Maroochydore CBD • Aerodrome Road • Alexandra Parade (Verge Running) • Venning Street • Walan Street • Brisbane Road • North Section of Nicklin Way • Main Drive
BRT Typical Section 2 (10.2 metres wide)	Kawana Way
BRT Typical Section 3	Nicklin Way (from Jessica Boulevard to Main Drive)

11.3.2.4 Bridges

On bridges, the BRT running way will be a smooth high strength asphalt surfacing on top of the bridge deck, similar to a general traffic lane pavement treatment. This will allow for the surfacing layer to be maintained and replaced during the operational life of the BRT system to ensure a high standard of ride quality for BRT passengers.

Signage and other treatments to discourage erroneous access to the BRT running way section of the bridge should be provided to limit the impact on operations of a road vehicle using the BRT corridor at the bridge.

11.3.2.5 Running Way Pavement

Three main pavement types have been identified for the BRT running way depending on the location within the route and potential vehicle loading requirements. These are all heavy pavements due to the high axle loading of the BRT vehicles and are summarised in Table 61.

Table 61 – BRT running way pavement

Typical Section	Location
BRT Typical Section 1 (8.2 metres wide)	• Maroochydore CBD • Aerodrome Road • Alexandra Parade (Verge Running) • Venning Street • Walan Street • Brisbane Road • North Section of Nicklin Way • Main Drive
BRT Typical Section 2 (10.2 metres wide)	Kawana Way
BRT Typical Section 3	Nicklin Way (from Jessica Boulevard to Main Drive)

11.3.2.6 Technical parameters

The technical criteria prepared for the Reference Project – BRT has been based on parameters used for recent Australian projects and relevant Australian and international standards. The input documents reviewed include:

- Austroads Guide to Road Design Part 3: Geometric Design
- The BRT Standard – Institute for Transportation and Development Policy (ITDP)
- Review of available information for Brisbane Metro and Sydney BRT CBD
- Local requirements.

Key aspects of the BRT design parameters are identified in Table 62.

Table 62 – BRT design parameters

Design Parameter	Value
BRT Standard Requirements	• Achieve 'Bronze Standard' • Category 'B' Right of Way[1] • Off-board ticketing (platform only) • Platform-level boarding
BRT vehicle - Light Metro Vehicle (LMV)	
Number	14
Length	24 metres

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Design Parameter	Value
Static cross section	2.55 metres
Maximum height of the vehicle	3.5 metres
Boarding height	0.33 metres
Platform kerb height	0.3 metres (0.15 metres minimum)
Minimum clearance height	Not less than 4.5 metres
Vehicle doors	4 access doors at front, centre and rear with accessibility provision
Tyres	12 tyres, in single and dual tyre configuration
Axles	4 no.
Maximum axle load	12 tonnes on single axle with dual tyres
Alignment	
Design speed – close to adjacent road (narrow median or side running)	Match posted road speed
BRT Lane Width	3.5 metre minimum
Horizontal alignment radius (minimum)	Desirable 35 metres Absolute minimum 25 metres
Vertical Alignment (maximum)	3.5 per cent preferred 10 per cent absolute (for passenger comfort)
Flood immunity	Match adjacent road requirements

Road criteria are based on TMR and SCC requirements.

11.3.2.7 BRT Vehicle Example – a LMV

To facilitate the development of the Reference Project – BRT an example of a high-capacity BRT vehicle has been used to inform the technical design parameters. The proposed LMV for Brisbane Metro, by Hess, is a battery electric vehicle which is 23,820 millimetres in length and weighs 22.7 tonnes (empty weight) and has a capacity in the order of 130 – 150 passengers (60 seated). The vehicle has a high standard of aesthetic appearance and rider comfort features (see Figure 68[157]).

This 24-metre-long vehicle is close to the practical maximum length for safe operation of public of buses under current technologies. For comparison, the maximum allowable length of a B-double truck in Queensland is 25 metres.

[157] Hess. *lighTram.* Accessed at https://www.hess-ag.ch/fileadmin/user_upload/Hess/Bus/lighTram/lighTram25/Flyer_lighTram25/Flyer_lighTram25DC_BERNMOBIL_EN_Web.pdf

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Figure 68 – Example BRT vehicle – left hand drive version

11.3.2.8 Provision for BRT future extensions

Previous studies on the mass transit corridor identified future stages to extend the route north from Maroochydore CBD and south from the SCUH.

The route developed for the Reference Project terminus provide for future extension.

11.3.2.9 BRT Stations

Stations, along with the vehicles, are the key interface points between the travelling public and the BRT system and need to provide facilities and information which make the user experience as inviting, legible and enjoyable as possible. It is intended that the stations will have a consistent design across the network to improve legibility and will be designed to suit the Sunshine Coast. Stations have been located where they:

- Will allow the convenient movement of people between the BRT system and surrounding origins and destinations
- Allow interchanges with other forms of transport to occur at convenient locations
- Provide a safe and inviting environment
- Can be made to safely and effectively fit with and integrate into the surrounding urban landscape and traffic network
- Meet geometric design standards including being located on a straight section of track and flat grade at the station.

Unlike LRT vehicles, the vehicle options that were examined for the Reference Project – BRT had doors on only one side. This requires the use of side platforms only, as passengers will not be able to board at island platforms. The option of crossovers at any island platforms was considered but was ruled out on safety and capacity grounds. Equally, BRT vehicles with doors both sides are not common and would be a bespoke feature, adding considerable cost and time for development and approval.

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Facilities

The facilities to be provided at each station are depicted in Figure 69.

Figure 69 – Station design elements

A standardised arrangement of these facilities will lead to customer familiarity and ease of maintenance. However, each station platform needs to be designed in relation to its local context. As an example, access points and pedestrian storage provisions on each platform will vary.

Station layouts

Two physical station typologies have been identified:

- Side
- Terminus.

All stations are located on straights with minimum grades along the alignment for passenger comfort and safety.

Side

Side platforms require two platforms located outside the busway. Side platforms adjacent to roads with speeds over 50 kilometres per hour have requirements for concrete crash barrier protection along the back of the platform.

This station configuration requires more width at the station location, but the impact is limited to the station length along the corridor as the track centres are not widened.

There is the need to duplicate facilities on the station so that passengers do not need to change platforms by crossing the busway to reach help points, top up go cards, or use other facilities on the stations.

Terminus

Terminus stops are located at the end of the alignment. When LMVs complete their journey in one direction, the vehicle turns around and returns in the other direction. Island platforms are possible in these circumstances.

Driver facilities are required at terminus stops for comfort breaks and rest breaks. At Maroochydore and SCUH, drivers' facilities are proposed to be shared with other public transport driver facilities however this will require confirmation with TransLink. If not suitable, driver facilities should be located in close proximity to the station but not on the station due to space impacts the facilities have on the operation of the platform.

Terminus stops require additional facilities for passengers as there are normally more passengers using these stops. The terminus platforms are proposed to have 100 per cent shelter and additional top-up machines, touch on/off points, and seating.

Intermediate intermodal

Intermediate intermodal stops are provided where passengers are able to transfer to or from the bus network. These stops generally have more passengers using them so require additional shelter and facilities. The intermediate intermodal stops are proposed to have 100 per cent shelter. One such stop at Bundilla is required in Stage 1.

It is important for the passengers that the transfer between modes is as efficient as possible.

11.3.2.10 Urban design and landscape

The SCMT is envisioned as a world class, urban and landscape infrastructure public transport system that is designed as an alternative green mode of transport that will allow residents and visitors to be more sustainable and better connected.

For the reference project, the following key design principles have been adopted:

- Build a strong design character to each of the station precincts through the use of specifically chosen materials and planting species associated with the place and station locations along the alignment.
- Maximise shade and planting in areas associated with the public realm and immediate interfaces of the new station nodes.
- Ensure a clear hierarchy and legible approach to pedestrian connections are embedded into the design of each station precinct.
- Design additional new open spaces that complement and enhance the existing open spaces for the public to enjoy.

11.3.2.11 Public bus operations and transfers

A key assumption for the Reference Project – BRT is that the BRT ROW would only be used by the BRT vehicles and would not be accessible for general public bus services. This is necessary to maintain traffic signal priority for the mass transit system and reduce delays at stations. Therefore, it is important to provide connectivity for passengers using the public bus services to the BRT system.

Three key bus/BRT transfer points have been identified along the corridor; Maroochydore CBD Transit Centre, Bundilla stop at MRI and SCUH bus station. For passengers travelling to and through Maroochydore, the proposed Maroochydore CBD Transit Centre will connect the BRT corridor with public buses from the north and west using the interchange and rail services proposed in the CAMCOS corridor. The BRT terminus has been integrated at ground level with the bus stops to provide direct connectivity for passengers. The current design for the CAMCOS corridor is proposed to be elevated and will have vertical transport to ground adjacent to the BRT terminus. The transit centre will become a hub for passenger movements into and through Maroochydore.

To provide a benefit for passengers who are not directly located on the busway corridor, the Bundilla station will integrate bus services from the west with the BRT system. The Bundilla station will allow direct interchange between buses and the BRT at a shared platform. Buses from the west using the Sunshine Motorway will be able to access the stop through a dedicated bus lane at the intersection of the Sunshine Motorway and Brisbane Road. This will allow buses on routes using the Sunshine Motorway to complete their journey at the interchange. Bus layover facilities and a driver's amenity building are included in this location.

The SCUH bus station currently has bus services operating from it to the south, west and north. SCUH is the southern extent of the Reference Project – BRT. The SCUH will form an important interchange for

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passengers from bus services from the south and west to the BRT corridor. The terminus of the BRT has replaced the eastern side of the bus station, with direct interchange between buses and the BRT at the entrance to the SCUH.

11.3.2.12 Active transport provisions – BRT

Pedestrian movements

The design has considered suitable active transport facilities either within or adjacent to the mass transit route. Pedestrian movements across the busway corridor are facilitated through the use of signalised crossings. Pedestrian crossings are provided at road intersections with the busway and dedicated pedestrian crossing where there are long distances between intersections and there is a desire for pedestrians to cross the corridor midblock.

To provide access for pedestrians from the west of the road to the beach accesses and facilities along Alexandra Parade, additional signalised pedestrian crossings are provided. Urban design treatments are proposed to be introduced along Alexandra Parade to direct pedestrians to designated crossing points.

To improve access to stops located in the median of the road, additional pedestrian crossings have been provided at the opposite end of the stop. These signalised pedestrian crossings will be coordinated with the adjacent traffic lights to minimise impact on road traffic flow.

Cycle facilities

On-road cycle facilities have been included in the Reference Project – BRT cross section along all existing cycle network routes. Along Alexandra Parade the busway alignment has been designed to consider the location of the future M2M separated cycleway although it is possible that some localised sections of the M2M cycleway will require reconstruction as part of the introduction of BRT.

On Nicklin Way the Reference Project – BRT has included on-road cycle lanes and a high-level feasibility investigation into separated cycle lanes has been completed. The investigation found that one-way separated cycle lanes on each side of the road would be the preferred option however the introduction of this treatment will require further design investigation in subsequent stages of the Project.

Cycle boxes to allow cycle hook turns are proposed at all intersections that interface with the BRT. The hook turn facility provides on-road cyclists turning right across the corridor with the opportunity to safely cross the busway at 90 degrees. They consist of marked cycle turning boxes on the left side of the road in front of the side traffic hold line.

An active transport path on the eastern side of the busway bridges crossing Mooloolah River is proposed. This will extend the existing Brisbane Road facility and connect to existing paths on the banks of the river.

11.3.2.13 BRT Signalling

The Reference Project – BRT is proposed to be operated as a line-of-sight system. Drivers of the LMVs operate their vehicles in the same way as a road vehicle driver would by responding to the environment in front of them.

All interactions between LMVs and road vehicles will be managed by traffic signals. The only change from standard traffic signals is the replacement of the green indication for LMVs replaced with a white “B” lantern[158]. Additional road intersection signals are required at a number of intersections along the route. Priority will be given to LMVs over general traffic.

11.3.2.14 Battery Electric Systems to power the LMVs

For the Reference Project – BRT, the LMVs have been identified to be battery electric with charging systems. The battery charging system including substations is summarised in Table 63.

Table 63 – BRT Battery charging systems

[158] Only authorised vehicles including buses may proceed through a lit “B” lantern. https://www.qld.gov.au/transport/safety/rules/road/traffic-lights

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Charging System Type	Features
Terminal Feeding Stations	• Power sub-station • One 150kW power cabinet • Two Depot charge boxes.
Flash Feeding Stations	• Power sub-station • One 150kW power cabinets • Two Pantograph down charge units.
Depot Feeding Station	• Power sub-station • Five 150kW power cabinets • Fourteen Depot Charge Boxes.

Battery electric technology and charging systems are a rapidly evolving technology. These technical parameters should be revisited at each stage of the Project.

11.3.2.15 Public utilities and BRT

Public utilities considerations for the Reference Project – BRT are the same as those outlined in the Reference Project – LRT section. Physical identification of all utilities within the corridor is recommended before releasing the Project to market. High risk and high cost utilities should be investigated in the Detailed Business Case stage. Detailed consultation with utility owners should occur in the DBC stage to coordinate any proposed upgrade of utilities to limit reworks occurring in the corridor.

11.3.3 BRT Construction stage considerations

The key constructability issues to be addressed during the delivery stage of the Reference Project – BRT are consistent with those outlined in the Reference Project – LRT section.

Early works

No early works have been identified as part of the Options Analysis. Further investigation of potential early works packages should be considered during future stages of the Project.

11.3.4 BRT Operations

The operation of the network will be controlled from the OCC located within the depot precinct. The OCC will provide real-time management, centralised control and monitoring of operations in the corridor including:

- The position of each BRT vehicle to ensure journey time and spacing between vehicles
- The status of traffic prioritisation and other network control systems
- Security at all stops
- Monitoring and updating of announcements and passenger information displays.

11.3.4.1 BRT Service frequency

The proposed service frequency has been developed to support the operational assessment of Reference Project – BRT. The frequency of services will be refined during future stages to provide frequency of service that is improved from current bus routes along the alignment and aligns capacity with demand. Table 64 provides the frequency based on the day of week and time of day.

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Table 64 – Operations schedule

Day	Period	Times	Services per hour	Average headway (minutes)
Monday to Friday	Early	5:00 am to 7:00 am	4	15
	AM Peak	7:00 am to 9:00 am	8	7.5
	Interpeak	9:00 am to 4:00 pm	8	7.5
	PM Peak	4:00 pm to 6:00 pm	8	7.5
	Evening	6:00 pm to Midnight	4	15
	Overnight	Midnight to 5:00 am	No BRT services	
Saturday and Sunday	Early	5:00 am to 7:00 am	4	15
	Daytime	7:00 am to 6:00 pm	4	15
	Evening	6:00 pm to Midnight	4	15
	Overnight	Midnight to 5:00 am	No BRT services[159]	

Journey time

The journey time for BRT is estimated to be 30 minutes from the Maroochydore terminus to the SCUH terminus.

11.3.4.2 BRT Depot and stabling

The proposed location and size for the LMV depot and stabling yard will be finalised in the detailed design. An indicative depot size and cost has been developed for the preliminary design.

The depot will have the following facilities:

- Set down areas for the Reference Project number of BRT vehicles (14)
- 14 Vehicle deep charging stations (Depot Feeding Stations)
- Wash facilities
- Allowance for future expansion of the facility for increased service frequency or expansion of the network
- Maintenance facility catering for 28 BRT vehicles to allow for expansion requirement without the need for a new facility
- Storage of spare parts
- Sheds and space for maintenance equipment and vehicles
- OCC
- Staff facilities for the operation of the network and training
- Car parking for operational and maintenance staff.

BRT Remote stabling

No requirement for remote stabling has been identified in the Reference Project – BRT. The depot and stabling facility have sufficient stabling for the Stage 1 fleet requirements.

[159] This should be reviewed prior to commencement of operations to ascertain the value of all night running on Friday and Saturday

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11.3.4.3 BRT and Special events

The Sunshine Coast hosts many special events along the Reference Project – BRT corridor. The BRT corridor has been developed to allow spectators and competitors to use the BRT to access their events. The number LMVs proposed for the Reference Project will allow, with planning of fleet maintenance, to operate an approximate five minute timetable to cater for event demands.

To allow some events to operate efficiently, there may be the need to only operate part of the corridor. As the LMVs are rubber tyred there is flexibility in catering for events by either rerouting or turning the BRT vehicles around in alternative locations where suitable space is available along the corridor. This may require traffic management to allow the BRT vehicles to complete the turn movements.

11.3.4.4 Ticketing - BRT

The Reference Project – BRT will be operated under the standard TransLink SEQ fare system with fare collection being off vehicle. Validators will be located on the platforms. Revenue protection will be through on-board customer service officers conducting random checks.

11.3.5 BRT Reference Project - Summary

The Reference Project – BRT has confirmed it is technically feasible to deliver a BRT project from Maroochydore to the SCUH and has assessed the potential impacts and benefits of the Project. There are areas for future investigation during the Detailed Business Case including:

- PUP investigations
- Refinement of corridor impacts, particularly the station locations
- Identify and determine size of depot location
- Refinement of the BRT vehicle specifications including emerging technology
- Refinement of the journey time and intersection performance using an advanced simulation tool
- Refinement of the construction schedule.

11.4. Reference Project –TT

Due to recent trends and stakeholder interest across Australia, this Options Analysis has evaluated an additional option called TT, sometimes called Trackless Light Transit. A TT is an emerging technology solution that is a rubber-tyred vehicle that is longer than a bus and may provide a smoother ride. This section outlines the process undertaken to develop the SCMT Reference Project – TT. It documents the option for the TT and presents an overview of the technical features that comprise the proposed solution.

The Reference Project – LRT was used as the benchmark against which to develop the Reference Project - TT. This approach was to ensure the Reference Project – TT was commensurate to the Reference Project - LRT in order to provide a suitable basis for comparison between the technologies, and to ensure a mass transit solution that has the ability to attract and keep passengers who may otherwise have driven. The best-known version of trackless tram is called the ART which is currently operating a revenue service on a 17-kilometre line in Yibin in the south-eastern part of Sichuan province, China. See Figure 70.

The ART is a proprietary product of the Chinese rail company CRRC. The ART trackless tram is a hybrid of LRT and BRT, intended to exploit the best features of both technologies. It is electrically powered using battery storage on board the vehicle. It can use an optical guidance system[160] or a path delineated using magnets, and can detect objects in its path using radar, however requires a driver to take over for certain operations.

To allow the vehicle length to be extended to longer than a bus, each of the six axles are able to be steered, minimising the required lane width through corners as each set of wheels follows the guidance system, similar to how a tram follows the tracks. The ride quality is reported to be improved through the use of a

[160] Optical guidance is not a new technology. It dates back to the 1980s, and has been applied in France, Spain and the United States. Ref: https://www.sydney.edu.au/business/news-and-events/news/2019/01/21/debunking-the-myths-around-optically-guided-bus--trackless-trams.html, accessed 6 February 2021.

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bogie-like wheel arrangement to maximise ride quality, potentially achieving smooth ride quality comparable to light rail, though other factors would affect this (e.g. pavement quality).

Figure 70 – CRRC Autonomous Rapid Transit "Trackless Tram" vehicle on display in Zhu Zhao, China

The key components of the Reference Project – TT are shown in Table 65.

Table 65 – Components of the Reference Project Trackless Tram[161].

Component	Description
System	Stand-alone trackless tram system from Maroochydore to SCUH 1. Northern Terminus at Maroochydore CBD Transit Centre 2. Southern Terminus at SCUH bus station
Route length	13.6 kilometres
Stations	16 stops • 9 central island stops • 5 side platform stops • 2 terminus stops.
Cross section	Dual running way, combination of centre running and verge running. The trackway dimension of 8.0 metres adopted for design purposes for light rail is assumed for the trackless tram based on a published swept path clearance of 3.83 metres.
Track type	A heavy duty pavement based on the Reference Project – BRT has been assumed for the Trackless Tram. Line marking and any embedded magnets in lieu of rails will be deployed as required by the chosen guidance system.

[161] In Table 65, an asterisk (*) against a particular component indicates this is identical to the Reference Project - LRT. A hash (#) denotes this component is based on the Reference Project – BRT. Depatures are detailed in the the description.

Component	Description
Vehicles	14 vehicles (Trackless trams), 8 services per hour in both directions, plus 2 spares
Vehicle specification	• 32 metres long four compartment vehicles • 2.65 metres wide • Doors both sides to allow use of island platforms • Fully low floor, accessible vehicles • Total capacity of approximately 200 passengers.
Bridges and structures	5 new bridge structures and one new pedestrian bridge
Key traffic interactions	66 at grade intersections, including major intersections at Aerodrome Road/Sixth Avenue, Walan Street/Brisbane Road, Nicklin Way/Jessica Boulevard, Kawana Island Boulevard, Wyandra Drive, and Kawana Way
Active transport	Active transport consideration for the length of the corridor
Electric traction power	Flash-charging via pantograph contacting a charging bar assumed at termini and two intermediate stops. Overnight deep charging in the depot.
Bus network	Bus interchanges at Maroochydore CBD Transit Centre, SCUH, Main Drive and Bundilla
Park n Ride	A Park 'n' Ride near the MRI at the Bundilla station
Running time	An expected journey time of approximately 30 minutes
Service hours	Weekday services • Peak and between peak service frequency: 7.5 minutes • Off peak service frequency: 15 minutes • Weekend service frequency: 15 minutes.

Figure 71 – Artist's impression the 32-metre trackless tram in operation on a busway in the Sunshine Coast.

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11.4.1 System specification

11.4.1.1 Alignment options

The alignment options adopted for the Reference Project – LRT are assumed for the Reference Project – TT.

11.4.1.2 Provisions for future extensions

The provisions for future extensions adopted for the Reference Project – LRT and the Reference Project – BRT are assumed for the Reference Project – TT.

11.4.1.3 Stations

The provisions for stations for the Reference Project – LRT are assumed for the Reference Project – TT.

11.4.1.4 Bridges

The provisions for future extensions adopted for the Reference Project.

11.4.1.5 Running Way Pavement

Some the Reference Project -TT is based on the Reference Project -LRT which is median running, the Reference Project – TT needs to provide pavement median, a full trackway construction is required. The pavement design for the Reference Project – BRT has been adopted.

Three main pavement types have been identified for the running way depending on the location within the route and potential vehicle loading requirements. These are all heavy pavements due to the high axle loading of the vehicles and are summarised in Table 66.

Table 66 – TT running way pavement

Running Way Location	Pavement Type
TT running way lanes mid-block	• Flexible pavement consisting of asphalt over granular pavement
TT stations and approach lanes	• Rigid concrete pavement consisting of plain concrete pavement
TT running way lanes at intersections	• Rigid concrete pavement consisting of plain concrete pavement

11.4.1.6 Alternative alignments

Two alternative alignments were considered for the TT, kerbside and median bus lanes or even in general traffic lanes (refer Section 10.3.1.7). These do not provide a dedicated ROW, as the trackway is shared with road vehicles at locations such as turn protection lanes. As such these alternative alignments would be classified as a Category C ROW (refer Section 3.1.2).

The feasibility of the large TT operating in bus lanes under general traffic conditions will need to be subject to further analysis in the next stage of the Project, should a Category C option be seen as a preferred approach to providing public transport in Sunshine Coast Region. It is not considered a feasible approach at this time, as there are too many unresolved technical and regulatory issues.

11.4.1.7 Urban design and landscape

The SCMT is envisioned as a world class, urban and landscape infrastructure public transport system that is designed as an alternative green mode of transport that will allow residents and visitors to be more sustainable and better connected.

For the reference project, the following key design principles have been adopted:

- Build a strong design character to each of the station precincts through the use of specifically chosen materials and planting species associated with the place and station locations along the alignment.

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- Maximise shade and planting in areas associated with the public realm and immediate interfaces of the new station nodes.
- Ensure a clear hierarchy and legible approach to pedestrian connections are embedded into the design of each station precinct.
- Where the opportunity arises, design additional new open spaces that complement and enhance the existing open spaces for the public to enjoy.

11.4.1.8 Public bus operations

The provisions for public bus operations adopted for the Reference Project – LRT are assumed for the Reference Project – TT.

11.4.1.9 Active transport provisions

The provisions for public bus operations adopted for the Reference Project – LRT are assumed for the Reference Project – TT.

11.4.1.10 Signalling

TT is proposed to be operated as a line-of-sight system. Drivers of the TT's operate their vehicles in the same way as a road vehicle driver would by responding to the environment in front of them. The radar detection fitted to the TT vehicles may assist in improving safety, however will not replace the driver under present technological capabilities.

All interactions between TTs and road vehicles will be managed by traffic signals. Additional road intersection signals are required at a number of priority-controlled intersections along the alignment. The current technology for autonomous vehicle operation does not allow for driverless operations in a mixed traffic environment where there are traffic signals.

11.4.1.11 Public utilities

Public utilities considerations for the Reference Project – TT are the same as those outlined in the Reference Project - LRT section. Physical identification of all utilities within the corridor is recommended before releasing the Project to market. High risk and high-cost utilities should be investigated in the Detailed Business Case stage. Detailed consultation with utility owners should occur in the DBC stage to coordinate any proposed upgrade of utilities to limit reworks occurring in the corridor.

Compared to LRT overhead, there may be some reduction in impact on utilities in relation to electrical clearances and stray current clearance away from locations where the TTs are charged.

11.4.2 Construction stage considerations

A preliminary construction schedule was developed for the purpose of producing a reliable cost estimate for the Reference Project – LRT and the Reference Project - BRT.

These construction schedules have been reviewed in light of the available information on the TT. Whilst available information suggests marked reductions in construction time, the construction task for the Reference Project – TT would be significantly different to the Reference Project – BRT hence it is unknown whether this information can be relied upon. For the Sunshine Coast system there is the need for a dedicated Category B ROW, high-quality stations, dedicated cycle network improvements, modifications to the road network, provision of urban design treatments, and charging points similar to the Reference Project - BRT.

11.4.2.1 Early works

No early works have been identified. Further investigation into potential early works packages should be considered during future stages of the Project.

11.4.3 Operations

Each of the TT vehicles will be controlled by a driver operating on line of sight, the same as the LRT reference project. The direction of the vehicle will not need to be monitored by the driver, but the speed and braking will need to be controlled by the driver.

Operation of the network will be controlled from the OCC located within the depot precinct. The OCC will provide real-time management, centralised control and monitoring of operations in the corridor including:

- Position of each TT to ensure timetable match and spacing between vehicles
- The status of traffic prioritisation and other network control systems
- Security at all stops
- Monitoring and updating of announcements and passenger information displays.

11.4.3.1 Service frequency

The proposed service frequency has been developed to support the operational assessment of Reference Project – TT. The frequency of services will be refined during future stages to provide frequency of service that is improved from current bus routes along the alignment and aligns capacity with demand. Table 67 provides the frequency based on the day of week and time of day.

Table 67 – Trackless Tram operations schedule[162]

Day	Period	Times	LRVs per hour	Headway (minutes)
Monday to Friday	Early	5:00 am to 7:00 am	4	15
	AM Peak	7:00 am to 9:00 am	8	7.5
	Interpeak	9:00 am to 4:00 pm	8	7.5
	PM Peak	4:00 pm to 6:00 pm	8	7.5
	Evening	6:00 pm to Midnight	4	15
	Overnight	Midnight to 5:00 am	No LRT services	
Saturday and Sunday	Early	5:00 am to 7:00 am	4	15
	Daytime	7:00 am to 6:00 pm	4	15
	Evening	6:00 pm to Midnight	4	15
	Overnight	Midnight to 5:00 am	No LRT services	

11.4.3.2 Traffic signal priority

The interaction between the proposed TT service and the traffic signal network will have a significant impact on the journey time for the TT and has the potential to disrupt the road network. The TT will require a high level of signal priority at traffic signals to reduce the delay for the TT and thereby improve the journey time, and ultimately the ridership on the TT.

11.4.3.3 Journey time

The journey time for TT is estimated to be just under 30 minutes from the Maroochydore terminus to the SCUH terminus, the same as the LRT option.

[162] This operation schedule has been provided here to determine the number of vehicles required for the cost estimate. This schedule results in a conservatively high number of vehicles to ensure an adequate allow for vehicles is included in this early project lifecycle cost estimate. The actual operations schedule would need to be developed in consultation with Translink and the operator.

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11.4.3.4 Depot and stabling

The proposed location and size for the TT maintenance depot and stabling will be finalised in the detailed design. An indicative depot size and cost has been developed for the preliminary design.

The depot will have the following facilities:

- Set down areas for the Reference Project number of TT vehicles (14)
- Vehicle charging stations (Depot Feeding Stations) for all vehicles
- Wash facilities
- Allowance for future expansion of the facility for increased service frequency or expansion of the network
- Maintenance facility catering for 28 TT vehicles to allow for expansion requirement without the need for a new facility
- Storage of spare parts
- Sheds and space for maintenance equipment and vehicles
- OCC
- Staff facilities for the operation of the network and training
- Car parking for operational and maintenance staff
- Similar to the Reference Project - BRT, the depot and stabling facility can be provided off corridor if the vehicle is accredited to operate on certain parts of the road network. This increases the available sites for the facility.

11.4.3.5 Remote stabling

No requirement for remote stabling has been identified in the Reference Project – TT. The depot and stabling facility have sufficient stabling for the Stage 1 fleet requirements.

11.4.3.6 Special events

The Sunshine Coast hosts many special events along the Reference Project – TT corridor. The TT corridor has been developed to allow spectators and competitors to use the TT to access their events. The number of TT vehicles proposed for the Reference Project would allow, with planning of fleet maintenance, to operate an approximate five-minute timetable to cater for event demands.

To allow some events to operate efficiently, there may be the need to only operate part of the corridor. As the TT are rubber tyred there is flexibility in catering for events by either rerouting (if accredited to operate on certain parts of the road network) or turning the TT vehicles back at alternative locations where suitable space is available along the corridor.

11.4.3.7 Ticketing

It is expected that the Reference Project – TT will be operated under the standard TransLink SEQ fare system.

11.4.4 Opportunities and risks

11.4.4.1 Vehicle Accreditation and Registered Professional Engineer of Queensland (RPEQ) Certification

The TT will require accreditation before operating in Australia as a potential new vehicle class.

It would first need to be determined whether the vehicle would be accredited as a road or rail vehicle. This would determine the relevant accreditation authority. The current information available indicates that the TT vehicle is 2.65 metres in width, which is similar to an LRT vehicle. However, this width exceeds the current width limit of 2.5 metres for road vehicles under the National Heavy Vehicle Regulator.

Further if this TT vehicle is to be classified as a road vehicle, it would fall outside of the regularly accepted vehicle types that underpin the current road design guidelines, such as Austroads. This would require additional research and specific engineering review of the road system for which these vehicles would be intended to operate within before the design could be certified by a RPEQ.

It is understood proponents of the TT are aware of this and intend to have a trial vehicle tested in a non-public road environment in the foreseeable future. This would signal the commencement of discussions with the accreditor.

11.4.4.2 Non-competitive market

This ART TT technology remains proprietary. There are significant risks when locked in to one supplier. However during the procurement stage, other suppliers could emerge.

11.4.4.3 Ability to be sub-staged

Depending particularly upon accreditation it may be possible to construct the TT route partly as Category B ROW, partly Category C ROW, with a view to upgrading the latter Category C sections to Category B over time. That is, the system could, for example, run in a dedicated corridor with signal priority from the Maroochydore City Centre to the Mooloolah River, then like the Reference Project – QBC in kerbside lanes from the river to SCUH. The latter section would be progressively upgraded over time to achieve the full Category B system. This would delay costs and improve affordability of the Project, however there are many risks associated with attempting to operate these large vehicles in general traffic, as noted in Section 10.3.1.7.

11.4.4.4 On-board electricity system

The CRRC TT is no more or less inherently suited to on-board electricity storage than other forms of mass transit. Battery technology continues to evolve and this may be one area where the wireless versions of mass transit like the TT are able to gain advantage of traditional power of LRT using overhead power supply.

However the more mature light rail wireless operations industry does not yet claim to have a reliable solution for more than 25 kilometres of travel on a single ten-minute flash-charge. An in-service track record in Australian conditions would greatly improve certainty in this regard.

11.4.4.5 Pavement quality and wear

Ride quality is a critical factor in the success of any mass transit system.

The TT vehicles are at or beyond the upper limit of allowed road vehicle axle loads in Australia. These require stronger pavements than normal road pavements due to the high loads and high frequency along the same route.

In guided systems, because the vehicles follow exactly the same path, loads on the road surface are concentrated, and wear occurs more quickly than in typical circumstances.[163] This phenomenon was observed in two guided bus systems Caen[164] and Nancy[165], both in France. These systems used a centrally located guide rail to guide the rubber tyred articulated buses.

It is understood that in the case of a CRRC computer guided TT, variable offset from the guideline can be employed to delay this accelerated wear at least partially. Evidence of the efficacy of this solution in revenue service would be invaluable.

11.4.4.6 Remote depot location

Assuming the vehicle was accredited for the route to the depot, depots more remote from the route could be considered if a TT system was implemented.

[163] https://lightrailnow.wordpress.com/2016/02/29/caen-guided-brt-out-real-lrt-tramway-in-by-2019/, accessed 6 February 2021.
[164] https://en.wikipedia.org/wiki/Caen_Guided_Light_Transit, accessed 6 February 2021.
[165] https://en.wikipedia.org/wiki/Nancy_Guided_Light_Transit, accessed 6 February 2021.

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11.4.5 Summary – Reference project - TT

A Category B ROW TT option with signal priority similar to the Reference Projects for LRT and BRT would address the Project objectives and likely meet the service needs. This system is comparable to the other Category B Reference Projects in terms of cost and constructability.

There are a number of risks associated principally with the unproven status of this technology in revenue service, however there is time for information on the efficacy of the Trackless Tram vehicle to be gathered as part of the Project.

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TRANSPORT OUTCOMES OF THE REFERENCE PROJECTS

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12. Transport Outcomes of the Reference Projects

This chapter details the transport modelling outcomes for the shortlisted mass transport options assessed as part of Chapter 10. The shortlisted Reference Project options that were required to be tested for transport outcomes are listed in Table 68:

Table 68 – Shortlisted Reference Project cases evaluated for their transport outcomes

Category B Project cases	Category C Project case
• LRT with overhead power supply (LRT overhead) • LRT with on-board energy storage, no overhead power (wLRT) • BRT with on-board energy storage (BRT) • TT with on-board energy storage	• QBC – articulated bus (targeting zero emissions technology)

Due to the strategic nature of the transport model used during this Options Analysis stage, modelling of the LRT, BRT and TT options would result in similar transport outcomes given the characteristics of the transit systems. These options are therefore generally grouped as "Category B" for the purposes of representation in this chapter.

The modelling assumptions were identical for all three of the Category B technologies with the exception of a slightly longer travel time (about 50 seconds extra over a 30 minute run) for BRT as opposed to LRT and TT. This is due to turning and swept path timing allowances. Hence only LRT and BRT were modelled. The TT results, when running in a Category B busway, are considered to be identical to LRT.

12.1. Mass transit option assessment criteria

12.1.1 Meeting the service need

Assessment of mass transit options against the desired benefits of the Project (which determined the service needs) was undertaken. The benefits sought were identified in Section 6.8 and are outlined in Table 69.

Table 69 – Benefits sought from addressing the service need

Benefits	Description
Connect key employment, tourism and health precincts within the SCUC Corridor	Linking primary economic development between (Maroochydore and Kawana), to knowledge-based industry areas and tourist destinations.
Enhanced livability of the Sunshine Coast Region	Enhanced livability and greater accessibility for Sunshine Coast residents to employment, schools, shopping, services and recreational facilities within 30 minutes of their home.
Improved urban consolidation, creating urban change in the SCMT corridor	Improved land use outcomes including a broad range of housing opportunities such as affordable living, 'missing middle' housing and mixed-use development in established centres on the Sunshine Coast.
Better accessibility for residents and tourists	Increased transport options (both public transport and active transport) for people of different ages and mobility levels without reliance upon private cars and, subsequently, significant reduction in motor traffic, car parking requirements and environmental impacts.

12.1.2 Transport outcome assessment criteria – strategic transport drivers

To underpin the transport outcomes assessment, the desired benefits from Table 69 were used to develop the five 'strategic transport drivers' listed below. These strategic transport drivers were able to be directly tested against outputs from the transport model hence formed the basis for a quantified evaluation.

1. Improved passenger transport options that increase public transport patronage
2. Increased accessibility to key destinations by public transport
3. A transport system that increases access to employment by public transport and facilitates journey to work self-containment
4. A mass transit system that reduces reliance on car and reduces transport costs for users
5. Increased residential and employment densities within centres, and along high-frequency public transport corridors[166].

These have been used for the transport outcomes assessment to enable comparison of the Category B Mass Transit project options and the Category C Quality Bus Corridor.

12.2. Strategic transport modelling

12.2.1 The strategic transport model

The Sunshine Coast Zenith Model (SCZM) is a strategic transport model and has been used to undertake transport modelling as part of the Options Analysis. The structure of the SCZM is depicted in Figure 72.

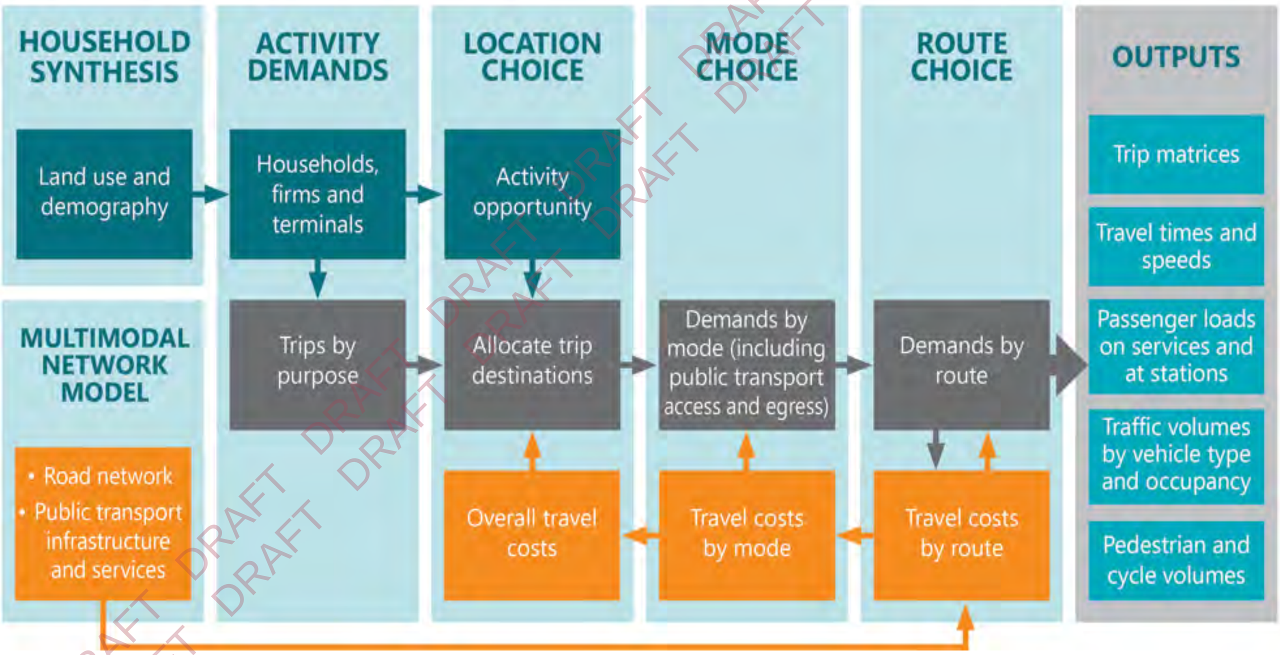

Figure 72 – SCZM Model Structure

The SCZM is a locally validated and calibrated version of Veitch Lister Consulting's Zenith Model of the entire SEQ region.

Zenith is a predictive strategic model of travel within urban environments. The model is deterministic[167], meaning there is no randomness involved in the development of future states of the system. The inputs and assumptions used to calculate transport outcomes and other outputs are the results of some 30 years of transport research and model development.

[166] Strategic transport driver 5 has been addressed in Chapter 7 through the analysis of QGSO infill development versus a greenfield (trend) scenario, and hence will not be discussed further within this chapter.
[167] A **deterministic model** will thus always produce the same output from a given starting condition or initial state.

The Zenith Model is sensitive to a great number of key factors (variables) which influence travel behaviour including:

- Population and demographics – including workforce participation, age profiles, income and car ownership levels
- The distribution of land uses – including office blocks, factories, shops, schools, hospitals and airports
- The level of accessibility provided by the transportation network – including travel by car, public transport, walking and cycling
- The cost of travel – including road tolls, public transport fares, fuel costs and parking charges.

By comparing the outputs between modelled scenarios, the impact of changes to the travel environment can be evaluated and understood, for example:

- The effect of population growth and distribution, in terms of growth in travel demand and increased congestion
- The impact of adding or removing new services
- The effect of building new transport infrastructure
- The effect of changes to the cost of travel, e.g. parking price or fares.

12.2.2 Modelling cases utilised

Three cases have been modelled to analyse the performance of each option against the assessment criteria. These are shown in Table 70. As discussed above, LRT, BRT and TT are grouped as Category B Project options.

Table 70 – Modelling cases

Case	Land use scenario	Transport scenario
Base case		A 'Do Minimum' transport investment scenario which consists of minor extensions to existing bus routes to provide access in growth areas, as well as only committed road upgrades.
Category B Mass Transit reference project options	QGSO (2018 edition) medium series	Stage 1 of the Sunshine Coast Urban Corridor utilisation by a LRT, BRT or TT system, with a supporting bus network upgrade.
Quality Bus Corridor reference project option		Stage 1 of the Sunshine Coast Urban Corridor utilisation by a QBC, with a region-wide upgrade of the bus network specifically tailored to make best use of the bus priority infrastructure.

12.2.3 Category B Mass Transit Project options

At the core of the Category B Mass Transit Project options case is a corridor running between the planned transit centre at Maroochydore CBD and the SCUH. Figure 73 outlines the route and details of the modelled mass transit system.

The mass transit services operate in a dedicated ROW corridor with traffic signal priority at intersections. They have high-quality station environments with security, information and ticketing equipment. There are a maximum of eight services per hour at 7.5-minute headways, and the journey time from beginning to end for LRT and TT is estimated at 29 minutes and 40 seconds[168], while BRT was 30 minutes and 30 seconds.

A 1,000 space Park 'n' Ride facility is provided at Bundilla near the Sunshine Coast Motorway. There is also a transfer facility adjacent to the mass transit platform, allowing the mass transit to intercept buses coming from the west of the region.

An upgraded and redesigned Sunshine Coast bus network has been modelled in the Category B Mass Transit Project options case to ensure maximum access to the mass transit from outside of its walk-up catchment, as shown in Figure 74.

[168] Based on comparison with GCLR and built up by analysing running conditions in each section of the route. Running times should be reviewed in the Detailed Business Case with more detailed simulation models.

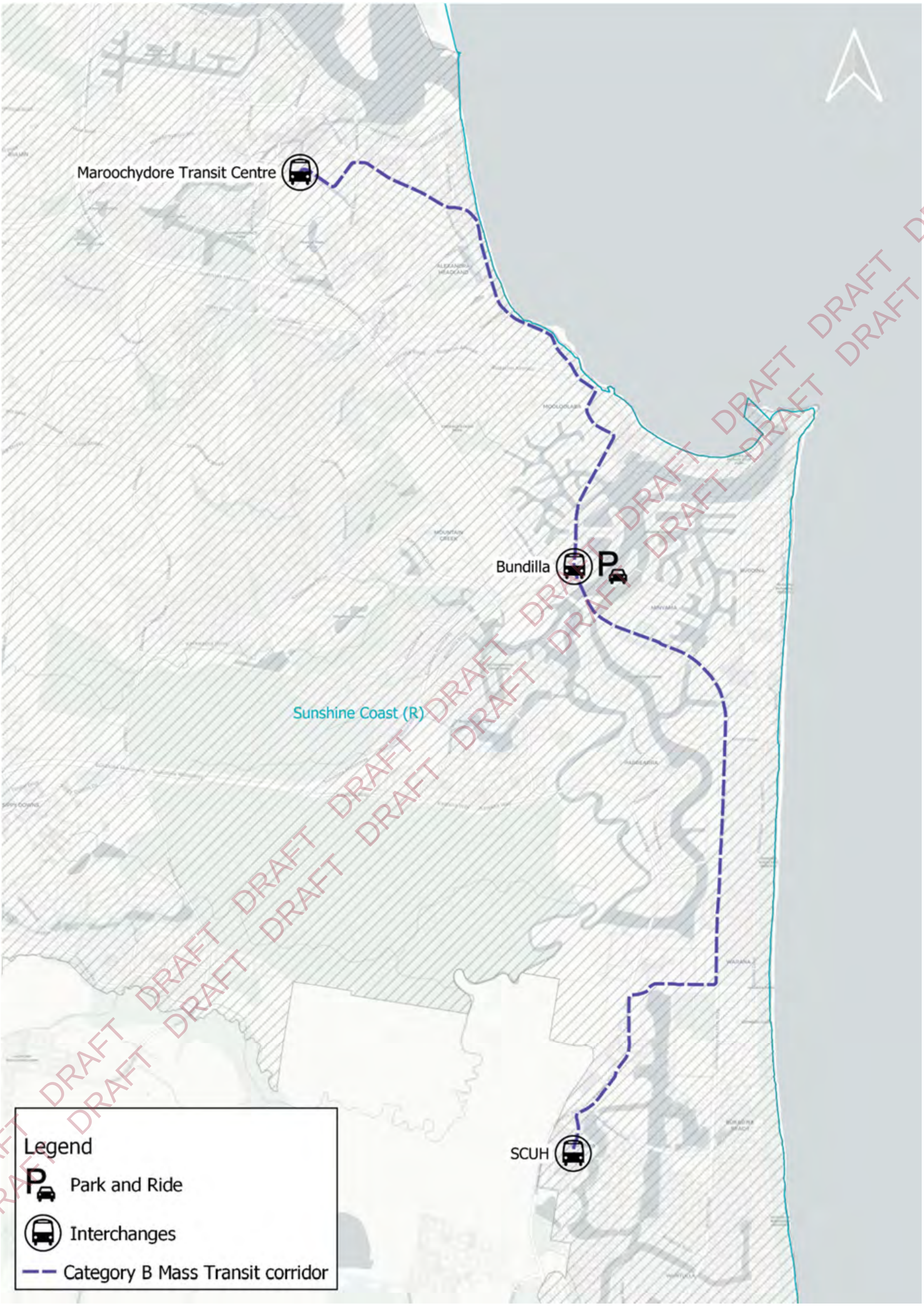

Figure 73 – Category B Mass Transit as modelled

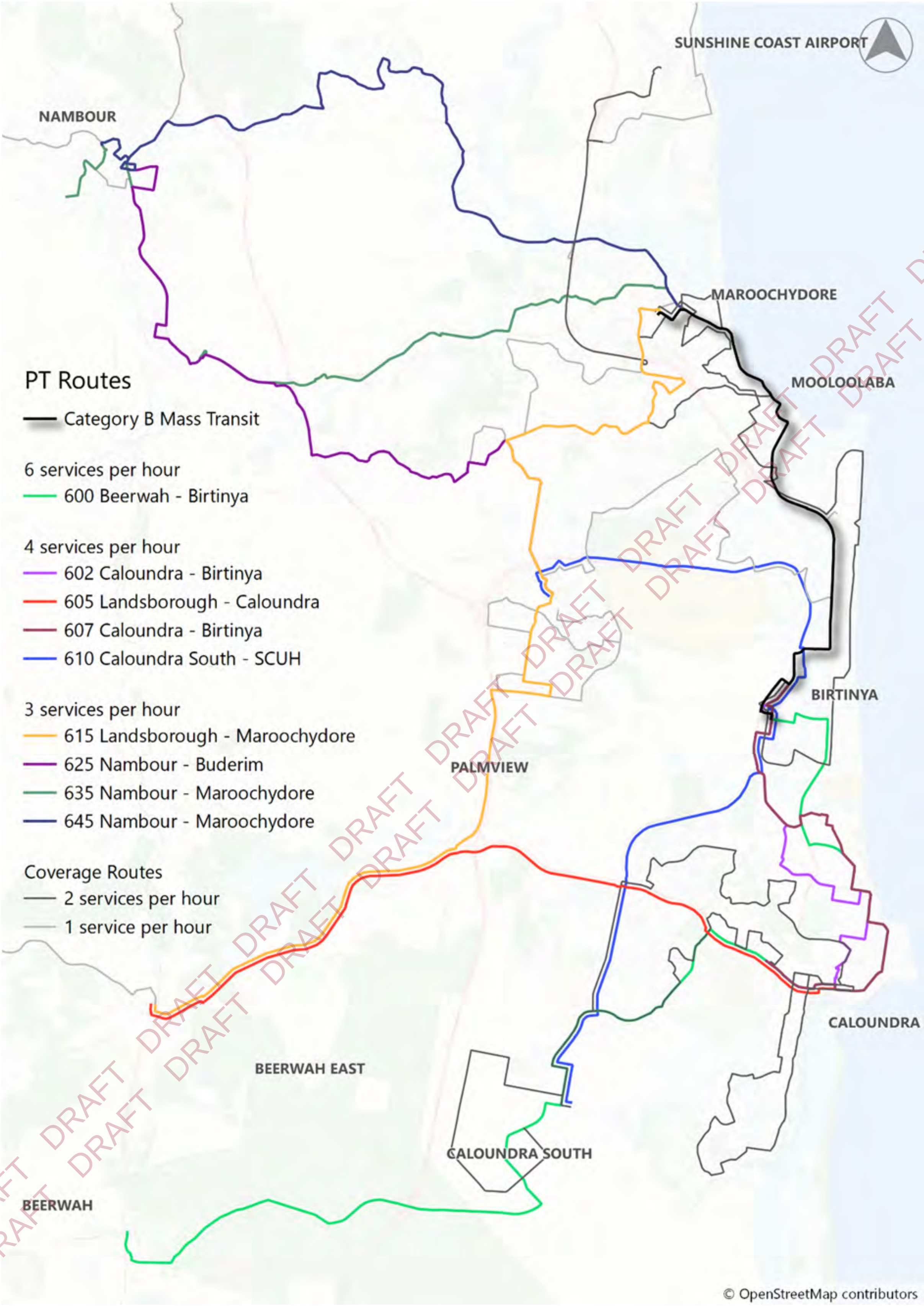

Figure 74 – Category B Mass Transit network showing supporting bus routes

The Category B Mass Transit Project options case also includes several road network changes to facilitate delivery within the existing road corridors and to minimise the need to widen the public road corridor.

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These changes include turn bans at some intersections and lane reduction on key arterials including Nicklin Way, Alexandra Parade and Walan Street as shown in Figure 75[169].

Figure 75 – Modelled road network changes to facilitate mass transit

12.2.4 QBC Project case

The QBC Project case includes infrastructure that gives priority to buses in the corridor extending from Maroochydore to SCUH. This priority infrastructure reflects, as closely as possible, the TMR CoastConnect: Caloundra to Maroochydore Concept Design. The QBC Project case includes a mix of dedicated and non-dedicated treatments and capacity reductions on Nicklin Way are still required. The primary mechanism is the kerbside bus lanes as proposed in CoastConnect.

Figure 76 illustrates sections of the corridor that have dedicated kerbside bus lanes and Table 71 outlines the frequency and road capacity reductions. In these sections, buses do not experience the full effects of congestion. All stops are high-quality premium stops, and this is modelled through lower stop access penalties. Bus travel speeds in sections of the corridor with priority are modelled at 10km/h faster than the travel speeds in adjacent general traffic lanes. Although buses have dedicated lanes, those turning left or looking for kerbside car parks share the lanes. There are no physical barriers, and the buses run alongside cycle lanes.

[169] Refer to Section 18.3 for discussion on supporting transport network projects that would offset the impacts of these lane reductions.

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Figure 76 – Quality Bus Corridor option as modelled.

Table 71 – QBC - frequency and road capacity reductions

Frequency (services per hour)	Road capacity reductions	Key points
AM Peak – eight services Inter Peak – eight services PM Peak – eight services	• Delete one general traffic lane in each direction between Eden Street and Lutana Street • Delete one South bound general traffic lane between Lutana Street to Kawana Island Boulevard.	• Mix of bus lanes and shared traffic lanes • Prepaid fares only • High quality bus stop treatments.

The QBC Project case is built around a different bus network to the Category B Mass Transit Project options. Figure 77 illustrates the QBC network with all bus routes benefitting from the bus lanes used. Passengers boarding any bus in these locations will benefit from improved bus stop infrastructure.

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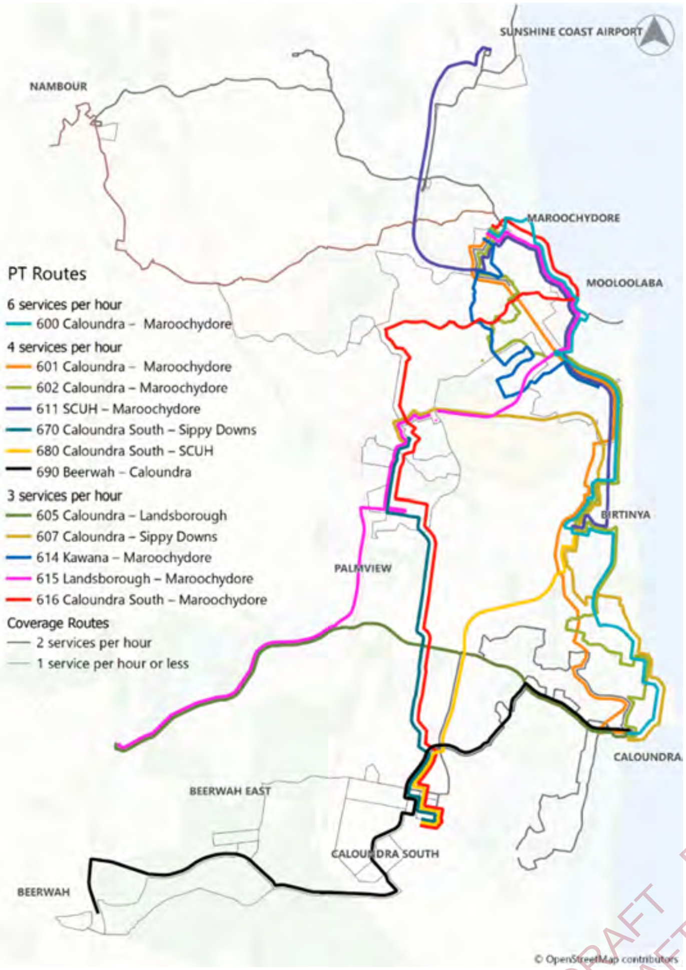

Figure 77 – Quality Bus Corridor option and supporting bus network

12.3. Performance against the transport option assessment criteria

12.3.1 Strategic transport driver 1: Improved passenger transport options increase public transport patronage

12.3.1.1 Public transport volumes

With the Category B Mass Transit Project case, the total number of daily public transport trips on the Sunshine Coast is forecast to increase significantly compared to the Base Case. Both LRT and BRT result in significant increases to public transport ridership with the most pronounced increase occurring from within the immediate corridor catchment.

As detailed in Figure 78, the 2041 forecasts indicate that approximately 25,200 (LRT) to 25,340 (BRT) new journeys are made each day from origins within the Sunshine Coast LGA when compared to the Base Case.

In comparison, the QBC Project case sees only marginal increases in the total number of trips made each day on the Sunshine Coast despite the redesign of the supporting bus network to make best use of the bus priority infrastructure, and reducing the need to transfer between services. The 2041 forecasts indicate that only 9,170 new public transport journeys are made each day under the QBC Project case from origins within the Sunshine Coast LGA when compared to the Base Case.

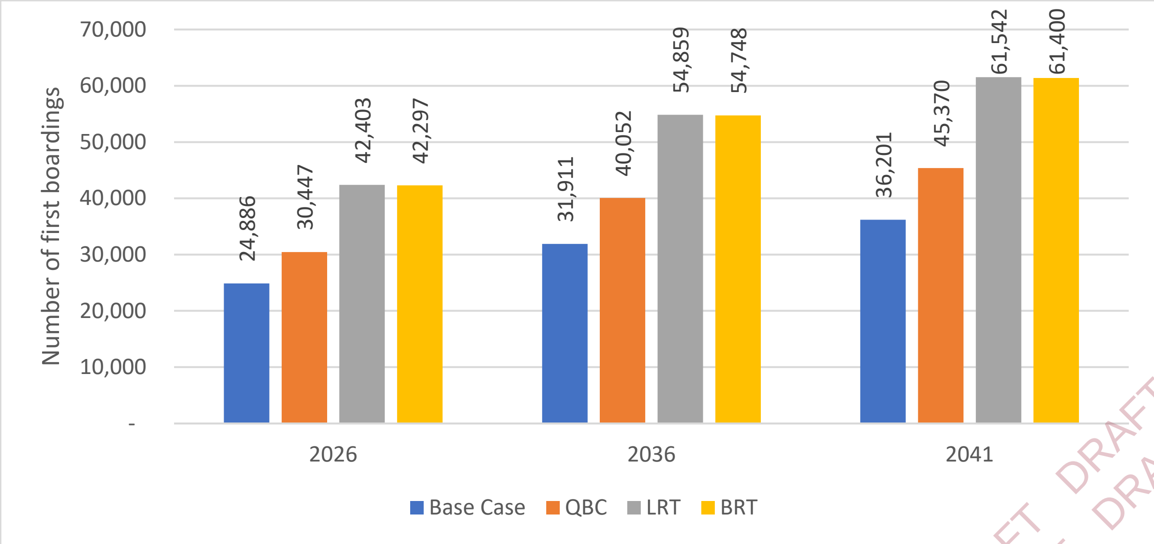

Figure 78 – Number of daily public transport trips from origins within the Sunshine Coast LGA; Base Case vs Category B Mass Transit[170] vs QBC

12.3.1.2 Public transport mode share

As shown in Figure 79, the Category B Mass Transit Project case result in a higher public transport mode share for all trips within the Sunshine Coast LGA when compared to the QBC Project case. Both the LRT and BRT options show up to 2.32 per cent public transport mode share in 2041, compared to 1.18 per cent under the Base Case. This represents a doubling of public transport mode share to approximately 49,000 trips per day in the Category B Mass Transit Project case compared to around 25,000 trips in the Base Case, with approximately15,000 fewer car trips. Public transport mode share in the QBC Project case shows only a slight increase, reaching just 1.57 per cent in 2041.

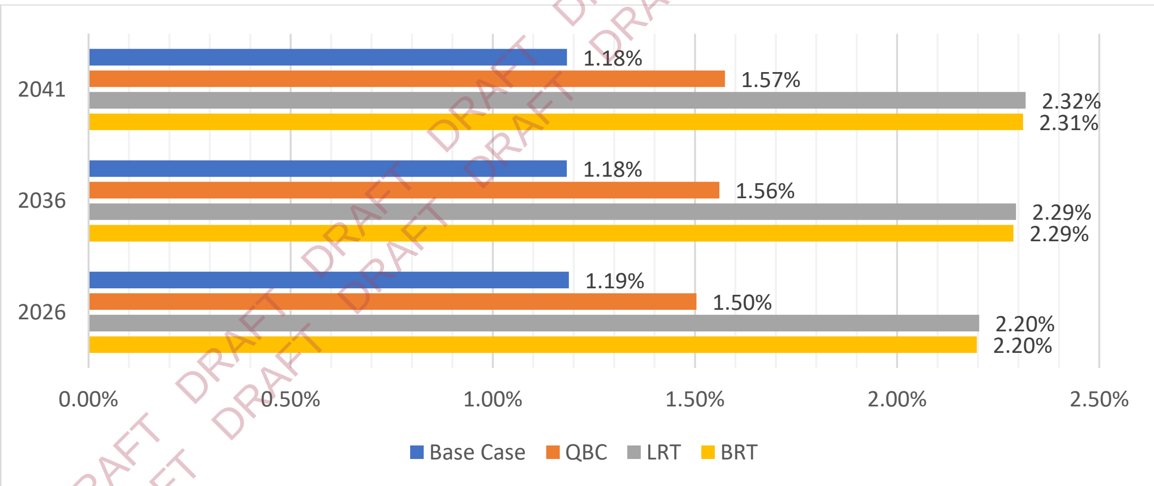

Figure 79 – Public transport mode share for all trips within the Sunshine Coast LGA

12.3.1.3 Daily Public transport loads

Figure 80, Figure 81 and Figure 82 show daily loads across the network in 2041 under the Category B Mass Transit Project case versus the QBC Project case. Loads per section of the LRT and BRT corridors range from 4,700 and 9,500 passengers a day with the most heavily utilised segments of the corridor being north of the Mooloolah River. Supporting bus routes play a vital role in facilitating movement between the light rail corridor and growth areas, as well as the suburban rail network to the west. The highest daily load in Priority Area 1 under the QBC Project case occurs at the entrance to Maroochydore town centre with 5,700 total movements. However, unlike the Category B cases, this demand is spread across multiple bus routes.

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[170] Modelled as LRT and BRT only. Trackless Tram is assumed to be the same as BRT in this strategic analysis

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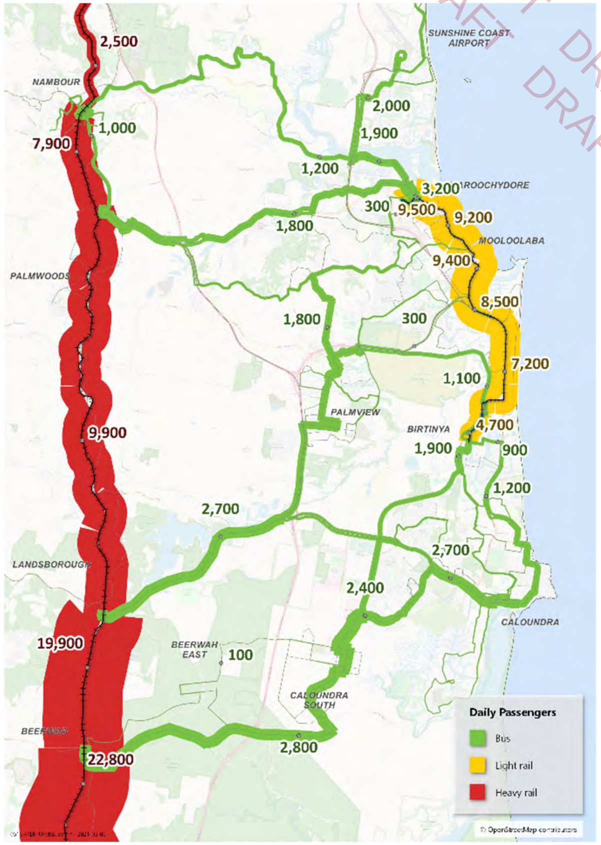

Figure 80 – 2041 daily public transport loads – LRT

Figure 81 – 2041 daily public transport loads – BRT

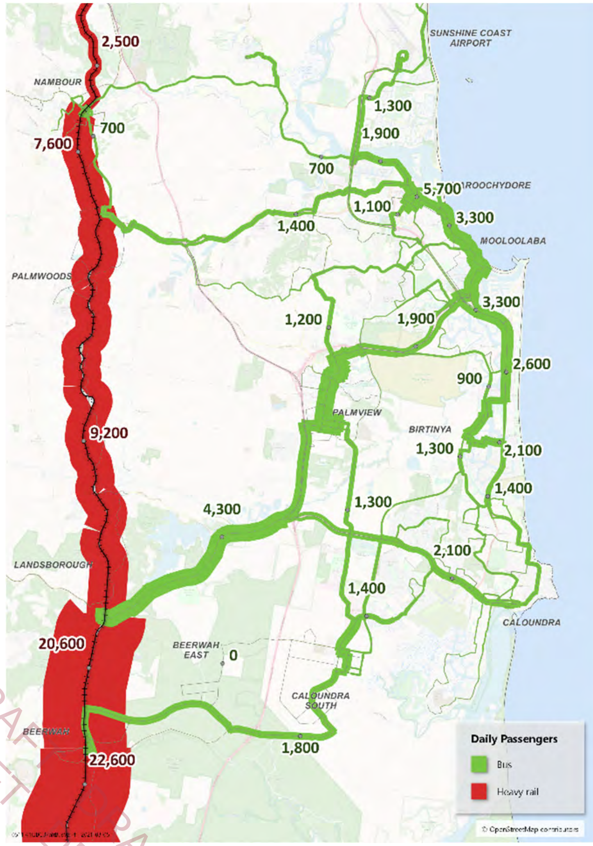

Figure 82 – 2041 daily public transport loads – QBC

12.3.1.4 Daily Public transport boardings

The forecast number of total boardings from within the Sunshine Coast Region is significantly higher in all modelled years as a result of the Category B Mass Transit Project case. Figure 83 provides a breakdown of total boardings by public transport type. Under the QBC Project case, the forecast number of boardings from origins within the Sunshine Coast is only marginally higher than the Base Case in all modelled years. Figure 83 showcases a breakdown of total daily boardings by mode.

For the Category B Mass Transit Project case, including transfers, there are approximately 76,500 boardings forecast each day within the Sunshine Coast LGA and just under 40 per cent of these boardings are on LRT/ BRT services. For the QBC Project case, including transfers, there are approximately 51,700 boardings forecast each day within the Sunshine Coast LGA in 2041, 33 per cent less than the Category B cases.

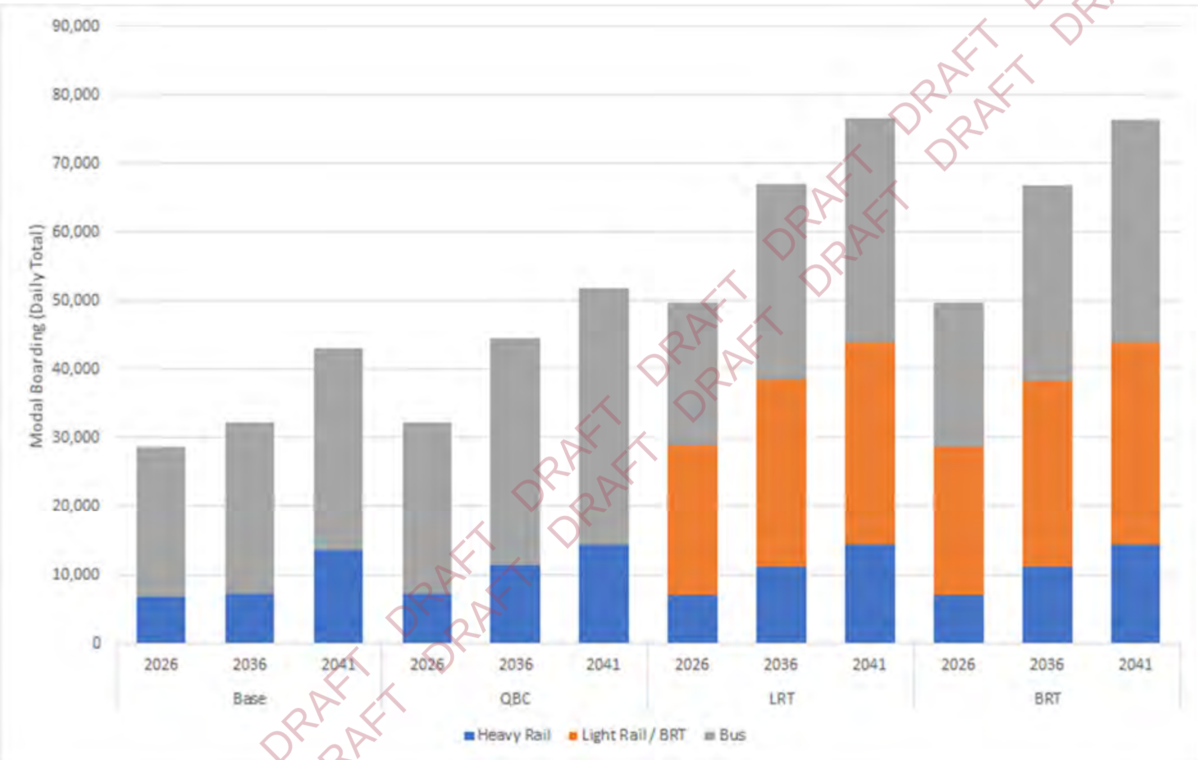

Figure 83 – Daily boardings by service type (Category B Mass Transit vs QBC) from Sunshine Coast LGA

The following tables and charts detail daily boarding, alighting and total passenger load statistics for the Category B Mass Transit Project case and the QBC Project case.

Maroochydore station is the busiest in terms of both boarding and alighting, given it is located at the entrance of the Maroochydore centre and serves the greater Maroochydore area. After Maroochydore, the SCUH station is the southern terminus of the light rail line and has the second-highest level of demand. The Park 'n' Ride and bus interchange at Bundillla Station results in the third-highest passenger demand each day.

Figure 84 and Figure 85 show the patronage profile of northbound Category B, LRT and BRT services during the 2-hour AM peak period (7am to 9am) in 2041, by mode and the cumulative load on each segment of the corridor. Most mass transit users in the AM peak access the service by active transport modes, 29 per cent drive or get dropped off, with most of these (45 per cent) occurring at the major Bundilla Park 'n' Ride.

Only six per cent of all mass transit boardings transfer from a bus.

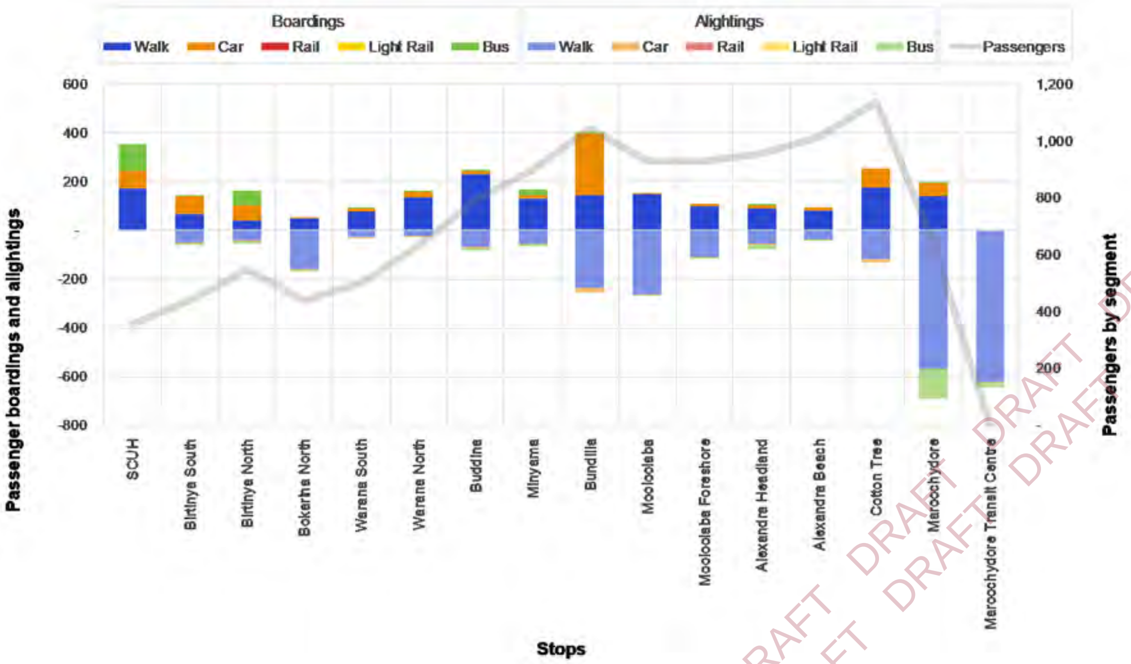

Figure 84 – Northbound line loading, boarding and alighting in Priority Area 1, 2041 AM Peak (7-9am), LRT

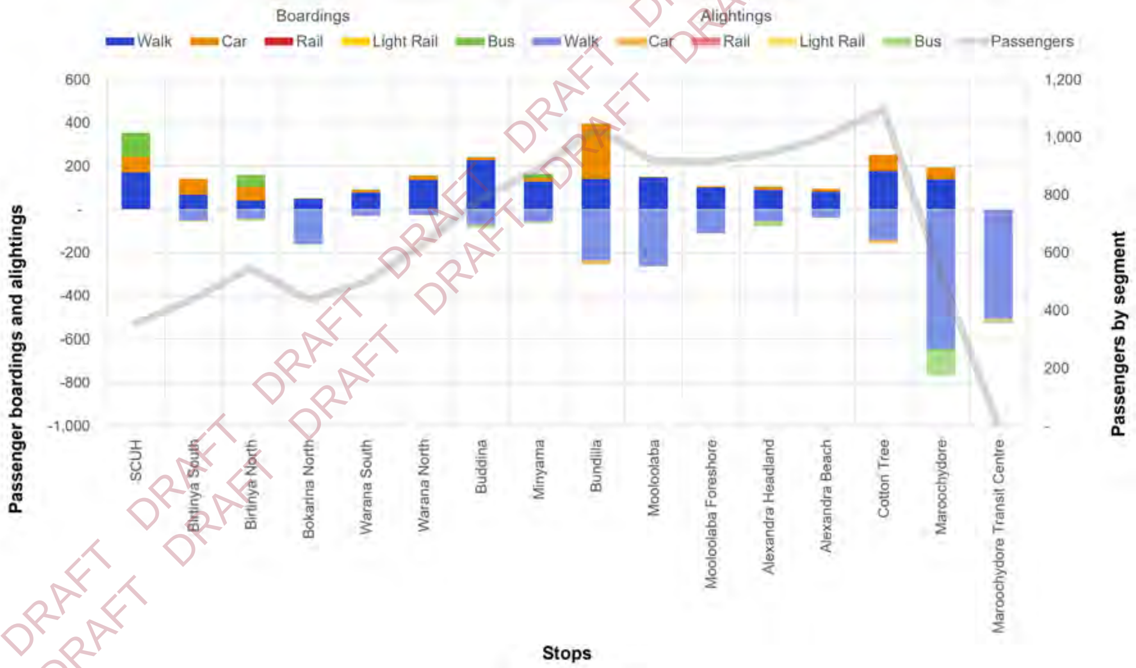

Figure 85 – Northbound line loading, boarding and alighting in Priority Area 1, 2041 AM Peak (7-9am), BRT

Under the QBC scenario, the 600 route forms the busiest route of the coastal bus network. The 600 route runs from Caloundra to Maroochydore CBD at ten-minute headways.

Figure 86 shows the daily patronage profile of northbound 600 services under the QBC Project case.

Figure 86 – Northbound 600 bus line loading, boarding and alighting in Priority Area 1, 2041 AM Peak (7-9am), QBC

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12.3.2 Strategic transport driver 2: Increased accessibility to key destinations by public transport

Figure 87 to Figure 95 show the percentage change in generalised costs of travel by public transport for users accessing the University of the Sunshine Coast (USC), SCUH and Maroochydore town centre. Generalised cost includes all elements of a journey including access, wait and transfer times, and the perceived quality of services provided.

Under the Category B Mass Transit Project case, there are significant improvements to public transport accessibility across the region given more frequent and reliable connections to activity centres are provided. It is evident from these plots that the Category B Mass Transit Project case significantly reduces the cost of travel to key destinations, with benefits extending far further than the corridor itself.

Access to the USC

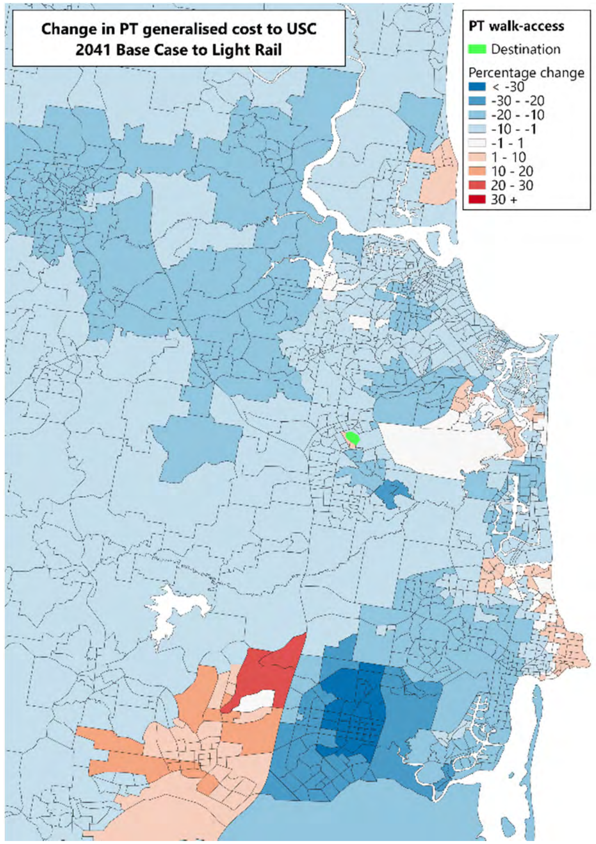

Figure 87 – Change in PT cost to access USC (LRT v Base 2041)

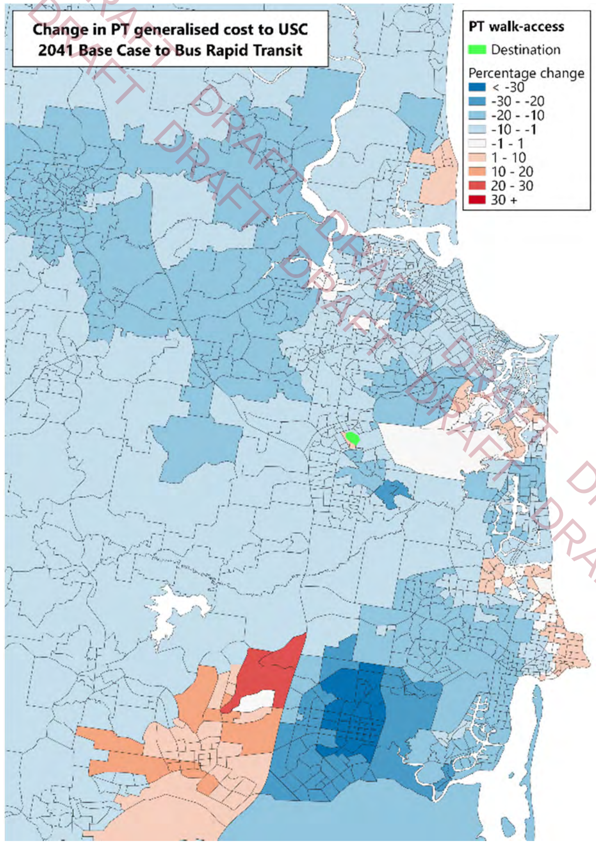

Figure 88 – Change in PT cost to access USC (BRT v Base 2041)

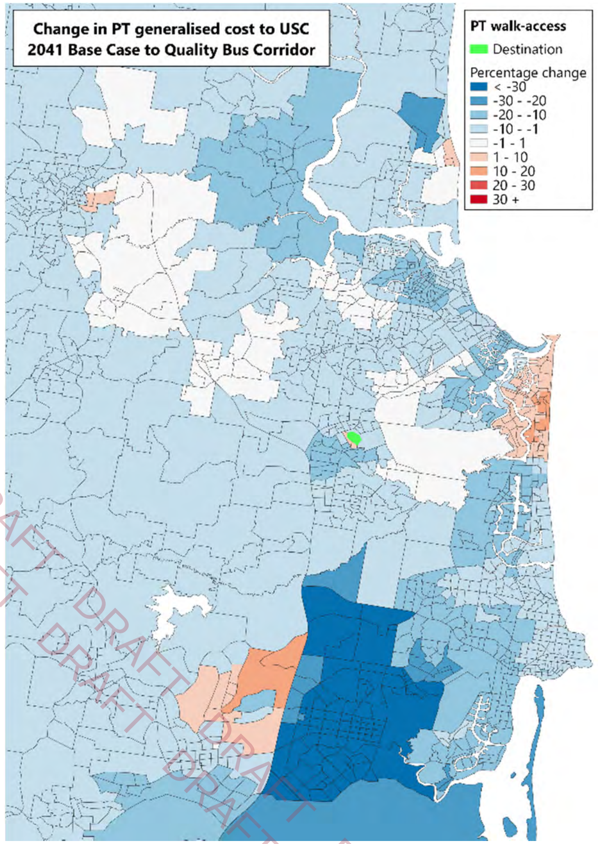

Figure 89 – Change in PT cost to access USC (QBC v Base 2041)

Access to the SCUH

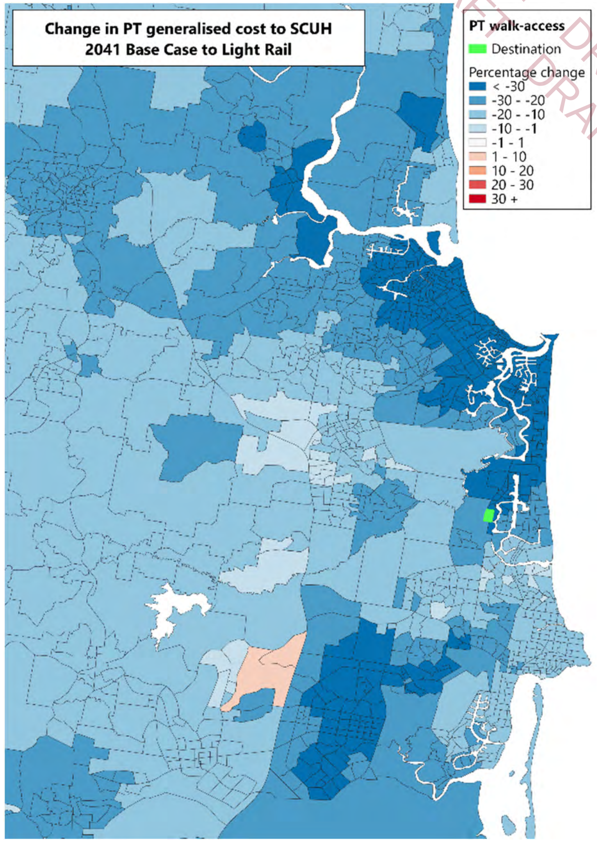

Figure 90 – Change in PT cost to access SCUH (LRT vs Base 2041)

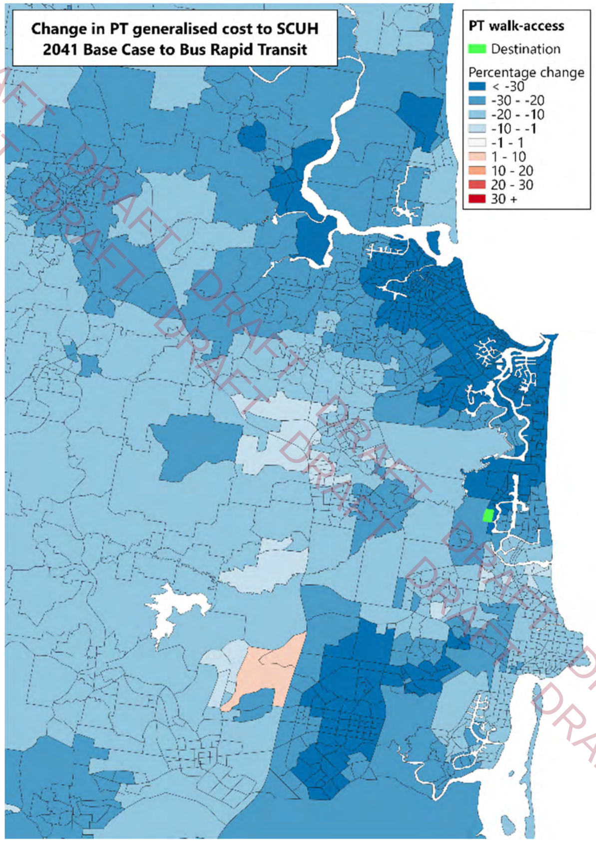

Figure 91 – Change in PT cost to access SCUH (BRT vs Base 2041)

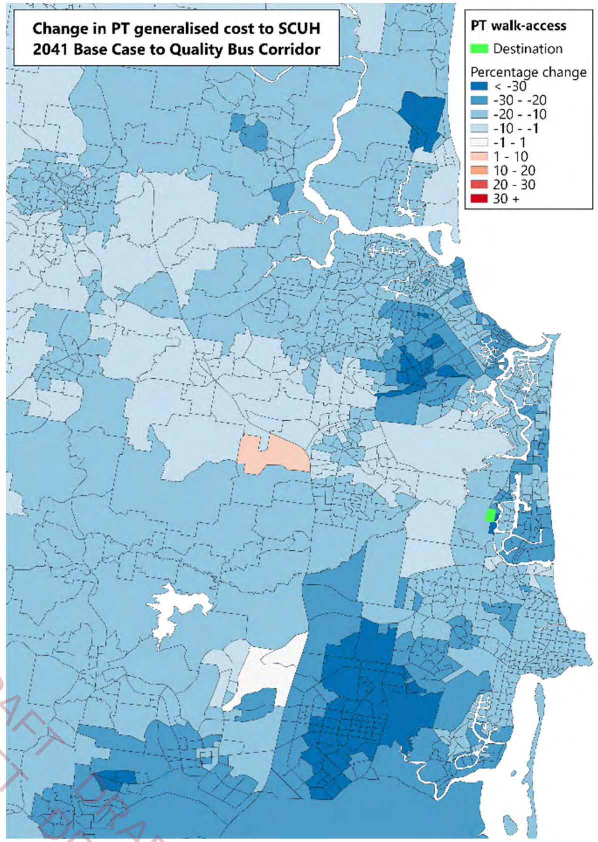

Figure 92 – Change in PT cost to access SCUH (QBC vs Base 2041)

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Access to the Maroochydore CBD

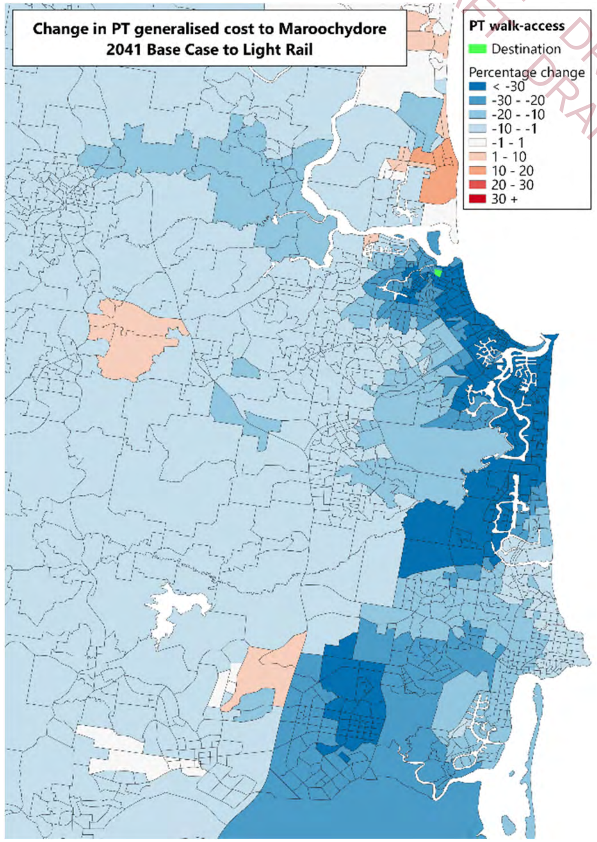

Figure 93 – Change in PT cost to access Maroochydore (LRT v Base 2041)

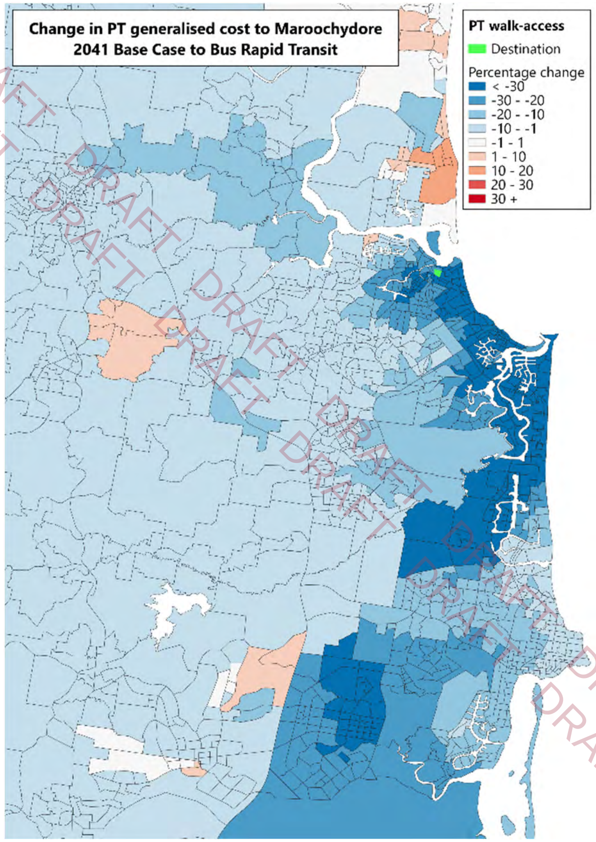

Figure 94 – Change in PT cost to access Maroochydore (BRT v Base 2041)

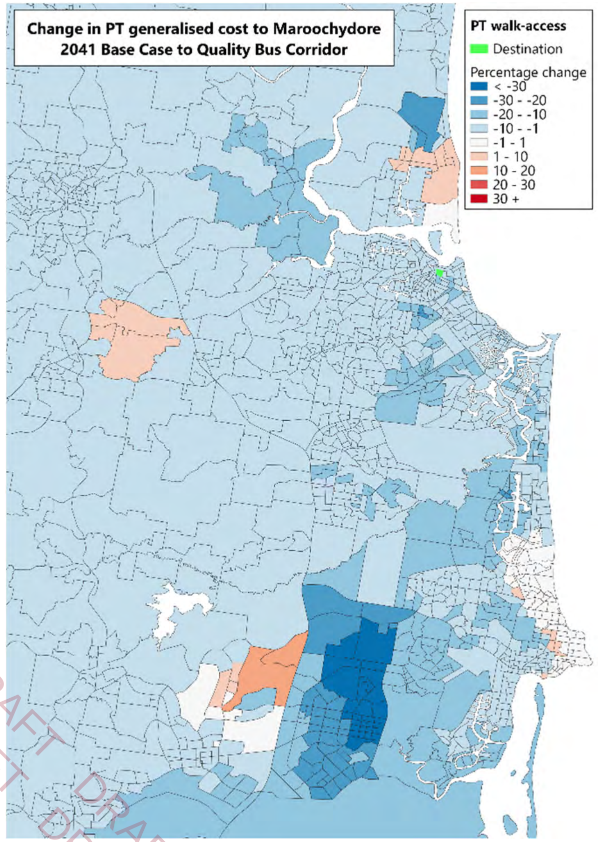

Figure 95 – Change in PT cost to access Maroochydore (QBC vs Base 2041)

12.3.3 Strategic transport driver 3: A transport system that increases access to employment by PT and facilitates journey to work self-containment

The Category B Mass Transit Project case corridor connects the Sunshine Coast's CBD and the Maroochydore Regional Economic Cluster with the major activity centre, health, knowledge and technology precinct at Birtinya. The Category B Mass Transit Project case includes a dedicated ROW for its entire route. This priority and travel time competitiveness significantly increases public transport mode share for work during peak times. The proportion of journeys to work made on public transport is three times higher under the Category B Mass Transit Project case than in the Base Case.

In 2041, journey to work mode share from within Priority Area 1 almost triples from 2.64 per cent in the Base Case up to 7.46 per cent for Category C options as demonstrated in Figure 96.

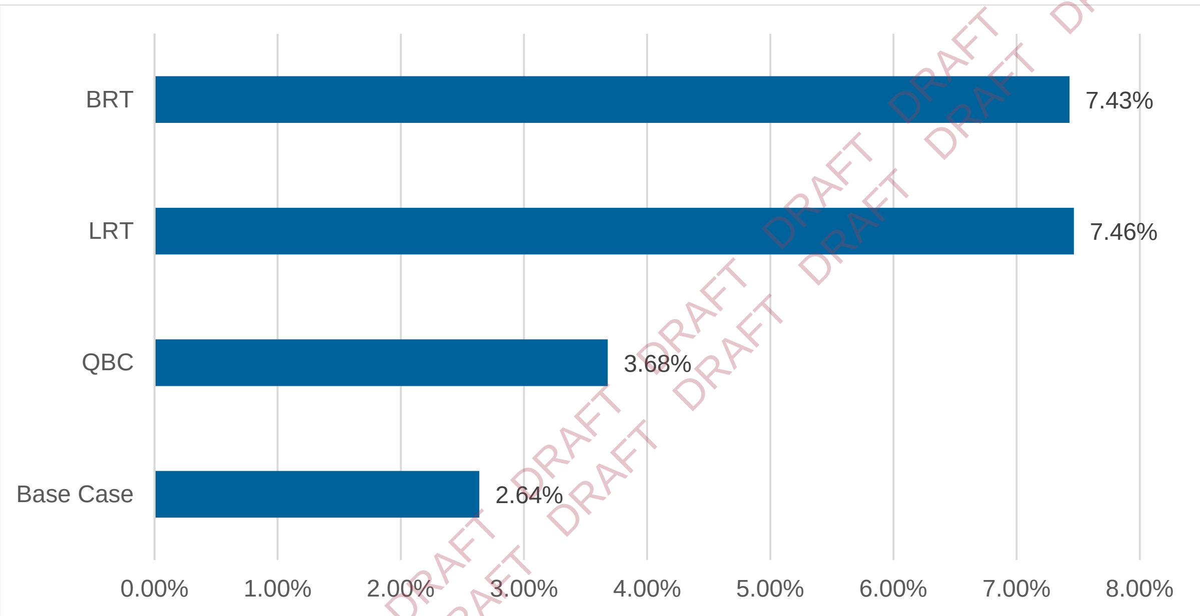

Figure 96 – 2041 public transport mode share for journey to work trips within Priority Area 1 (origin and destination), Base Case vs. Category B Mass Transit vs QBC

Journey to work self-containment marginally increases when compared to the Base Case. In the Category B options, there are approximately 1,500 more trips to work being made to local destinations within the Sunshine Coast Region

Figure 97, Figure 98 and Figure 99 show the change in the number of jobs accessible within 45 minutes by public transport as a result of the Category B Mass Transit Project case and the QBC Project case.

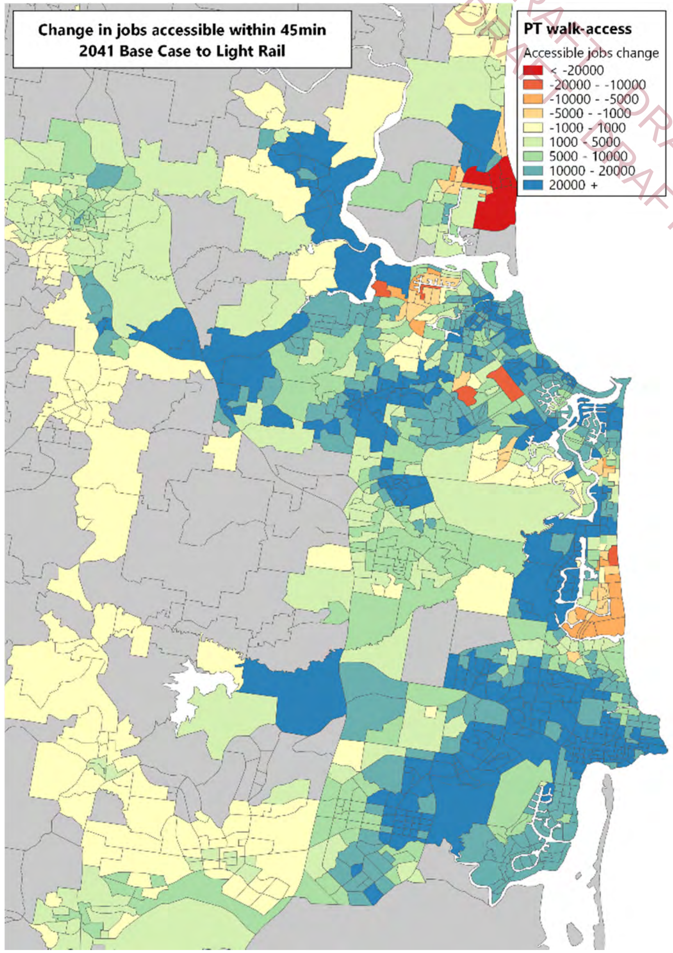

Figure 97 – Change in the number of jobs that can be accessed within 45 minutes (LRT – Base Case)

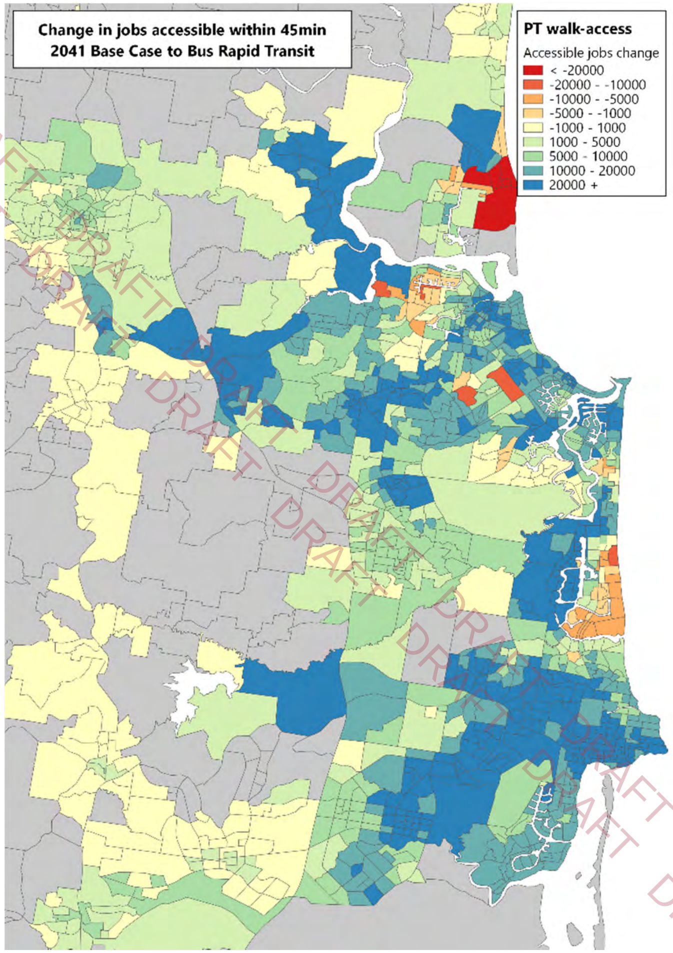

Figure 98 – Change in the number of jobs that can be accessed within 45 minutes (BRT - Base Case)

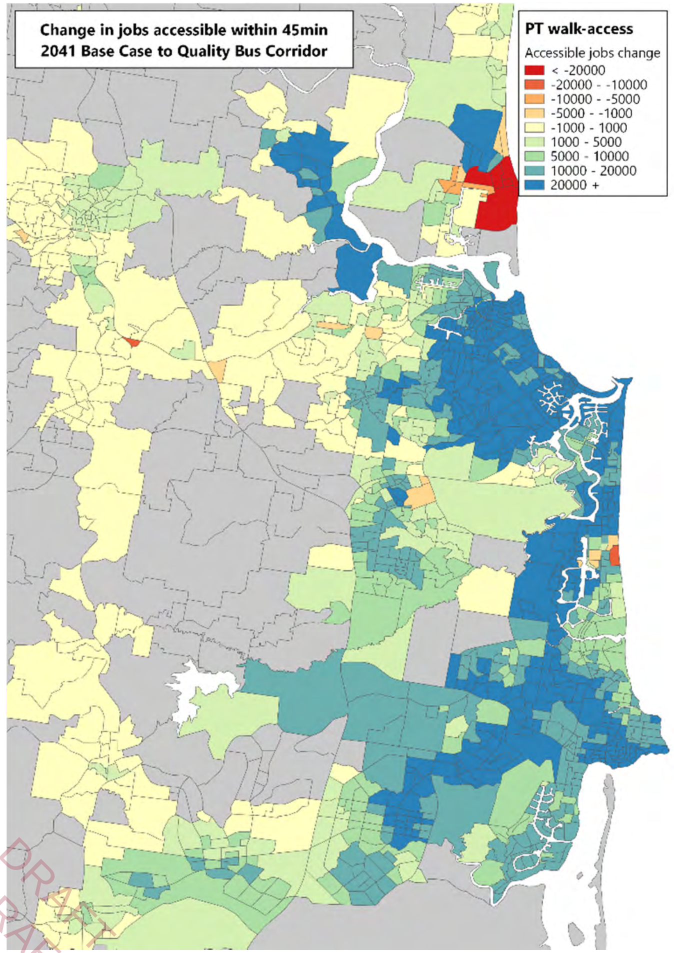

Figure 99 – Change in the number of jobs that can be accessed within 45 minutes (QBC - Base Case)

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12.3.4 Strategic transport driver 4: A mass transit system that reduces reliance on car and reduces transport costs for users.

Total VKT within the Sunshine Coast Region LGA is lower in all years under the Category B Mass Transit Project case. In 2041, total VKT within the Sunshine Coast Region LGA reduces by an average of approximately 184,350 km each day (-1.17 per cent) from Base Case as a result of the Category B interventions, as demonstrated in Figure 100.

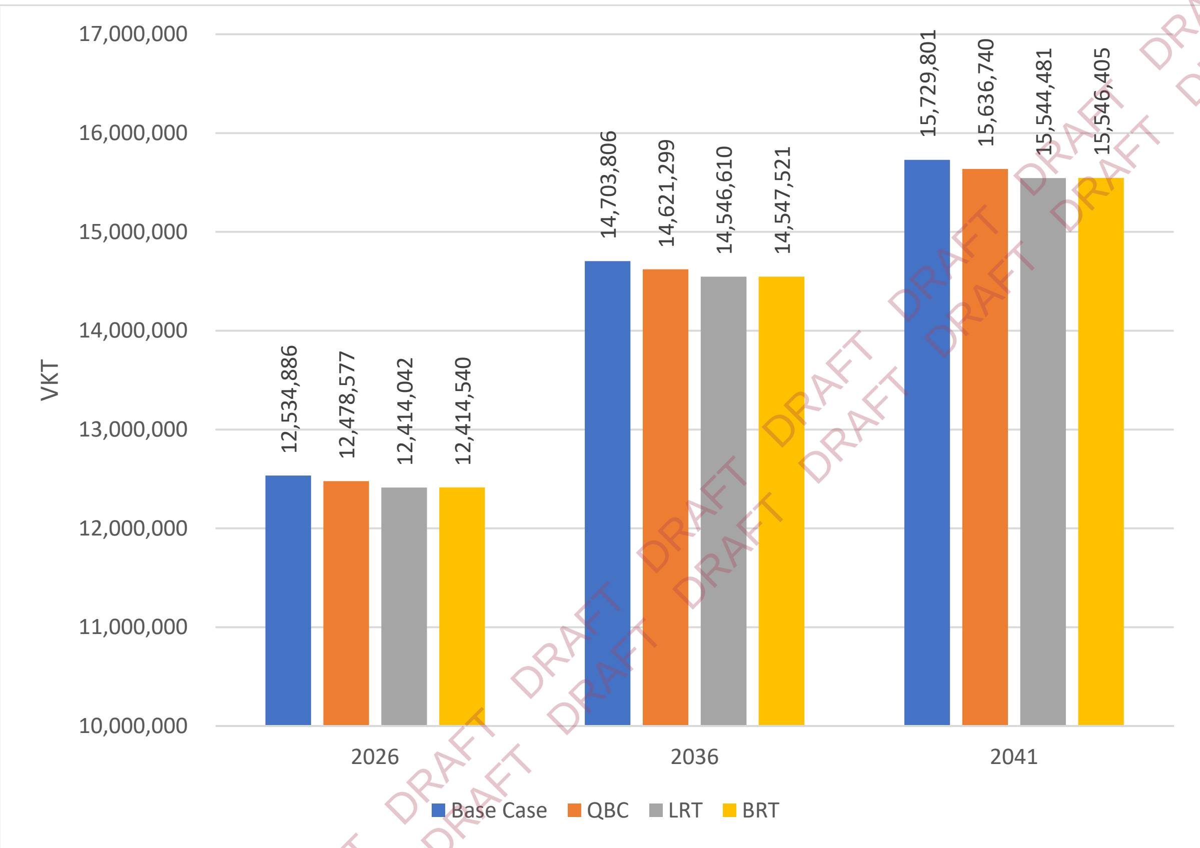

Figure 100 – VKT within the Sunshine Coast LGA

A significant benefit of the Category B Mass Transit Project case is the priority and legibility of a dedicated corridor that has the ROW for its entire route. As a result, passengers have more competitive and more reliable travel times, services are more attractive, and legibility is dramatically improved.

The downside is that dedicated corridors such as this require space for infrastructure. In the Category B options, the area needed to facilitate the dedicated ROW is attained through utilising space within the existing road reserve, in some cases repurposing this space from traffic lanes or car parking. Some increases to road corridor widths are also required. Areas where general traffic lane reductions occur are illustrated in Figure 75. Each of these capacity reductions has a cost impost on those who continue to use cars, and the highest costs occur on Nicklin Way. However, there will be a high-quality mass transit option available for many of these users if they choose to use it.

Congestion in the AM peak is illustrated by the VC ratio plots Figure 101 to Figure 103 which show the forecast VC ratios in 2041 scenario on Nicklin Way for the Base Case, the Category B Mass Transit Project case and the QBC Project case.

With the Category B Mass Transit Project case in place, the busiest sections of Nicklin Way may need to carry up to approximately 72,400 vehicles per day by 2041. Forecast travel speeds are lower than those in the Base Case, with the worst sections only 10km/hr slower for a short distance.

Compared to the Base Case, vehicle-hours delay on Nicklin Way (from the Mooloolah River Bridge to the Currimundi Creek) increase by 1,165 hours per day, or less than 60 seconds per vehicle on average. It should be noted however that in the Base Case, there is also significant congestion at Currimundi Creek.

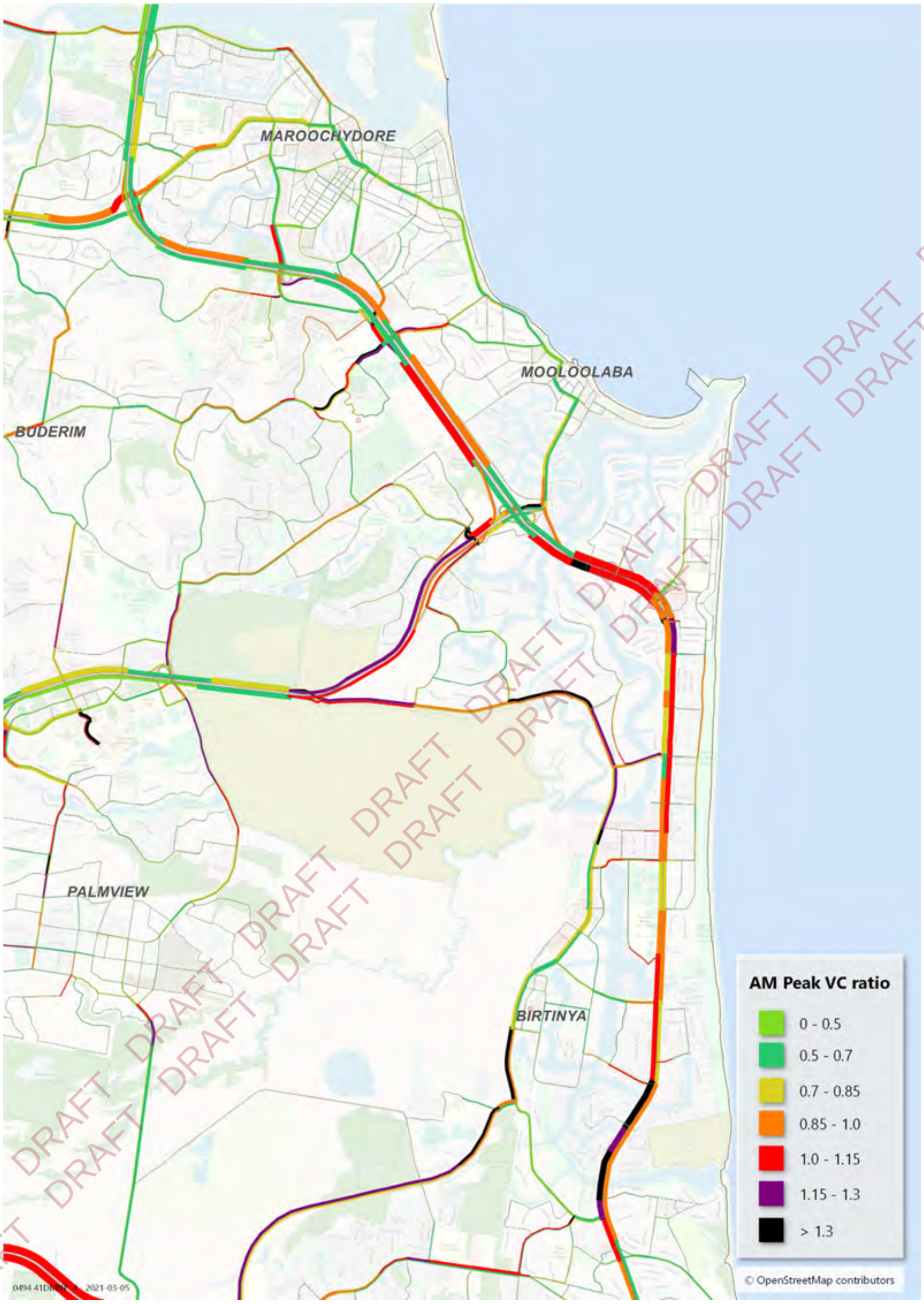

Figure 101 – Base Case VC ratio Nicklin Way, AM peak

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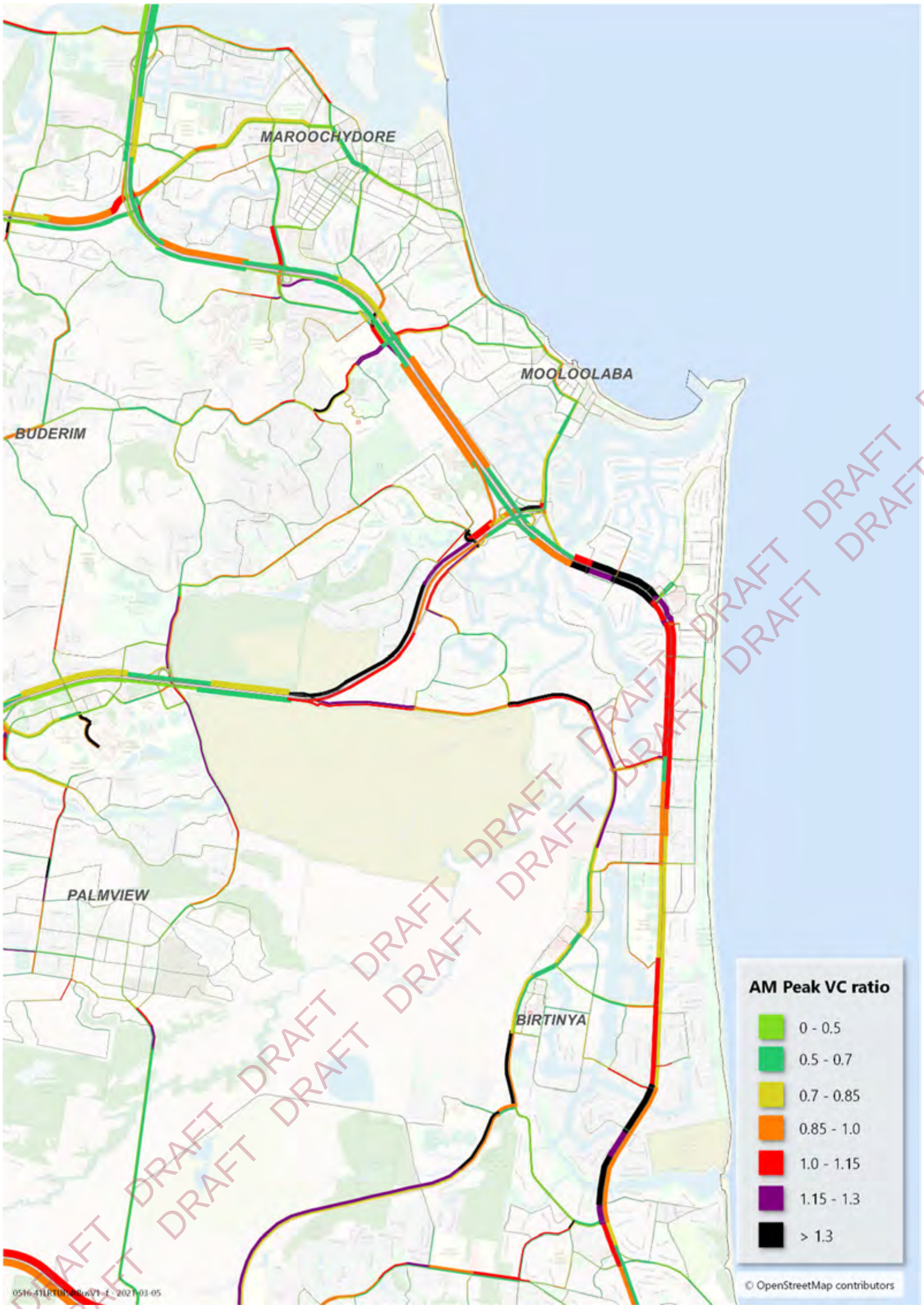

Figure 102 – Category B - LRT, BRT and TT scenario VC ratio Nicklin Way, AM peak

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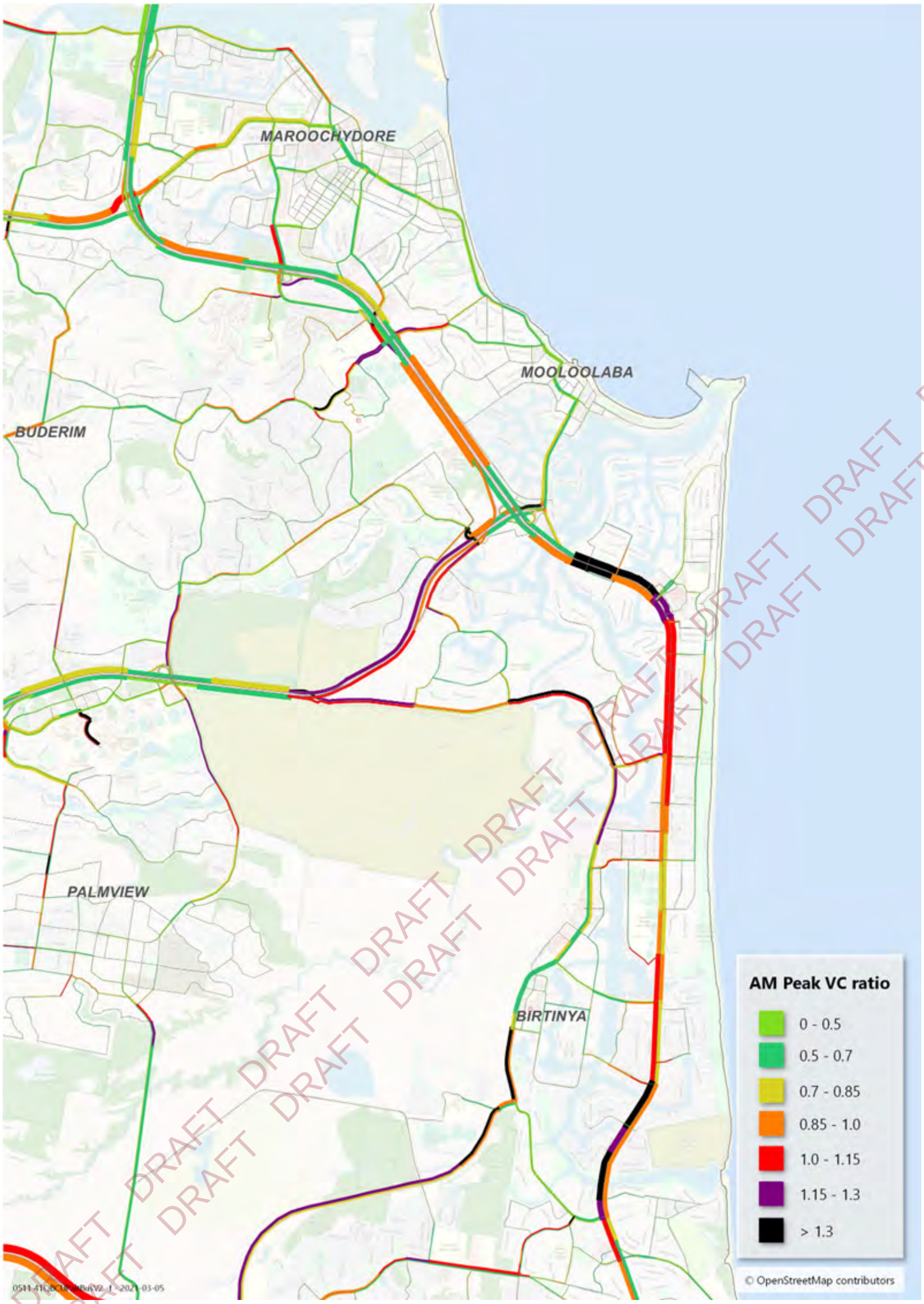

Figure 103 – QBC scenario VC ratio Nicklin Way, AM peak

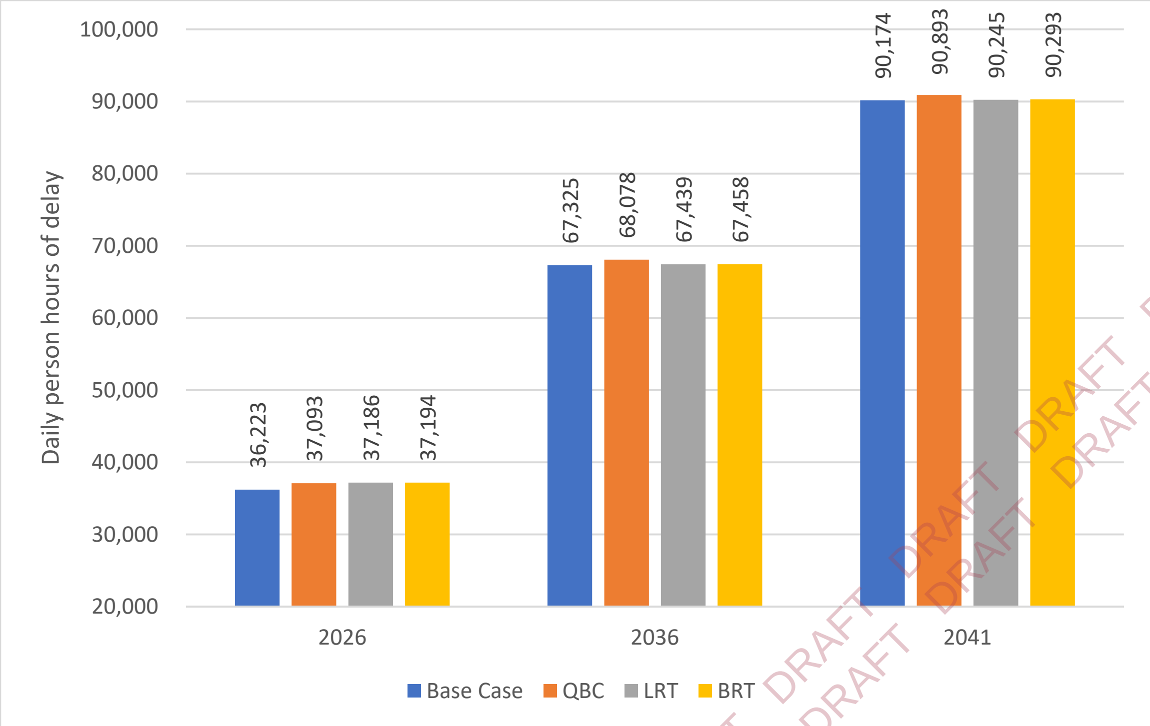

Figure 105 – Daily person hours of delay for car users

Figure 104 – Hours delay for car users 2026 -2041 for Base Case and all options

Figure 105 shows hours of delay for car users in 2041 remaining relatively the same across the Base Case, the QBC and the Category B options. Given the removal of existing road space under the Category B Mass Transit Project case, road congestion increases slightly from Base Case despite the growth in public transport trips and reduction in VKT.

However, when all users are considered, it is the QBC Project case which increases the person hours of delay the most from Base Case under the 2036 and 2041 scenarios, as shown in Figure 104.

The QBC Project case still involves the reduction of road capacity (particularly on Nicklin Way) due to the buses having dedicated lanes, but higher congestion is experienced as public transport mode share for QBC does not significantly increase as it does for the Category B options.

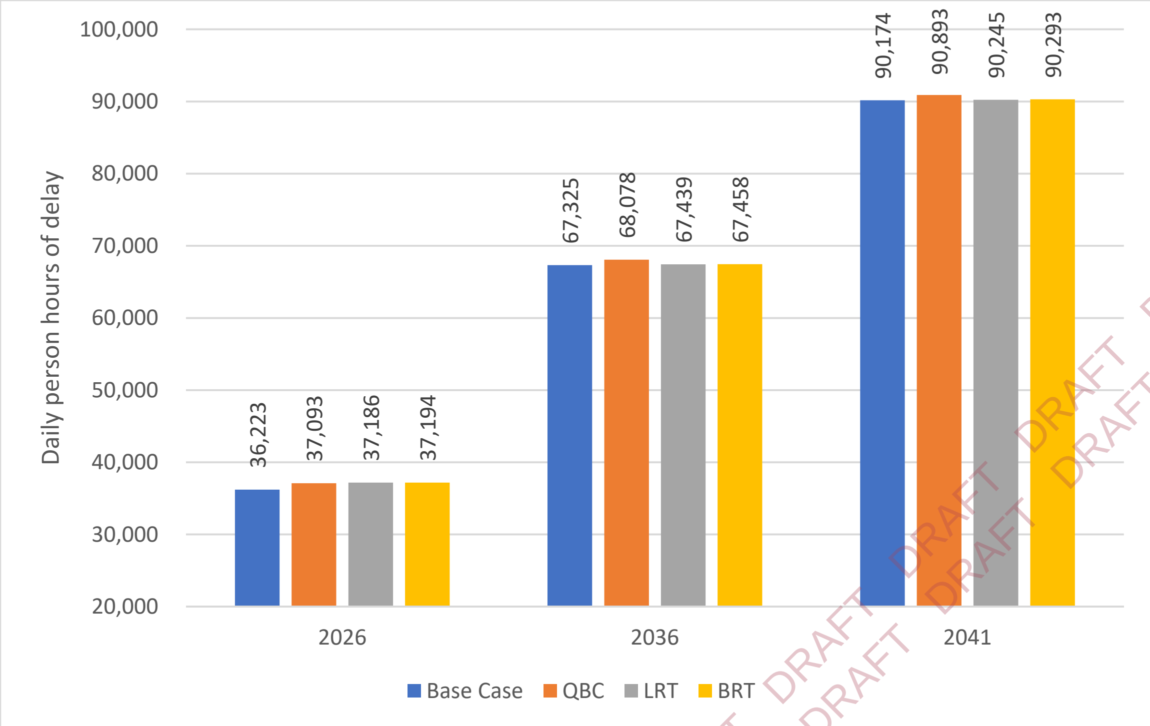

Figure 105 – Daily person hours of delay for car users

12.4. Summary of transport outcomes

When transport considerations are considered alone, the outcomes confirm the best performing option against the service needs are the Category B options, which outperform the Category C QBC option in all four strategic transport drivers assessed in this chapter.

The QBC Project case provides some time savings for public transport users but fails to deliver the step-change in mode shift observed under the Category B Mass Transit Project case. The QBC Project case leads to the highest increase in the total hours of delay experienced by car users and is the least valuable Project case from a transport outcomes perspective.

All of the options require some general traffic capacity reductions in the existing road network unless acquisitions of property are made to facilitate the previous traffic capacity.

The most noticeable increase in travel times as a result of congestion occurs on Nicklin Way between Eden Street and Lutana Street. In the case of this segment, there are very few alternative routes, and congestion is unavoidable from several areas, assuming the MRI project is not provided. However if the MRI project is provided, there is an alternative route for those who continue to drive to destinations outside of the SCMT corridor, (i.e. those who were previously using Nicklin Way as a through-route to get somewhere else).

Figure 106 visualises the cumulative impacts of lane reductions, public transport provision and population growth. For each link, the map shows which Project case delivers the least congestion. Orange links in this plot show where LRT delivers the lowest levels of congestion, and the impacts of redistribution are clear. LRT reduces the congestion most on the Bruce Highway and the section of Nicklin Way in Priority Area 1, relative to the other project cases. BRT and LRT combined show a high level of influence, even outside of the catchment of Stage 1 of the Project.

Figure 106 – Lowest level of congestion by project case (2041 AM peak)

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SOCIAL AND ENVIRONMENTAL IMPACTS

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13. Social and Environmental Impacts

13.1. Social impact assessment

13.1.1 Social Impact Assessment approach

The BQ Social Impact Evaluation Guide (SIE), released 2 December 2016, has been used to guide the discussion of the existing social and economic environment. The three step process, defined in the SIE Guide, has been used as general reference for the discussion of the existing social environment, potential impacts and mitigation measures.

The SIE focuses on the potential social impacts of Project options, relative to the social impact baseline (SIB).

In undertaking the SIE, regard has been given to the existing social environment and the likely degree of change (positive or negative impact) in the Stage 1 corridor during the construction and operation stages of the Project. Key elements of the SIE included:

- Identifying potential social impacts associated with Project delivery and operation
- Identifying appropriate measures to manage or mitigate potential impacts on the social environment and maximise potential benefits
- Undertaking a risk assessment of the potential impacts.

13.1.2 Identification of social impacts

This section details the social impacts which may be expected to occur as a result of the Project being implemented, during construction and upon commencement of services. The expected social impacts are perceived to be similar for the BRT, TT and LRT Project options (Category B). This includes benefits and costs that have been allocated into the following categories, based on the SIE Guide:

- Community, quality of life and lifestyle – transport
  - Social impact arising from transport, traffic and congestion in the Social Assessment during construction and operation of the Project. These social impacts involve community, quality of life and lifestyle.
- Personal and property rights
  - The effects of any land acquisitions and personal impacts caused by the Project – particularly where people are economically affected, or experience personal disadvantage, which may include where their civil liberties are infringed. This could also be perceived as positive impacts in the advantages gained from increased property values.
- Local community roads and infrastructure
  - Social impacts on the community resulting from the changes to local roads and supporting infrastructure for the Project.
- Community
  - The construction and operation stages of the Project will have an effect on the community through the impact on services and accessibility to parts of the region.
- Public health and amenity
  - The Project may impact air, noise and vibration levels in the Social Assessment Area.
- Lifestyle – business and employment
  - Impacts on the way people behave and relate to family, friends and cohorts on a day-to-day basis, particularly with a focus on the significant number of businesses and employment centres that will be impacted throughout the construction and operation stages of the Project. In particular, the lifestyle advantage and impacts of improved access to high speed, legible public transport for commuters.

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- Quality of life and cultural impacts – environmental and cultural heritage
  - Impacts to the natural environment and cultural heritage land due to the construction or operation of the Project.

13.1.3 SIE outcomes

The outcomes of the SIE are reflected in the Reference Project and design, environmental assessment and sustainability assessment and should be considered alongside the quantitative economic results presented in Chapter 15.

Based on the assessment of the social impacts, a summary of the comparative expectations between the different options has been outlined in Table 72. The numbers in the table denote the total number of matters identified against that category.

Table 72 – Comparative social impact assessment

Positive Social impacts (benefits)	LRT (Cat B)	Trackless Tram (Cat B)	BRT (Cat B)
High likelihood/consequence	9	9	9
Medium likelihood/consequence	4	3	3
Low likelihood/consequence	-	1	1
Neutral social impacts	**LRT (Cat B)**	**Trackless Tram (Cat B)**	**BRT (Cat B)**
High likelihood/consequence	2	1	1
Medium likelihood/consequence	3	4	4
Low likelihood/consequence	3	3	3
Negative social impacts (costs)	**LRT (Cat B)**	**Trackless Tram (Cat B)**	**BRT (Cat B)**
High likelihood/consequence	8	8	8
Medium likelihood/consequence	4	4	4
Low likelihood/consequence	-	-	-

The SIE has been used to identify the key social impacts of each Project option and categorise the evaluation approach for each impact. The Project Team will continue to monitor the social impacts and update the SIE for future stages of the business case.

The 2021 community engagement by Sunshine Coast Council is critical for updating this assessment and will be used to finalise this Options Analysis.

13.2. Environmental Assessment

13.2.1 Purpose and overview

This Environmental Assessment has been prepared as part of the SCMT Options Analysis to identify and assess potential environmental and heritage risks of both the SCMT options.

The Project area for this assessment has been based on the Preliminary Concept Designs for the LRT and BRT along the identified route. Additional information has been sourced from planning information available for the QBC option.

The section aims to identify and broadly consider critical issues that may impact the viability of the Project. Detailed consideration of environmental and heritage impacts will be undertaken during the Detailed Business Case stage.

The purpose of the Environmental Assessment is to provide the following:

- Review of previous documentation prepared for the Project
- Desktop review of publicly available information relevant to environmental, heritage and planning matters
- Identification and preliminary assessment of potential environmental and heritage risks of relevance to the proposed Project
- A preliminary assessment of the likelihood of occurrence of Matters of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), including a statement of the need to refer the Project to the Australian Minister for the Environment for assessment under the EPBC Act
- Nomination of potential mitigations for further design during the Detailed Business Case stage to enable impacts from key environmental and heritage risks to be avoided, minimised, mitigated or offset.

13.2.2 Desktop review

The desktop assessment involved the following:

- Review of previous documentation related to the Project, including:
  - Concept Mass Transit Master Plan
  - SCMT SBC[171]
  - Concept Designs for BRT and LRT
  - CoastConnect information
  - Route Planning Impact Assessment report by Arup, 2014
- Review of publicly available information relevant to environmental, heritage and planning matters, through reference to the listed supporting information sources:
  - Water, soils and land management, and ecology listed in Table 73
  - Cultural heritage, amenity and special areas and tenures listed in Table 74.

[171] Sunshine Coast Council (2019). Sunshine Coast Mass Transit Strategic Business Case.

Table 73 – Information sources for water, soils and land management, and ecology

Water	Soils and land management	Ecology

• Applicable standards prescribed within the Environmental Protection (Water and Wetland Biodiversity) Policy 2019
• Catchment maps
• CoastConnect – Caloundra to Maroochydore: Concept Design and Impact Management Plan (CDIMP)[172]
• State Planning Policy (SPP) Interactive Mapping System
• Development Assessment Mapping System[173]
• *Sunshine Coast Planning Scheme 2014* – Flood mapping
• Queensland Globe layers:
  – Watercourses, drainage areas and catchments under the Water Act 2000 (Water Act)
  – Queensland waterways for waterway barrier works under the Fisheries Act 1994 (Fisheries Act)
  – DES coastal hazard areas
  – DES storm tide inundation areas.
	• Atlas of Australian Soils and Acid Sulphate Soils (ASS)
	• CoastConnect CDIMP
	• Queensland Globe including the following layers:
	  – Department of Natural Resources, Mines and Energy (DNRME) ASS mapping
	  – Atlas of Australia soils
	• Department of Environment and Science (DES) Environmental Management Register (EMR) and Contaminated Land Register (CLR)
	• *Sunshine Coast Planning Scheme 2014* – ASS mapping
	• SPP Interactive Mapping System.
		• DSDMIP Development Application mapping:
		  – Fish habitat mapping
		  – Wetland Protection Areas
		• Queensland Globe layers:
		  – Watercourses under the Water Act
		  – SEQ Koala habitat
		• *Sunshine Coast Planning Scheme 2014* - Native Vegetation Areas mapping
		• CoastConnect CDIMP
		• SPP Interactive Mapping System
		• EPBC Act Protected Matters Search Tool to identify MNES that may occur within the Project area, utilising a buffer of ten kilometres
		• DES Wildlife Online database to identify flora and fauna species recorded within or surrounding the Project area, utilising a buffer of ten kilometres
		• Atlas of Living Australia database to identify locations of previously recorded flora and fauna species within or surrounding the Project area
		• DNRME Regulated Vegetation Management Map to determine the extent of Category A, Category B, Category C and Category R vegetation within and surrounding the Project area
		• DNRME Vegetation Management Regional Ecosystems Map including Essential Habitat mapping and vegetation management watercourse and drainage features map
		• The Queensland Herbarium Regional Ecosystem Description Database for current regional ecosystem descriptions and geological and land zone descriptions
		• DES Protected Plants Flora Survey Trigger Map to identify the high-risk areas for protected plants and determine whether a targeted flora survey and a clearing permit is required
		• DES certified Biodiversity Planning Assessment mapping to identify significant wildlife corridors and areas

[172] Parsons Brinckerhoff Australia Pty Ltd. (2010). *CoastConnect Caloundra to Maroochydore: Concept Design and Impact Management Plan*. Retrieved from Unpublished Report to Queensland Government website: https://www.tmr.qld.gov.au/Projects/Name/C/CoastConnect-Caloundra-to-Maroochydore-Quality-Bus-Corridor.aspx

[173] Department of Infrastructure, Local Government and Planning (2017).

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Water	Soils and land management	Ecology
		of State, regional and local biodiversity significance • SCC *Environment and Liveability Strategy* and associated council policies.

Table 74 – Information sources for cultural heritage, amenity, special areas and tenures

Cultural Heritage	Amenity	Special areas and tenures
• Department of Aboriginal and Torres Strait Islander Partnership (DATSIP) Indigenous Cultural Heritage Database • CoastConnect CDIMP • Queensland Heritage Register • *Sunshine Coast Planning Scheme 2014* – Local heritage mapping • SPP Interactive Mapping System.	• CoastConnect CDIMP • Queensland Globe, including the SEQ Regional Planning Scheme layers of regionally significant greenspace and urban footprint • Applicable standards prescribed within the Environmental Protection (Noise) Policy 2019 • Applicable standards prescribed within the Environmental Protection (Air) Policy 2019 • *Sunshine Coast Planning Scheme 2014* – Regional land use category and regionally significant greenspace • SPP Interactive Mapping System • SCC Street Tree Master Plan.	• Coastal Pathway Linear Open Space Master Plan • CoastConnect CDIMP • Queensland Globe • *Sunshine Coast Planning Scheme 2014*.

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13.2.3 Identification of environmental impacts

Table 75 summarises the potential environmental and heritage considerations and impacts of the Project. Further detail on the impact assessment and relevant mitigation measures for each aspect will be assessed as the Project moves into the Detailed Business Case stage following consideration by Governments.

Table 75 – Identification of potential environmental impacts

Aspect	Potential environmental impacts
Legislation and permit requirements	Approvals will be required to enable the Project under Commonwealth and State legislation. The approval requirement for the Project will need to be reviewed and refined through the DBC process.
Planning and land use	Land use change considerations are included in Chapter 8.
Property impacts	The Project will encroach on properties adjacent to the alignment resulting in partial or full property acquisitions. The potentially impacted properties are identified in Chapter 11.2 and Chapter 11.3.
Land and soil management	• Soils – soils within the Project area, although only mildly dispersive, may potentially impact on water, air and visual amenity through the construction period. • ASS – ASS and Potential Acid Sulphate Soils (PASS) occur within almost the entirety of the Project area. Disturbance of ASS/PASS has the potential to impact on the environments and further investigations to determine the nature and extent of the impact will be required. • Contaminated land – There are known impacted properties listed on the EMR and unknown potential contaminated land occurring across the Project area. Further investigation will be required to determine the impact to the Project due to potentially contaminated land.
Water quality and features	Significant water features occur within or adjacent to the Project area, including waterways, canals and wetlands. Environmental values and water quality objectives for each of these will need to be protected through the construction and operation of the Project.
Hydrology and flooding	The Project area is located within low lying coastal plains and has the potential to be impacted by flood events. Flood levels and flood immunity requirements will need to be determined for the Project as part of further investigations.
Climate change and air quality	Construction of the Project has the potential to result in air quality impacts at adjacent sensitive receptors, primarily due to the generation of dust. These potential impacts will be managed through an Air Quality Management Plan and baseline data obtained prior to the commencement of construction.
Climate change and GHG emissions	• The consequences of climate change, including sea level rise, increased storm intensity and increased temperatures, may impact on the Project area both directly and indirectly and will need to be considered as part of the detailed design. • A benefit of the Project will be a reduction in local greenhouse gas emissions through improved sustainable transport and a reduction of vehicles on the road. For example, conventionally powered light rail uses ten times less energy than a car, per passenger kilometre[174].
Flora and fauna including aquatic ecology	• Potential impacts to flora and fauna within and adjacent to the Project area may include: – Impacts on surrounding waterways including loss of riparian vegetation, changes to hydrological regimes and reduced water quality – Potential disturbance and exposure to oxidising conditions of ASS/PASS – Clearing of vegetation – Degradation or loss of fauna habitat – Fauna mortality or injury – Construction noise impacts to fauna including reduced foraging ability by auditory predators and increased risk of predation by visual predators.

[174] Transport for NSW (2020). Accessed at: https://sydneylightrail.transport.nsw.gov.au/frequently-asked-questions

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Aspect	Potential environmental impacts
	• Aquatic ecology impacts during the operation stage are expected to be minor in nature and directly related to altered sediment regimes and increased pollutant delivery from the Project area to the Mooloolah River.
Noise and vibration	• Construction noise levels along the alignment are likely to exceed nominated criteria during the site works. Site specific noise mitigation strategies will need to be prepared and implemented during construction. • Some construction activities may impact on vibration receivers including the SCUH. A detailed vibration assessment will need to be completed. • The introduction of the BRT, TT or LRT to the existing roadways are likely to have negligible increases in noise and vibration during the operational stage.
Landscape and visual amenity	• Potential impacts of the Project on scenic amenity values identified in the *Sunshine Coast Regional Plan 2014* and other surrounding areas are considered to be negligible. • Short term impacts throughout the construction period may impact on neighbourhood visual amenity. • When completed, it is expected that all Project options will improve the local environment and amenity through an improved transport system and a reduction in the growth of traffic in the area.
Cultural heritage	• The Project area has been assessed under the Duty of Care Guidelines as being Category 4 - Areas previously subject to Significant Ground Disturbance. • No known Indigenous heritage sites will be impacted by the Project. • No previously registered non-Indigenous heritage sites will be impacted by the Project area. Some are in close proximity and should be noted during the DBC stage. • Some non-Indigenous heritage sites not registered on local heritage registers may be impacted. Whilst not statutorily protected, stakeholder engagement during the DBC will be required.
Waste management	The construction stage is expected to have the greatest potential for waste generation, through site preparation and civil works. Construction and demolition (C&D) waste is the primary waste stream anticipated to be produced from these activities (i.e. asphalt, concrete). The potential impacts associated with waste generation from the Project include: • Contamination of receiving environments (i.e. land, surface water and air) due to the improper storage or failure of waste management systems. • Increased incidence of vermin, insects and pests from the inappropriate storage and handling of putrescible wastes from site offices/depots. • Increased transportation of waste materials on and offsite, resulting in: – Increased road traffic from the operation of vehicles and plant – Decreased amenity of land uses adjacent to the Project from the generation of dust. • Reduced airspace at receiving landfill facilities. • Reduced visual amenity of adjacent land uses. Waste and resource management for the Project will be undertaken in accordance with the *Waste Reduction and Recycling Act 2011* (Qld) (WRR Act) hierarchy, in the preferred order of avoid or reduce, re-use, recycle, recover energy, treat and dispose. Opportunities for the offsite re-use of C&D waste from the Project also exist through the end of waste framework, as per the WRR Act.

13.2.4 Climate change and greenhouse gas emissions

Sunshine Coast Council is working towards carbon neutrality, with key developments in sustainable transport, biodiversity, land use and social planning initiatives for the region. The Project is part of the strategy to improve sustainable transport options within the Sunshine Coast Region. The Project is expected to result in a reduction in local contributions to greenhouse gas emissions. Electrically powered mass transit moves people much more efficiently than private cars and uses less energy than a car per passenger kilometre. For electrically powered options, there is also a potential to offset electricity requirements by purchasing renewable power from the energy grid. This reduction in greenhouse gas emissions will assist in the transition to a lower carbon economy and contribute to addressing climate change.

13.2.5 Recommendations for additional investigations in the next stage

Additional environmental investigations and monitoring will be required to support future stages of the Project including during the Detailed Business Case stage. These include:

- Land and soil management – EMR listed sites that are encroached by the Project will be subject to a preliminary risk assessment to determine site-specific assessment and management measures. Intrusive investigation works may be deemed necessary, to occur at a later stage of Project development. Further investigation of the extent and location of ASS and PASS will be required for the Detailed Business Case stage. ASS and PASS testing should be incorporated into a geotechnical testing program in support of future works and detailed design.
- Water quality – baseline water quality monitoring upstream and downstream within waterways and wetlands is recommended to inform water quality design measures and for comparison against monitoring during construction.
- Hydrology and flooding – modelling of low elevation areas is proposed for areas where stormwater retention is likely to attenuate peak flow rates and where significant inundation of the area occurs. Hydraulic analysis is to be undertaken as part of the development of the detailed design to size the required cross drainage structures to provide flood immunity of 100-year annual recurrence interval event including allowance for climate change impacts.
- Climate and air quality – air quality monitoring program to occur pre-construction to inform baseline conditions.
- Flora and fauna – ecology field surveys are recommended to confirm and ground-truth ecological values within the Project area.
- Cultural heritage – investigations into non-statutory heritage sites within the Project area are conducted if they cannot be avoided (note, this is not a statutory requirement as sites are not protected).

13.2.6 Summary of environmental assessment

This preliminary Environmental Assessment has been based on available information relevant to environmental, heritage and planning matters of interest and an assessment of potential environmental and heritage risks associated with the Project.

Key environmental risks associated with the Project include:

- Impacts on MNES located either within, or in proximity to the Project area, including:
  - Listed threatened ecological communities (may occur within the Project area)
  - Listed threatened flora and fauna species (may occur within the Project area)
  - Ramsar declared wetland of international importance, Moreton Bay (occurs adjacent to the Project area).
- Impacts on Matters of State Environmental Significance (MSES) located either within, or in proximity to the Project area, including:
  - Essential habitat for protected plants under the *Nature Conservation Act 1992*
  - High risk areas for protected plants under the *Nature Conservation Act 1992*
  - Moreton Bay Ramsar wetland of international importance (High ecological value waters) under the Environmental Protection *(Water and Wetland Biodiversity) Policy 2019, Schedule 1 (In accordance with MSES definitions (e) and (f)).*

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- Hydrology and flooding
  - Climate change impacts relating to rising sea levels and increased flood events
  - Impacts on the natural hydrology of creeks and wetlands (e.g. levels and flows)
  - Impact on the current hydrological regime of the creeks within and adjacent to the Project area
  - Impacts on flow pathways and afflux (change flood levels) and flow velocities resulting in scouring of waterways and inundation to the road corridor and adjacent properties.

The preliminary Environmental Assessment has identified further investigations and/or monitoring recommended to refine the appreciation of potential environmental and/or heritage impacts as the Project design progresses. This chapter also includes a preliminary assessment of the likelihood of occurrence of MNES under the *EPBC Act* and MSES under Queensland legislation. An assessment of the likelihood for significant impact to MNES and MSES (if confirmed to be impacted) as a consequence of the Project will be required. This will be informed by site investigations.

Potential mitigation measures have been identified for key environmental elements where impacts are unable to be avoided and will be required to be refined in parallel with design progression to enable impacts from key environmental and heritage risks to be appropriately mitigated or offset where these options are available. Environmental offsets to mitigate impacts will need to be investigated and informed by these future studies.

When completed, it is expected the Project will improve the local environment and amenity through an improved transport system and a reduction in the growth of traffic in the Project catchment. While this preliminary Environmental Assessment has identified a number of potential impacts, both positive and negative, it is not anticipated identified impacts will prevent any of the Project options from proceeding.

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Sunshine Coast Mass Transit
DRAFT Options Analysis
APRIL 2021

COST AND RISK ASSESSMENT

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14. Cost and Risk Assessment

14.1. Introduction

This chapter documents the whole of life risk adjusted cost estimates for the shortlisted options for Stage 1 of the Project. The Project cost estimates consist of two key categories:

- Capital costs incurred during the development and construction stage
- Operating costs based on a 30-year operating period.

Note: The risk-adjusted cost estimates presented throughout this chapter may not sum precisely due to rounding differences in source data. All dollar values in this chapter are presented in February 2020 real terms unless noted otherwise.

14.1.1 Capital cost estimates

The risk adjusted capital cost estimate for each option was developed in two steps:

1. The development of the initial capital cost estimate for Stage 1 of the Project based on the Reference Project, supporting technical reports and the expertise of the project team.
2. The quantitative risk assessment of the capital cost estimate to monetise the risk and uncertainty associated with various elements of the estimate.

14.1.1.1 Initial cost estimate for Stage 1 of the SCMT Project

The capital cost estimates were prepared using a base estimate date of February 2020 to reflect the forecast cost of delivering the planned works for each of the Reference Project options in Stage 1 of the Project.

In developing the cost estimates, a number of different cost estimating techniques were used to reflect the nature of the activity being estimated and the level of design information available. The techniques used included:

- A fully resource-based estimate of labour, plant and materials priced using local market rates
- Allowances for packages of work based on actual costs obtained from completed comparable projects and adjusted to suit local market conditions.

The cost estimates include allowances for all direct and indirect construction costs, principal costs for all stages of Project development, property acquisition costs, and appropriate vehicle purchase costs.

14.1.1.2 Capital cost risk adjusted

The capital cost estimates have been risk adjusted using quantitative risk assessment techniques to account for the risk and uncertainty associated with various elements of the estimate. The capital cost risk adjustment is shown in Table 76.

Table 76 – Capital cost risk adjustment

Cost Item	Delivery Stage Cost (2020 real $million)				
	QBC	BRT	TT	wLRT	LRT
Total client costs	146	536	512	580	579
Total construction costs	111	504	500	634	657
Total base cost	257	1,041	1,012	1,214	1,237
Total risks P50	172	273	310	314	317
Total Project cost (P50) ($2020)	429	1,313	1,322	1,528	1,553

Source: Fission (2020). Including sunk costs pre-February 2020.

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The capital cost estimates for the Category B Reference Projects (all except QBC) represent a high standard of public transport (referred to as a ‘Bronze’ standard in Chapter 11). This means a high-quality level of service is provided with dedicated right-of-way, low floor vehicles and other quality features. This higher standard is reflective in the cost estimate and highlights why BRT and TT cost estimates are toward the top end LRT costs.

Although the wireless LRT system saves the cost of installing and maintaining poles and wires, this saving is largely offset by the costs associated with the alternative power source, such as battery charging infrastructure enabling frequent quick charging and overnight deep charging.

14.1.1.3 Pricing assumptions and cost escalation

The capital cost estimates were prepared using a base estimate date of February 2020 for input to the Project financial and economic assessment. Escalation has been applied to the cost estimate to determine the outturn cost based on the delivery timeframes shown in Figure 107. The outturn costs are presented in the financial analysis.

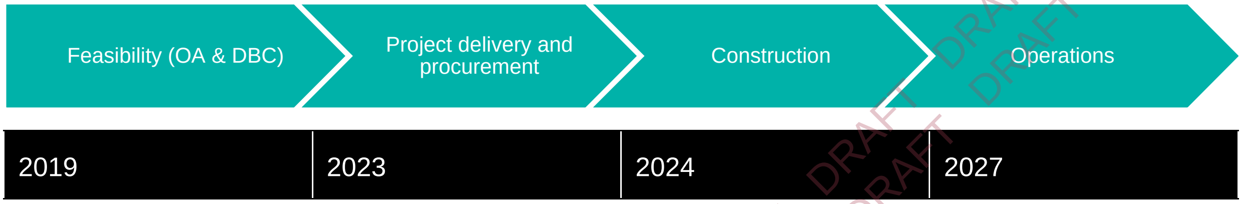

Figure 107 – Project timing

14.1.1.4 Operations cost estimates

An Operations and Maintenance (O&M) cost estimate has also been prepared for each of the Reference Projects. The O&M cost estimates for the BRT and the LRT use a first principles approach and reflect the cost to establish and operate a standalone LRT or BRT system on the Sunshine Coast. The BRT and LRT costs are estimated based on Australian precedent projects including GCLR and Brisbane Metro.

The cost estimate for the QBC option reflects the cost to operate a new fleet of high-quality buses as an expansion of the existing Queensland Government contracted bus services on the Sunshine Coast. The key cost components of the O&M costs for each option are shown in Table 77.

Table 77 – Key elements of the O&M costs

Cost Category	QBC	BRT	TT	wLRT	LRT
Client costs	✓	✓	✓	✓	✓
Operational staff and corporate staff	✓	✓	✓	✓	✓
Electricity		✓	✓	✓	✓
Fuel	✓				
Routine maintenance	✓	✓	✓	✓	✓
Vehicle lifecycle maintenance	✓	✓	✓	✓	✓
Depot costs	✓	✓	✓	✓	✓

14.1.1.5 Operations cost

The operating stage cost estimate for each option is shown in Table 78.

Table 78 – Operating stage cost estimate

Cost Item	Operating Stage Cost (2020 $million)				
	QBC	BRT	TT	wLRT	LRT
Average annual mass transit system operating stage costs (real)	-	29.9	29.9	32.5	32.5
Average annual bus net operating stage costs (real)	28.3	29.7	29.7	29.7	29.7
Sum of Operating Stage Costs over 30 years (excluding additional bus network costs)	-	897	897	990	990
Additional bus network costs	850	890	890	891	891

14.2. Risk management and risk assessment

The purpose of this section is to provide an overview of the risk management approach that has been applied during the development of the Reference Project and the Options Analysis. The key outputs from the risk assessment at this stage of the Project are risk registers for strategic, process, and Project risks, and risk adjustments to the capital and operating costs. Overall, the risk assessment during the Options Analysis stage serves several purposes including:

- Developing risk adjusted cost estimates
- Informing risk management plans for future stages of the Project
- Informing the delivery model analysis for this Options Analysis stage and the subsequent Detailed Business Case stage.

14.2.1 Risk management process

Risk management has been embedded as part of developing the Reference Project solutions for LRT, BRT and QBC, and was undertaken as part of the Options Analysis through formal and informal processes. The formal approach to risk management has included establishing a risk management process that complies with ISO31000:2009. This included risk identification with the Project Team and regular review of process and Project risks. Less formally, a risk management approach that relies on all team members continually and actively managing risks as the Project proceeds has been incorporated in all project management activities.

14.2.2 The context for risk management

Risk has been defined as "the effect of uncertainty on objectives", in accordance with ISO31000:2009. Project objectives identified in the Strategic Business Case stage are fundamental to ongoing risk management. The Project also used the service needs and benefits identified in the SBC in conjunction with the Project objectives as the basis for identifying risks, establishing risk severity ratings and developing mitigation strategies.

Risk is inherent in any project; it creates the potential for a range of possible outcomes to materialise over time. Identifying and quantifying project risks enables the potential overall cost to Government to deliver a project to be estimated. Ultimately, the risk assessment will inform the Project's overall cost profile and helps guide the activities in subsequent Project stages.

14.2.3 Planned and unplanned risks

The assessment of Project risks includes planned and unplanned risks. Planned risks are those risks that have an impact on known elements of the Project. For example, the cost of a raw material such as concrete, or the cost of an element of work such as cleaning. The planned risks are translated to allowances being made to the quantity and the rate for the various items within the cost estimate schedule prepared by the cost estimators.

Unplanned risks are generally unforeseen events that do not have a direct impact on a specific element of the Project and may be quantified using a contingent sum or adjustments to several prime cost items.

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Unplanned risks are events that may or may not happen and are quantified using a likelihood and a financial outcome should the risk occur.

14.3. Key Project risks

The Project Team has identified, assessed, and quantified the risks that may impact on the successful delivery of the Project. This section provides an overview of the key unplanned Project risks and key Project risks for consideration as the Project progresses from Options Analysis Detailed Business Case stage.

14.3.1 Unplanned project risks

This section presents the key unplanned Project risks that have greatest impact on the quantum of the risk adjustment used in cost estimates. These risks were identified using the sensitivity analysis in the risk modelling software. The sensitivity of the Project cost to individual risks is a useful guide to the risks that require detailed management during the Detailed Business Case and subsequent delivery stages.

An example of an unplanned risk is the wireless on-board storage and charging systems adopted in the TT, BRT and wLRT options. As technology develops, the cost of the components of such a system could in fact reduce as a result of economies of scale as more systems are deployed. However, another risk is that a section of the reticulated electricity grid will need to be upgraded to supply electricity to one or more of the charging points of the future mass transit system. It is not appropriate to design the upgraded system and analyse the grid at this stage of the design development process, particularly because there are many options still under consideration. Best practice therefore requires that cost contingencies are included in the relevant cost estimates so that the probability of the cost being exceeded is within the target range.

14.3.1.1 Key project risks – LRT and BRT

Table 79 provides a summary of the key Project risks which will require further investigation and management during the Detailed Business Case stage and subsequent delivery stages.

14.3.2 Unplanned project risks

This section presents the key unplanned Project risks that have greatest impact on the quantum of the risk adjustment used in cost estimates. These risks were identified using the sensitivity analysis in the risk modelling software. The sensitivity of the Project cost to individual risks is a useful guide to the risks that require detailed management during the Detailed Business Case and subsequent delivery stages.

An example of an unplanned risk is the wireless on-board storage and charging systems adopted in the TT, BRT and wLRT options. As technology develops, the cost of the components of such a system could in fact reduce as a result of economies of scale as more systems are deployed. However, another risk is that a section of the reticulated electricity grid will need to be upgraded to supply electricity to one or more of the charging points of the future mass transit system. It is not appropriate to design the upgraded system and analyse the grid at this stage of the design development process, particularly because there are many options still under consideration. Best practice therefore requires that cost contingencies are included in the relevant cost estimates so that the probability of the cost being exceeded is within the target range.

14.3.2.1 Key project risks – LRT and BRT

Table 79 provides a summary of the key Project risks which will require further investigation and management during the Detailed Business Case stage and subsequent delivery stages.

Table 79 – Key Project risks

Risk Name	Risk Description	Consequence	Mitigation Strategies	Indicative Risk Rating	Options the risk is relevant to:				
					QBC	BRT	TT	LRT	wLRT
Additional property impacts	This is the risk that the final design has more impact on properties than expected and additional property acquisitions are required.	Additional property acquisition with additional time and cost.	The Reference Project and DBC will make allowance for construction and temporary works property impacts.	Low	*	*	*	*	*
Delays to delivery program	This is the risk that the Project is delayed during construction due to several factors including: • weather • industrial action • handover of acquired properties by the client • access to PUP • contractor performance	Delays to project with associated increased cost to contractors and client.	Contracting model to allocate D&C performance risk to contractor. Liquidated damages for client costs.	Moderate, though mitigation measures are in place	*	*	*	*	*
Client initiated variations	This is the risk that the State varies the Project scope, specifications or standards after contract award.	Increased cost to deliver change in scope, variations priced in a non-competitive environment Delays to Project delivery.	Define scope of works in the Reference Project and DBC and any variations to be subject to a formal change process.	Low, with thorough planning and good governance	*	*	*	*	*
Out of scope works	This is the risk that there are unforeseen changes to the agreed scope of work.	Increased cost and delays to Project to implement new changes.	Define scope of works in the Reference Project and DBC and any variations to be subject to a formal change process.	Low, with thorough planning and good governance	*	*	*	*	*
Impact on existing pavements	This is the risk that the final design requires a greater amount of pavement modification (other than the ROW) than allowed in the Options	Delays to project with associated increased cost to contractors and client.	Contracting model to allocate D&C performance risk to contractor. Liquidated damages for client costs.	Moderate, though mitigation measures are in place	*	*	*	*	*

Risk Name	Risk Description	Consequence	Mitigation Strategies	Indicative Risk Rating	Options the risk is relevant to: QBC	BRT	TT	LRT	wLRT
	Analysis and DBC including: • upgrades to inadequate strength pavements within the corridor • local road upgrade following diversions for construction traffic extent of pavement works in adjacent streets.								
Traffic management and temporary works during construction	This is the risk that the requirement for traffic management during construction is much greater than anticipated including temporary intersection closures, temporary diversions, lane closures, and traffic control devices and systems.	Increased cost Delays to Project to implement traffic controls Increased disruption to local motorists causes community angst.	Traffic management to be considered in considered Reference Project in staging and constructability reviews.	Moderate, yet temporary and can be mitigated with good planning and design	*	*	*	*	*
Power services treatment	This is the risk that service alignments are unknown or do not match surveys results, or that a change to scope and/or design and cost of treatments occurs.	Increased cost to deliver change in scope, design or cost of treatments Delays to Project to implement new treatments.	Assess power services condition and define any variations to be subject to a formal change process in the Reference Project and DBC.	Major due to PUP risk but risk can be transferred to the party best able to manage this risk through a suitable delivery model	*	*	*	*	*
Water services treatment	This is the risk that service alignments are unknown or do not match surveys results, or that a change to scope and/or design and	Increased cost to deliver change in scope, design or cost of treatments Delays to Project to	Assess water services condition and define any variations to be subject to a formal change process in the Reference Project and DBC.	Moderate and can be transferred to the party best able to manage this risk through a suitable	*	*	*	*	*

Risk Name	Risk Description	Consequence	Mitigation Strategies	Indicative Risk Rating	Options the risk is relevant to: QBC	BRT	TT	LRT	wLRT
	cost of treatments occurs.	implement new treatments.		delivery model.					
Transport stations, interchanges, buildings, stations, stabling, maintenance and buildings design	This is the risk that more details are required than currently developed at the concept level for transport stations, interchanges, buildings, stations, stabling and maintenance buildings.	Additional costs as more detail is developed.	Define design detail in the Reference Project and DBC and any variations to be subject to a formal change process.	The uncertain depot location is a planned risk with contingency provided in the cost estimate	*	*	*	*	*
Tele-communications services	This is the risk that service alignments are unknown or do not match survey results or that to scope, design and cost of treatment occurs.	Increased cost to deliver change in scope, design or cost of treatments Delays to Project to implement new treatments.	Assess telecommunications services condition and define any variations to be subject to a formal change process in the Reference Project and DBC.	Major due to PUP risk but risk can be transferred to party best able to manage it through suitable delivery model	*	*	*	*	*
Trackwork design	This is the risk that more details are required than currently developed at the concept level for trackwork.	Additional costs as more detail is developed.	Define design detail in the Reference Project and DBC and any variations to be subject to a formal change process.	Low, with good planning and design		*	*	*	*
Roadworks, landscaping and fencing design	This is the risk that more design development for roadworks, landscaping and fencing is required than currently developed at the concept level.	Additional costs as more detail is developed.	Define design detail in the Reference Project and DBC and any variations to be subject to a formal change process.	Low, with good planning and design	*	*	*	*	*
Power supply and distribution design	This is the risk that more design development for power supply and distribution is required than currently developed at the concept level.	Additional costs as more detail is developed.	Define design detail in the Reference Project and DBC and any variations to be subject to a formal change process.	Low, with good planning and design. Discussions have been held with Energex, who consider that supplying electricity to the system is well within	*	*	*	*	*

Risk Name	Risk Description	Consequence	Mitigation Strategies	Indicative Risk Rating	Options the risk is relevant to: QBC	BRT	TT	LRT	wLRT
				the capacity of the existing system. Supply to the densified city is likely to be within the capacity of future planned upgrades.					
Flooding risk	The Project has the potential to impact on the current level of flood immunity by increasing flood impacts to surrounding properties and land use.	Flood immunity decreased as some of the existing roads in which infrastructure is proposed is less than current design standards.	Revise design standards to accommodate for future client change scenarios.	Low, with good planning and design.	*	*	*	*	*
Safety accreditation of the rollingstock	This is the risk that the Project's design vehicle, Hess/Volgren, from the Brisbane Metro project is not accredited in Australia for use on busways and the proposed scenario with no physical separation.	Project delays and increased cost to deliver the Project.	Ensure accreditation criteria during procurement and delivery.	Moderate but can be mitigated with appropriate planning and procurement		*	*		
Management of flash charging	This is the risk that the flash charging may require storage in the sub-station to smooth out demands on the Energex network.	Increased cost to deliver change in scope or design.	Contingency allowance in the case of storage requirements.	Low, with good planning and consultation with charging providers		*	*		*
Monopoly vehicle/system supplier	For systems using a vehicle that is manufactured by one supplier only, value for money to Government for subsequent stages cannot be guaranteed	Expensive subsequent stages, or alternatively forced interchange to a different technology between different systems on Stage 1 and	Careful consideration during procurement stage. Potential options for subsequent stages written into the original contract	Low to moderate			*		

Risk Name	Risk Description	Consequence	Mitigation Strategies	Indicative Risk Rating	Options the risk is relevant to:				
					QBC	BRT	TT	LRT	wLRT
		subsequent stages.							
System does not perform reliably	Emerging technology does not meet the promised performance standards. An example might be that range is not achieved and is inadequate for the schedule operations.	Delay to commencement of operation, or limitations on the frequency of services	Ideally procure a system with a proven in revenue service record.	Moderate		*	*		*
Stray current	Electrical current returning to the substation in a system supplied via overhead wires ‘strays’ to proximate conductive underground pipes.	Corrosion of proximate conductive underground pipes	Stray current collection system has been included in the cost estimate for the relevant option	Low				*	
Busway pavement fails due to repeated loading on the wheel path.	Guided rubber tyre systems will load the same path, concentrating pavement loads and bringing forward failure	Early pavement reconstruction required resulting in service disruption and additional cost	It has been suggested by proponents that the guidance system could be programmed to select a slightly different path for each vehicle	Low to moderate			*		

14.4. Summary

The cost estimates for each Project option (and associated benefits and revenues) was modelled in the economic and financial appraisals. The cost estimates for the LRT and BRT options have been through a process of value engineering and peer review to provide assurance to the cost components of subsequent economic, financial and commercial analyses. Costs were presented in real, outturn (i.e. nominal) and present value terms and represent the total funding requirement. All costs have been presented at the P50 confidence level to reflect the level of risk and uncertainty at this stage of development.

The cost estimates were prepared in accordance with the requirements of the relevant frameworks for a project at this stage of development and will be refined and tested in future stages of development.

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ECONOMIC APPRAISAL

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15. Economic Appraisal

15.1. Purpose and overview

The purpose of this chapter is to present the economic analysis undertaken to assess the proposed options for the SCMT Stage 1 Project.

The economic analysis uses a cost benefit analysis (CBA) framework that applies a discounted cashflow technique to estimate and compare the benefits and costs of the Project. This CBA seeks to assess the impacts across the Sunshine Coast LGA, including users of public transport (PT), private road vehicle users, and the broader community.

15.1.1 Economic assessment methodology

The economic appraisal framework has been designed to reflect the role SCMT has in driving a wide range of economic and social outcomes for the Sunshine Coast (see Figure 1). The framework aligns with Queensland and national economic appraisal guidelines and seeks to capture the broad range of benefits attributable to SCMT.

Reflecting that mass transit in this corridor offers the potential to not only improve accessibility, amenity, environmental and safety outcomes, but also offers a high-capacity PT corridor to support land use change, the economic appraisal framework has been developed to assess two rounds of benefits:

- The first round (benefits without land use change) isolates the transport and broader community benefits of the project that are independent of land use change
- The second round (benefits with land use change) assesses the benefits of the project inclusive of land use changes that reflect changes in land use and relocation of economic activity.

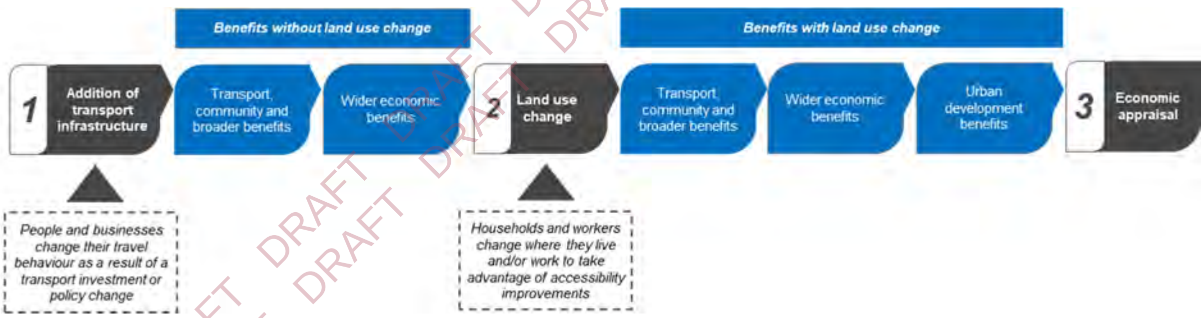

Figure 108 – Economic appraisal framework

15.1.2 Guidelines used in the economic analysis

The economic appraisal has been developed considering the following Queensland, Australian and international guidelines:

- TMR Cost-Benefit Analysis Manual (2011)
- BQ Cost-benefit Analysis Guide – Release 3 (2020)
- Transport and Infrastructure Council (2016) – The Australian Transport Assessment and Planning Guidelines (ATAP Guidelines)
  - PV2 Road Transport
  - Mode Specific Guidance (M1) – Public transport
  - Mode Specific Guidance (M4) – Active travel
  - T2 Cost-Benefit Analysis
  - T3 Wider Economic Benefits

- IA (2018) Assessment Framework (IA Guidelines)
- Australian Transport Council (2006) - National Guidelines for Transport System Management in Australia, Part 1 – Public Transport Economic Appraisal Guidelines
- Austroads (2012) – Guide to Project Evaluation Part 4: Project Evaluation Data
- Austroads (2010) – Guide to Road Safety Part 7: Road Network Crash Risk Assessment and Management
- Transport for NSW:
  - (2018) Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives (TfNSW Guidelines)
  - (2019) Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives – Economic Parameter Values
- United Kingdom Department for Transport (2018) - Transport Analysis Guidance (TAG).

15.1.3 Key assumptions and parameters

The key appraisal assumptions and parameters presented in Table 80 are assumed for economic appraisal considering the guidelines outlined above.

Table 80 – Key assumptions and parameters

Item	Assumption(s) proposed	Source(s) and comments
Real discount rate	7.0% (real)	Consistent with BQ guidelines and IA
Base price year	2019/20	Prices prior to the base price year are inflated to 2019/20 dollars
Preliminaries & Construction period	2020/21 to 2026/27	As per cost estimated developed for the Project by Fission
Appraisal period	30-year appraisal period	TMR and IA's CBA framework recommends a maximum evaluation period of 30 years for bus and light rail initiatives
Annualisation factors	285.6 PT annualisation factor is used for both PT and road modes	As recommended in ATAP Guidelines M1 – Public Transport
Interpolation, extrapolation of transport demand	• Interpolation between modelled years is required in general compound annual growth rates have been applied. In minor cases where there are negative impacts, straight line interpolation is used • Extrapolation of demand beyond the last modelled year based on population growth rates assumed in QGSO of 2.21%	• ATAP T2 supports interpolation and extrapolation based on historic trends, or related factors that may affect the growth in benefits • Demand modelling indicates that there is capacity following the last modelled year to enable continued growth to the end of the analysis period in 2057

Source: PwC analysis (2020) based on TMR (2011), IA (2018), ATAP (2016, 2018) and TfNSW (2018)

15.2. Land use and transport network demand assumptions

The land use and transport network projections form key inputs into the economic appraisal and are significant drivers of the outcome of the assessment. An overview of the land use and transport network assumptions is provided in this section. See Chapter 8 for a detailed summary of the land

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use analysis and Chapter 12 for the transport demand analysis undertaken to inform analysis of the Reference Project options in this business case.

15.2.1 Land use scenarios

Two future land use scenarios for 2026, 2036 and 2041 were developed for the draft Options Analysis and were applied in the core economic assessment. These land use scenarios represent the expected take-up response to mass transit, based on contemporary and current examples in Australia.

15.2.1.1 No-Intervention (trend) land use scenario

The *No-Intervention (trend)* land use scenario represents a business-as-usual approach to planning and transport infrastructure provision in the Corridor. It identifies the likely property market take-up of development entitlements under existing planning provisions. Broadly, the No-Intervention (trend) land use scenario has been developed in response to a “do-minimum” transport network, which does not involve the introduction of mass transit in the corridor.

15.2.1.2 Intervention land use scenario

The *LRT Intervention* (noting wLRT aligns with this scenario) and the *BRT Intervention* (noting TT aligns with this scenario) land use scenarios have been developed in response to a ‘with LRT project’ transport network and ‘with BRT project’ transport network, respectively. These scenarios involve the introduction of mass transit, as well as changes to planning provisions that unlock existing land supply and repurposing options in response to land market conditions as a result of the SCMT Stage 1 investment. The *BRT Intervention* land use is based on evidence from BRT projects delivered in Australia and benchmarked internationally and reflects the best available quantitative evidence.

The core economic results presented in Section 15.6 reflect the outcomes that would be realised in these scenarios, however, do not reflect that Council, through the Planning Scheme, has the ability to influence the actual level of land use change that is realised.

The core economic results presented in Section 15.6.1 are based on the *LRT and BRT Intervention scenarios*. Additional strategic land use outcomes are in Section 15.7, which explore the level of land use change that could be implemented by Council through the *Sunshine Coast Planning Scheme 2014*, and the potential outcomes of a high quality BRT/TT.

15.2.1.3 Transport network scenarios

The SCMT options are expected to change travel behaviour within the Sunshine Coast by increasing PT accessibility and providing an alternative travel mode to private car. To appraise the resulting economic outcomes, transport modelling has been undertaken to analyse the impacts of changes in travel behaviour and these outputs are used within the economic appraisal to monetise economic benefits associated with transport and the broader community. The transport modelling framework used the Sunshine Coast Zenith Model (SCZM) to estimate to estimate the level, composition and location of transport demand in the project case compared with the Base Case. Two core transport network scenarios were applied in the economic appraisal:

- *Base case transport network* - The Base Case transport network represents a ‘Do Minimum’ scenario including the existing road and PT networks as well as planned and funded upgrades (refer to Chapter 9 - Base Case for details).
- *Project case transport networks* - The project case transport network for each reference project option, including the assumed investment in mass transit and supporting revised bus operations and networks delivered under each option

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15.3. Base case and project case scenarios

15.3.1 Base case

The economic appraisal compares the costs and benefits of the reference project options incrementally to a Base Case. Specification of the Base Case is important to enable estimation of incremental benefits and costs relative to the status quo with no project intervention. The Base Case represents a ‘business as usual’ approach to planning and transport infrastructure provision in the Sunshine Coast Urban Corridor, assuming that mass transit is not invested in the Sunshine Coast. The Base Case includes the Base Case land use scenario as well as the Base Case transport network.

15.3.2 Reference Project options

The economic assessment considered the five shortlisted options that were identified through the Options Assessment. Table 81 outlines the key features of each option.

Table 81 – Reference project options

LRT	wLRT	BRT	TT	QBC
• Alignment per Figure 44 • Pre-paid boarding, tag on platform, no contact with driver • Dedicated right of way corridor • Priority at traffic signals • Journey time of 30 minutes from Maroochydore to SCUH.	• Alignment per Figure 44 • Battery powered light rail vehicles with charging at stations and terminus • Pre-paid boarding, tag on platform, no contact with driver • Dedicated right of way corridor • Utilises the same transport modelling outcomes as LRT.	• Alignment per Figure 44 • Modern battery electric buses • Pre-paid boarding, tag on platform, all doors, no contact with driver • Priority at traffic signals • Journey time of 30 minutes from Maroochydore to SCUH.	• Alignment per Figure 44 • Battery electric trackless tram vehicles • Priority at traffic signals • Utilises the same transport outcomes as BRT.	• Improved bus vehicles, higher specification branded bus vehicles, articulated or double decker buses • Dedicated bus lanes • Quality bus stops along corridor.

15.4. Economic costs

15.4.1 Delivery phase costs

The delivery phase cost estimates represent risk adjusted costs for design and construction, rollingstock/vehicle procurement, land acquisition, and client costs of the Project. These are included in the economic assessment during construction of the Project.

The base cost estimates used in the economic analysis are presented in Table 82 including the P50 risk adjustment.

Table 82 – Delivery phases costs ($ million, 2019/20 real)

Cost Item	Delivery Phase Cost				
	LRT	wLRT	BRT	TT	QBC
Total Client Costs	576	580	533	512	145
Total Construction Costs	657	633	504	499	111
Total Base Cost	1,233	1,214	1,037	1,011	255
Total Risks P50	316	313	272	310	171
Total Real Project Cost (P50)	1,549	1,527	1,309	1,322	426

15.4.2 Operating phase costs

An O&M cost estimate has been prepared for the QBC, BRT and LRT options. The O&M cost estimates for the BRT and the LRT use a first principles approach and reflect the cost to establish and operate a standalone LRT or BRT system on the Sunshine Coast. The cost estimate for the QBC option reflects the cost to operate a new fleet of high-quality buses as an expansion of the existing Queensland Government contracted bus services on the Sunshine Coast. The wLRT option utilises the same operating cost estimate as the LRT option. The TT option utilises the same operating cost estimate as BRT. The incremental change in bus service kilometres from the Base Case is monetised using a per kilometre rate based on an indicative rate from South East Queensland bus service contracts and includes the full cost of the required infrastructure to operate bus services including the depot, standard O&M as well as purchase of the bus fleet.

The operating phase cost estimate is shown in Table 83, and includes the annual average operating cost as well as the discounted cost of operations over the 30-year appraisal period post start of operations.

Table 83 – Operating phase cost estimate ($ million, 2019/20)

Cost Item	Operating Phase Cost				
	LRT	wLRT	BRT	TT	QBC
Average annual LRT/BRT Operating Phase Costs (Real, undiscounted)	33	33	30	30	-
Average annual Bus Net Operating Phase Costs (Real, undiscounted)	30	30	30	30	28
Total LRT/BRT Operating Phase Costs including capital replacement (Real, discounted)	245	245	233	233	-
Total Bus Network Operating Phase Costs including capital replacement (Real, discounted)	256	256	256	256	206
Total Operating Phase Costs (Real, discounted)	**501**	**501**	**488**	**488**	**206**

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15.5. Economic benefits

The appraisal framework reflects the broad range of benefits that SCMT will generate through influencing land use change, employment outcomes and travel behaviour in the Sunshine Coast region. To quantify these impacts, the appraisal will quantify three broad categories of benefits to cover the range of potential benefits summarised in Figure 109.

Figure 109 – Benefits appraised in the SCMT OA

Source: PwC analysis (2020)

15.5.1 Transport and community benefits

Through investment in SCMT, there are a range of transport-related benefits that could be realised through impacts on:

- Public Transport users with benefits quantified including travel time savings for PT users, farebox revenue resource cost correction, improved vehicle amenity and improved station/stop amenity
- Road network users with benefits quantified including car and freight user travel time savings, and car and freight vehicle operating cost savings
- The community with benefits quantified including reduced environmental externalities, reduced crash costs, health benefits from active travel, reduced road maintenance costs and the residual value of assets.

15.5.2 Urban development benefits

The mass transit options are anticipated to promote the strategic intent of supporting land use change. The benefits have therefore been quantified for this appraisal and include land use change, infrastructure cost savings, and environmental and sustainability benefits.

15.5.3 Wider economic benefits

Wider Economic Benefits (WEBs) refer to the economic impacts achieved from the concentration of economic impacts over an area. Economic theory indicates that under perfect competition a transport appraisal would estimate all welfare impacts arising from a project. However, most markets are not perfectly competitive. If only direct user impacts are appraised, some economic impacts would not be captured in the appraisal.

Research has shown that these WEBs can be significant and can arise in a number of ways. These include productivity gains resulting from improvements in how well businesses are connected to each other as well as potential employees, and benefits arising from structural changes as businesses and households relocate.

SCMT is expected to improve the transport accessibility as well as attract jobs and businesses to relocate into the corridor. The change in transport accessibility and change in land use will generate different forms of WEBs, including agglomeration, labour supply impacts and output change from imperfectly competitive markets.

15.6. Results

15.6.1 Core results

The results of the economic appraisal are set out in terms of NPV as well as BCR and are broken down by benefit type in Table 84.

Key findings are summarised below:

- Key benefits estimated relate to public transport user benefits, in particular travel time savings for existing and new users together with amenity benefits and land value change associated with future land use growth being supported in the Sunshine Coast Urban Corridor
- The LRT and wLRT are estimated to produce the highest total benefits, followed closely by TT, BRT and QBC
- When considering only transport and community benefits, the benefits estimated for the mass transit options (LRT, wLRT, TT and BRT) demonstrates that these options are able to produce greater mode shift from road, together with higher customer benefits associated with improved amenity and meeting customer preferences. In contrast the QBC principally achieves benefits for existing PT users.

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Table 84 – Results of economic appraisal ($ million, 2019/20 real, discounted at 7 per cent over a 30-year appraisal period)

Cost Item	LRT		wLRT		BRT		TT		QBC
	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response
Costs									
Capital expenditure (P50)	1,087	1,087	1,073	1,073	936	936	942	942	299
Operating expenditure	234	234	234	234	222	222	222	222	-
Capital replacement	12	12	12	12	12	12	12	12	-
Bus operator costs	**223**	**223**	**256**	**256**	**223**	**223**	**256**	**256**	**206**
Total economic costs	**1,557**	**1,557**	**1,542**	**1,542**	**1,393**	**1,393**	**1,432**	**1,432**	**504**
Transport benefits									
Public Transport									
PT travel time savings (existing users)	94	95	94	95	93	93	93	93	124
PT travel time savings (new users)	160	161	160	161	158	159	158	159	141
Fare revenue resource correction	140	140	140	140	140	141	140	141	67
Improved stop/station amenity	16	17	16	17	16	16	16	16	-
Improved vehicle amenity	3	3.1	3	3.1	3	2.8	3	2.8	-
Road user benefits									
Car user travel time savings (existing users)	(95)	(42)	(95)	(42)	(95)	(91)	(95)	(91)	(76)
Car user travel time savings (new users)	1	(18)	1	(18)	1	1.1	1	1.1	0

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Cost Item	LRT		wLRT		BRT		TT		QBC
	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response
Freight travel time savings	(2)	7.0	(2)	7.0	(2)	(1.8)	(2)	(1.8)	(0.3)
Reduced vehicle operating costs - cars	107	207	107	207	108	118	108	118	68
Reduced vehicle operating costs - freight	(3)	36	(3)	36	(2)	5.2	(2)	5.2	0.5
Community and broader benefits									
Reduced environmental externalities	28	99	28	99	28	37	28	37	18
Reduced crash costs	29	60	29	60	29	32	29	32	19
Health benefits from active travel as part of a PT journey	46	51	46	51	46	46	46	46	(26)
Reduced road maintenance costs	19	42	19	42	19	21	19	21	12
Residual value	17	17	17	17	12	12	12	12	2
Sub-total transport and community benefits	**559**	**876**	**559**	**876**	**553**	**591**	**553**	**591**	**349**
BCR	**0.4**	**0.6**	**0.4**	**0.6**	**0.4**	**0.4**	**0.4**	**0.4**	**0.7**
Urban development benefits									
Land value change from zoning and density	-	613	-	613	-	307	-	307	-
Infrastructure cost savings	-	296	-	296	-	21	-	21	-
Environment & sustainability benefits	-	29	-	29	-	0.9	-	0.9	-
Sub-total urban	**-**	**938**	**-**	**938**	**-**	**328**	**-**	**328**	**-**

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Cost Item	LRT		wLRT		BRT		TT		QBC
	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response
development benefits									
Cumulative benefits	**559**	**1,814**	**559**	**1,814**	**553**	**920**	**553**	**920**	**349**
BCR	**0.4**	**1.2**	**0.4**	**1.2**	**0.4**	**0.7**	**0.4**	**0.7**	**0.7**
Wider economic benefits									
Agglomeration	3.5	33	3.5	33	0.3	8.3	0.3	8.3	(9.2)
Output change in imperfectly competitive markets	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Increased labour supply	2	1.8	2	1.8	2	1.8	2	1.8	0.5
Sub-total wider economic benefits	**6**	**35**	**6**	**35**	**3**	**11**	**3**	**11**	**(8.3)**
Cumulative benefits	**565**	**1,849**	**565**	**1,849**	**556**	**930**	**556**	**930**	**341**
BCR	**0.4**	**1.2**	**0.4**	**1.2**	**0.4**	**0.7**	**0.4**	**0.7**	**0.7**
NPV (excluding wider economic benefits)	**(998)**	**257**	**(983)**	**272**	**(840)**	**(474)**	**(879)**	**(479)**	**(155)**
BCR (excluding wider economic benefits)	**0.4**	**1.2**	**0.4**	**1.2**	**0.4**	**0.7**	**0.4**	**0.7**	**0.7**
NPV (including wider economic benefits)	**(992)**	**292**	**(977)**	**307**	**(837)**	**(463)**	**(843)**	**(469)**	**(163)**
BCR (including wider economic benefits)	**0.4**	**1.2**	**0.4**	**1.2**	**0.4**	**0.7**	**0.4**	**0.7**	**0.7**

15.6.2 Sensitivity testing

Sensitivity analysis has been undertaken to test the sensitivity of the appraisal results to the identified risk factors, uncertainties, key assumptions and parameters. The outcomes of this are shown in Table 85. These results show that without land use response all options have a BCR below 1. However, when the benefits of the land use response are considered the LRT/wLRT options have a BCR above 1 under all considered sensitivities.

Table 85 – Sensitivity testing results, including wider economic benefits ($M, 2019/20, real, discounted at 7% over a 30-year appraisal period)

Cost Item	LRT		wLRT		BRT		TT		QBC
	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response
Unadjusted results	0.4	1.2	0.4	1.2	0.4	0.7	0.4	0.7	0.7
4% discount rate	0.5	1.4	0.5	1.4	0.6	0.8	0.6	0.8	0.9
10% discount rate	0.3	1.0	0.3	1.0	0.3	0.6	0.3	0.6	0.5
Cost +20%	0.3	1.0	0.3	1.0	0.3	0.6	0.3	0.6	0.6
Cost -20%	0.5	1.5	0.5	1.5	0.5	0.8	0.5	0.8	0.9
Benefits +20%	0.4	1.4	0.4	1.4	0.5	0.8	0.5	0.8	0.8
Benefits -20%	0.3	0.9	0.3	0.9	0.3	0.5	0.3	0.5	0.6
Zero growth rate beyond 2041	0.3	1.1	0.3	1.1	0.4	0.6	0.4	0.6	0.7
SSEQ population growth (3.02%) beyond 2041	0.4	1.2	0.4	1.2	0.4	0.7	0.4	0.7	0.7
SCMT Base Case land use growth (0.76%) beyond 2041	0.4	1.1	0.4	1.1	0.4	0.7	0.4	0.7	0.7
Higher annualisation factor of 324	0.4	1.2	0.4	1.2	0.4	0.7	0.4	0.7	0.7
Vehicle operating cost using Brisbane specific coefficients	0.4	1.2	0.4	1.2	0.4	0.7	0.4	0.7	0.7
Queensland vehicle occupancy rates (1.6 for non-business and 1.4 for	0.4	1.2	0.4	1.2	0.4	0.7	0.4	0.7	0.7

Cost Item	LRT		wLRT		BRT		TT		QBC
	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response	With land use response	Without land use response
business vehicles)									
SEQ land use assumption	0.4	-	0.4	-	0.4	-	0.4	-	0.6
LRT scenario with reduced closure of lanes on Nicklin Way	-	1.2	-	1.2	-	-	-	-	-

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15.7. Strategic land use scenarios

The core economic results presented above have been estimated based on the *LRT Intervention* and the *BRT Intervention* land use scenarios outlined in Chapter 8. Strategic land use scenarios and corresponding economic appraisal results have also been considered at a high level to explore the following two potential factors:

- *Firstly, exploring the impact if Council determines an alternate level of land use change for implementation* - Ultimately, the Sunshine Coast Council will determine the level of land use change that could be targeted through the *Planning Scheme*. Council can influence the actual level and nature of the of land use change that occurs. The change would be managed and approved by Council in line with their desired vision and urban form for the corridor. Therefore, while the Reference Projects offer the potential to support a certain level of additional population and employment densification in the project corridor, Council has the ability to control the actual realised growth. Based on this, an alternate strategic LRT land use scenario has been assessed assuming a lower level of second round and urban development benefits to those estimated in the core results.
- *Secondly, exploring a potentially higher land use response for BRT and TT assuming LRT-level of quality in services is possible* - The BRT as specified in this Options Assessment has currently no direct comparison in Australia and therefore has the potential to achieve a higher land use response than existing examples. On the basis that BRT and TT are able to offer a level of service and capacity more akin to light rail, it may be possible that these modes can achieve a level of land use change greater than that shown in the core results above. Based on this, an alternate strategic BRT and TT land use scenario has been assessed based on the capacity assumed in the costs/specifications in this business case, with BRT having approximately 50 per cent of the transport capacity of the LRT (and TT slightly higher), yet assuming a quality of service (e.g. in relation to travel time, reliability, permanence, signal priority, separated right of way, comfort of travel, stop amenity, etc) comparable to LRT.

Figure 110 shows the theoretical range of transport benefit outcomes in 2041 that could be achieved dependent on the level of land use change sought. It plots the change in potential population in the corridor against the baseline trend forecast and the level of additional second round benefits that could be realised.

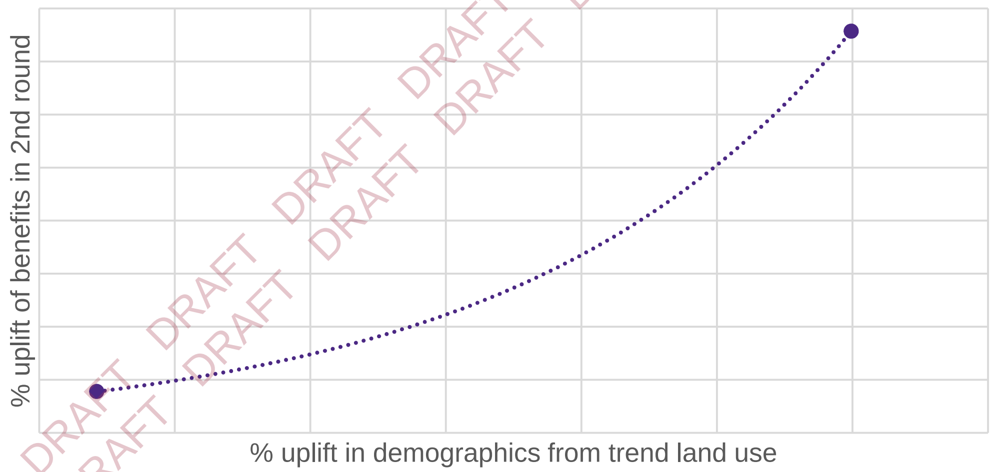

Figure 110 – Indicative second round benefit uplift based on change in demographic forecasts

Based on this concept, a spectrum of second round economic benefits and results have been strategically assessed resulting in the ranges presented in Table 86.

Table 86 – Alternate land use scenario economic results

Cost Item	LRT	wLRT	BRT	TT	QBC
	With land use change	With land use change	With land use change	With land use change	Without land use change
Total cost	**1,557**	**1,575**	**1,393**	**1,432**	**504**
PT user benefits	415-416	415-416	412-413	412-413	332
Road user benefits	154-190	154-190	32-100	32-100	(8)
Community and broad benefits	243-269	243-269	148-202	148-202	25
Sub-total benefits	812-875	812-875	591-715	591-715	349
BCR	**0.5-0.6**	**0.5-0.6**	**0.4-0.5**	**0.4-0.5**	**0.7**
Urban development benefits	750-938	750-938	328-469	328-645	-
WEBs	29-35	29-35	8-19	8-19	(8.3)
Cumulative benefits (excluding WEBs)	**1,562-1,814**	**1,562-1,814**	**919-1,184**	**919-1,360**	**349**
Cumulative benefits (including WEBs)	**1,591–1,849**	**1,591–1,849**	**928-1,203**	**928-1,379**	**341**
NPV (excluding WEBs)	**5.5-257**	**21-272**	**(474)-(209)**	**(513)-(72)**	**(155)**
BCR (excluding WEBs)	**1.0-1.2**	**1.0-1.2**	**0.7-0.8**	**0.7-0.9**	**0.7**
NPV (including WEBs)	**35-292**	**50-307**	**(465)-(190)**	**(504)-(53)**	**(163)**
BCR (including WEBs)	**1.0-1.2**	**1.0-1.2**	**0.7-0.9**	**0.7-0.9**	**0.7**

Note: to estimate the benefits ranges with land use presented above, a combination of modelled outcomes and adjusted scenarios has been applied.

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15.8. Summary and potential areas of exploration

The economic analysis suggested that:

- Investment in mass transit in the Sunshine Coast offers the potential to generate improved transport and amenity outcomes for public transport users, as well as reduced road congestion
- LRT/wLRT has the greatest potential to support land use change given the take-up it supports. Depending on the level of land use change that occurs, it could realise the highest BCR. However, BRT/TT appear able to achieve higher economic outcomes on the basis that they offer a similar level of transport quality and capacity. This should be the subject to further consideration in the Detailed Business Case.

Based on these results, it is considered that there is sufficient justification for further consideration of mass transit to deliver increased public transport mode share together with improved land use outcomes on the Sunshine Coast, and to achieve the Council's and Queensland Government's strategic objectives and maintain the lifestyle and amenity attraction of the Sunshine Coast.

As identified in the land use analysis, there is a current lack of clear evidence as to the potential ability of BRT/TT to increase land use take-up. This is reflected in the economic analysis which reveals a lower BCR for the BRT/TT options relative to LRT. Additionally, all the Category B mass transit options (LRT, wLRT, BRT and TT) have allow first round BCRs based on their current specification. Through the economic analysis a number of further areas of exploration have been identified.

Potential areas of exploration for further analysis:

- Quality of mass transit to be delivered – there is merit exploring the service offering able to be provided by LRT/BRT/TT to attract greater mode shift, more refined land use change, and ultimately potential economic benefits, in particular for BRT to improve outcomes relative to existing BRT systems in Australia. This could include exploring areas such as: service frequency, travel time, reliability, permanence, signal priority, separated right of way, comfort of travel, stop amenity, etc.
- Staging of investment/modes – there may be merit exploring the staging of modal solutions to commence behaviour change and PT use in early years yet balance costs over time
- Parking costs – to support transport behaviour change and take up of PT, there is merit exploring concurrent targeted changes in parking costs along the corridor
- Bus feeder services – there is merit exploring in greater detail the role of the existing bus network and investment in supporting bus feeder services to support a network response
- Complementary investments – there may be other complementary projects invested in the transport network, for instance investment in other parts of the road network that may minimise road congestion associated with removal of some road lane capacity to support each of the options assessed
- Land use vision with and without mass transit – it is recommended that land use analysis is undertaken to define Government's vision for the level and distribution of population and employment growth in the Sunshine Coast LGA, and that the transport solutions assessed are aligned with this
- Options for future assessment – there may be merit in continuing to explore a range of bus and mass transit options as the above areas of exploration are further considered, combined with further testing the evidence for BRT and TT to impact mode shift as well as land use change relative to LRT.

15.8.1 Improving the economic performance of options in the Detailed Business Case

There are a number of factors that can be addressed to improve the performance of shortlisted options in the Detailed Business Case, including:

- Updating the base transport network to include new road projects, most significantly the MRI project that will remove significant through traffic from Nicklin Way and reduce or eliminate dis-benefits to motorists that are reducing the mass transit BCRs
- Reviewing assumptions around the price and supply of car parking in major centres to ensure prices accurately reflect likely future conditions
- Considering alternative staging strategies for some of the options
- Improving the transport modelling tools to better reflect likely ridership on the system.

There are opportunities to significantly enhance the methodology used to undertake the economic assessment of shortlisted options during the Detailed Business Case stage, particularly the Category B mass transit options (TT, BRT, wLRT, and LRT)

Based on the findings of the economic assessment, and identified areas for further investigation, it is considered appropriate to further assess the development of Category B mass transit on the Sunshine Coast in a Detailed Business Case.

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Sunshine Coast Mass Transit
DRAFT Options Analysis
APRIL 2021

PRELIMINARY FINANCIAL ANALYSIS

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16. Preliminary Financial Analysis

The purpose of this chapter is to present the outcomes of preliminary financial and affordability analysis undertaken for the proposed options for Stage 1 of the Project. This chapter includes two key components:

1. **Financial analysis:** provides an overview of the whole-of-life cost and revenues of the Project over the evaluation period and presents the financial analysis outcomes.
2. **Affordability analysis**: provides an overview of the net funding requirement, affordability considerations and budgetary impacts.

16.1. Methodology

The financial analysis of Project options has been undertaken in accordance with the requirements of the 2016 BCDF Release 2. The method applied in this analysis is the same as the revised Stage 2 guidelines from the BCDF Release 3. Each of the Project cost and revenue elements are represented in nominal and present value (PV) terms.

A financial model was developed to capture the construction, mobilisation and operating period costs to present cash flows to the end of the analysis period for each option. Revenue has been used to offset operating costs to present the net cash flows. This approach reflects a typical discounted cash flow analysis methodology for the assessment of the infrastructure projects.

The financial analysis methodology and assumptions are illustrated in Figure 111.

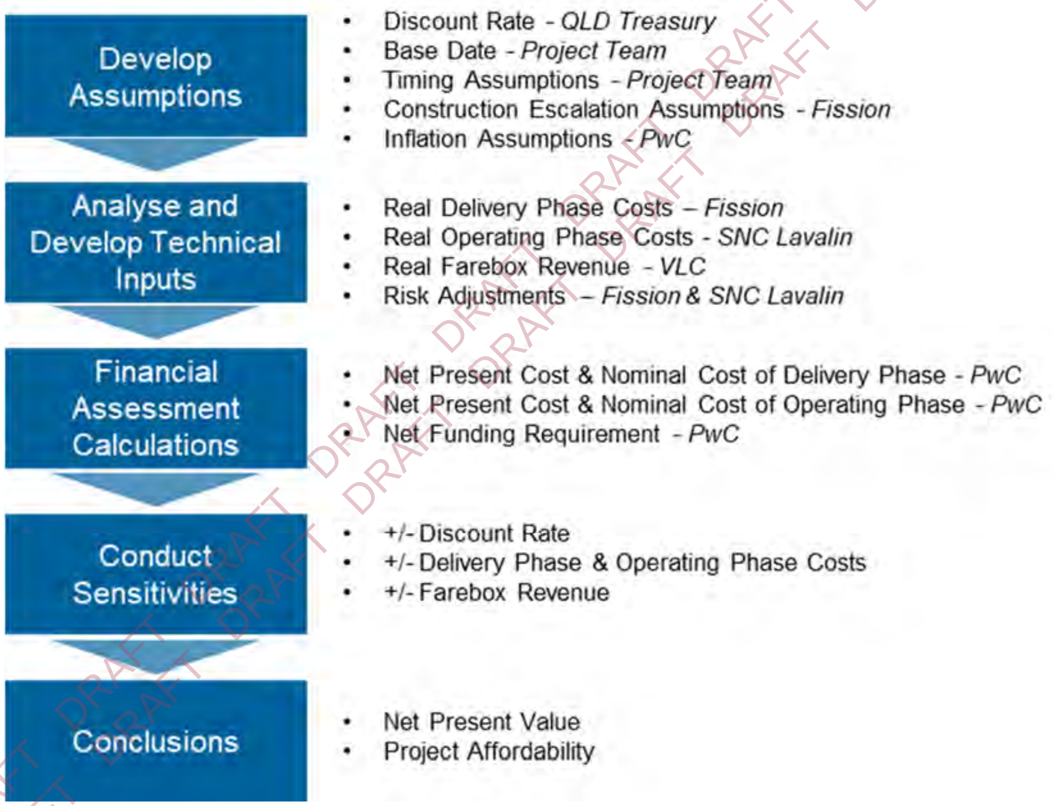

Figure 111 – Financial Analysis methodology

The five options identified as the Stage 1 Reference Projects which are assessed in this financial analysis are QBC, TT, BRT, wLRT and LRT.

16.2. General assumptions

Table 87 provides a summary of the general assumptions used in the development of the financial model relating to timing, escalation, discounting and tax.

Table 87 – General assumptions for the financial analysis

Category	Assumption	Source/Comments
Assessment period		
QBC	30 years of operations	Appraisal period is typical for infrastructure projects of this size and nature.
TT	30 years of operations	
BRT	30 years of operations	
wLRT	30 years of operations	
LRT	30 years of operations	
Periods by stage		
Preliminaries QBC TT BRT wLRT LRT	 1 July 2020 – 30 June 2025 1 July 2020 – 31 March 2024 1 July 2020 – 31 July 2024 1 July 2020 – 31 March 2024 1 July 2020 – 31 March 2024	*Preliminaries and construction* Developed by Fission which has been benchmarked where applicable against GCLR.
Construction period QBC TT BRT wLRT LRT	 1 July 2025 – 30 June 2027 1 April 2024 – 31 January 2027 1 August 2024 – 30 June 2027 1 April 2024 – 30 June 2027 1 April 2024 – 30 June 2027	
Mobilisation period QBC TT BRT wLRT LRT	 N/A 1 July 2023 – 30 June 2027 1 July 2023 – 30 June 2027 1 July 2023 – 30 June 2027 1 July 2023 – 30 June 2027	*Mobilisation and operations* The operations period was developed by SNC-Lavalin over a 30-year period. Mobilisation is assumed to start four years before operations commence on TT, BRT, wLRT and LRT projects. For QBC, mobilisation is not necessary. It has been assumed and agreed with the project team that all options will commence operations on 1 July 2027, for evaluation purposes.
Operations period QBC TT BRT wLRT LRT	 1 July 2027 – 30 June 2057 1 July 2027 – 30 June 2057 1 July 2027 – 30 June 2057 1 July 2027 – 30 June 2057 1 July 2027 – 30 June 2057	
Taxation		
Taxation	Tax and GST exclusive	Financial assessment has been performed on a tax and GST exclusive basis.
Discount rate		
Discount rate	2.73%	Queensland Treasury Corporation (QTC) recommends projects deemed as social infrastructure (investments where revenue does not recoup the initial investment) to adopt a discount rate that is the average for QTC 10-year bonds for the last 20 trading days. For such projects delivered by

Category	Assumption	Source/Comments
		Government, a recommended discount rate in nominal terms is the average for QTC 10-year bonds for the last 20 trading days, being 1.63%. A premium margin of 1.10% has been added as an applicable rate. The discount rate recommended is for use in the Project's financial analysis, not the economic analysis.
NVP base period		
NPV base period	FY2020	Reflects the delivery, mobilisation and operating pStage cost timing profile as provided by Fission and SNC-Lavalin, which commences FY20.
Rounding and summation in tables		
Rounding and summation in tables		The sum figures presented in each table may not total due to differences in rounding.

Table 88 provides the technical inputs assumptions used in the financial model relating to capital and operation escalation, farebox revenue and the risk assessment.

Table 88 – Assumptions on technical inputs

Input	Assumption	Detail
Capital escalation assumptions	Escalation rates applied across all capital expenditure during the delivery Stagestage.	Fission adopts escalation using indices from DITRDC. See Table 108 for the year by year breakdown.
Farebox revenue	Patronage revenue multiplied by uplift in PT users.	Refer to Chapter 15 for detail.
Operation escalation assumptions	1.88% p.a.	Operation escalation applied to the operational expenditure to convert to nominal terms using the 10-year average of Brisbane historical Consumer Price Index, retrieved from QTC.
Risk assessment – QBC	Total risk contingency to be adopted is 67%.	The cost estimate for the QBC Reference Project was developed as a Strategic Estimate and risk adjusted using a contingency approach in accordance with Annexure E of the TMR PCEM.
Risk assessment – TT, BRT, wLRT and LRT	Capital expenditure has been provided by Fission for TT, BRT, wLRT and LRT at P50 and P90 levels. This analysis will examine the risk at only the P50 level.	Calculated using a Monte Carlo simulation. Monte Carlo simulations are used to model the probability of different outcomes in a process that cannot easily be predicted.

The escalation of costs has been determined by applying escalation indices using the DITRDC Project Cost Breakdown template across the various years of Project capital expenditure. Table 89 summarises the rates used in the costings estimates. Note that for the QBC option, a flat escalation rate of 2.75 per cent was used.

Table 89 – Escalation rates provided by DIRTC

	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27+
Escalation	2.85%	3.39%	3.43%	2.82%	2.29%	2.12%	2.81%

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16.3. Financial assessment

This section outlines the financial assessment results of the Project. It presents the financial outcomes according to the following structure:

- **Delivery stage** - which includes the risk adjusted capital expenditure estimates.
- **Operating stage** - which includes the mobilisation and the O&M costs and Project revenue.
- **Whole-of-project summary** - which outlines the NPV of the whole Project.
- **Sensitivity analysis** - which tests the Project options' NPV against various scenarios based on changes to underlying assumptions.

16.3.1 Delivery stage

The delivery stage costs include all direct and indirect costs associated with the Project options. Table 90 outlines the delivery stage costs for each option in both nominal and PV terms.

Table 90 – Delivery stage costs – nominal and present value (PV)

Construction costs	QBC	TT	BRT	wLRT	LRT
Nominal $'000	493,070	1,540,454	1,524,808	1,783,806	1,816,668
PV $'000	426,701	1,343,899	1,331,623	1,546,795	1,574,456

The risk estimates for TT, BRT, wLRT and LRT have been provided at P50 levels of confidence for the capital expenditure costs applied over the relevant construction periods. Given the preliminary nature of this analysis, only P50 risk adjustments will be used for the financial examination. Risk costs were quantified by Fission and calculated using a Monte-Carlo simulation using the @Risk software.

QBC risk cost was developed as a strategic estimate, and risk was adjusted using a contingency approach in accordance with the TMR PCEM.

16.3.1.1 Excluded Costs

This financial assessment is based on cash inflows and outflows from July 2020. Expenditure incurred before this date or already incurred can be considered sunk costs and, accordingly, not appropriate to include in this financial assessment.

16.3.1.2 Operating stage period

The operating stage costs assume a 30-year operating period, with the Project assumed to start operations on 1 July 2027.

16.3.1.3 Operating costs

The operating stage costs for BRT and LRT have been developed by SNC-Lavalin with costs, where possible, benchmarked against similar operations and then adjusted accordingly to reflect the metrics of the proposed Project. The operating costs for QBC are purely driven by additional bus kilometres. The operating costs for wLRT are based on the LRT operating costs and TT utilises the BRT operating cost estimates.

Table 91 summarises the O&M costs in PV and nominal terms over the 30-year operating analysis period.

Table 91 – Operating and Maintenance costs

O&M costs	QBC	TT	BRT	wLRT	LRT
Nominal $'000	1,333,279	2,943,435	2,943,435	3,056,513	3,056,513
PV $'000	700,361	1,578,139	1,578,139	1,634,013	1,634,013

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16.3.1.4 Farebox Revenue

Farebox revenue is the revenue generated by the Project that is used to offset the operating stage costs.

Table 92 shows the amount upon which the revenue of each individual Project offsets the costs to realise net Project value.

Table 92 – Total farebox revenue - nominal

Total farebox revenue	QBC	TT	BRT	wLRT	LRT
Nominal $'000	480,937	1,028,144	1,028,144	1,047,401	1,047,401

Table 93 to Table 97 outline the whole-of-life summary of the total Project cost for each option, respectively. These costs determine and review the net Project value given all sources of revenue against all sources of costs over the Project's appraisal period.

Table 93 – QBC total Project costs

QBC			
Cost Item	**Real ($000)**	**Nominal ($000)**	**PV ($000)**
Construction Costs	(426,392)	(493,070)	(426,701)
Operating Costs	(849,229)	(1,333,279)	(700,361)
Farebox Revenue	300,611	480,937	245,639
Net Project Value	(975,011)	(1,345,412)	(881,423)

Table 94 – TT total Project costs

TT			
Cost Item	**Real ($000)**	**Nominal ($000)**	**PV ($000)**
Construction Costs	(1,321,975)	(1,540,454)	(1,343,899)
Operating Costs	(1,901,021)	(2,943,435)	(1,578,139)
Farebox Revenue	646,578	1,028,144	529,939
Net Project Value	(2,576,418)	(3,455,745)	(2,392,098)

Table 95 – BRT total Project costs

BRT			
Cost Item	**Real ($000)**	**Nominal ($000)**	**PV ($000)**
Construction Costs	(1,309,754)	(1,524,808)	(1,331,623)
Operating Costs	(1,901,021)	(2,943,435)	(1,578,139)
Farebox Revenue	646,578	1,028,144	529,939
Net Project Value	(2,564,198)	(3,440,100)	(2,379,823)

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Table 96 – wLRT total Project costs

wLRT			
Cost Item	**Real ($000)**	**Nominal ($000)**	**PV ($000)**
Construction Costs	(1,527,645)	(1,783,806)	(1,546,795)
Operating Costs	(1,970,316)	(3,056,513)	(1,634,013)
Farebox Revenue	657,993	1,047,401	539,027
Net Project Value	(2,839,968)	(3,792,918)	(2,641,781)

Table 97 – LRT – conventional overhead power supply total Project costs

LRT			
Cost Item	**Real ($000)**	**Nominal ($000)**	**PV ($000)**
Construction Costs	(1,549,709)	(1,816,668)	(1,574,456)
Operating Costs	(1,970,316)	(3,056,513)	(1,634,013)
Farebox Revenue	657,993	1,047,401	539,027
Net Project Value	(2,862,033)	(3,825,780)	(2,669,441)

The best compactor for total Project costs is the net Project value taken in PV costs. A summary of the PV of all costs for the options is provided in Table 98.

Table 98 – Comparison of the Net present values of all options

Cost Item	NVP ($000)				
	QBC	TT	BRT	wLRT	LRT
Construction Costs	(426,701)	(1,343,899)	(1,331,623)	(1,546,795)	(1,574,456)
Operating Costs	(700,361)	(1,578,139)	(1,578,139)	(1,634,013)	(1,634,013)
Farebox Revenue	245,639	529,939	529,939	539,027	539,027
Net Project Value	**(881,423)**	**(2,392,098)**	**(2,379,823)**	**(2,641,781)**	**(2,669,441)**

All options require an increasing level of funding after the delivery stage, however, QBC requires significantly less operational expenditure funding after delivery due to the project being less capital intensive.

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16.3.1.5 Sensitivity analysis

Sensitivities have been conducted on the NPV for the different Project options to consider various incremental increases and decreases to cost, revenue and discount rates. Outcomes of the sensitivity analysis are presented in Table 99. The results show that the TT, BRT, wLRT and LRT options are most sensitive to changes in O&M and construction costs. The QBC option is more sensitive to changes in O&M costs relative to other options. Changes in revenue have immaterial impact to all options.

Table 99 – Sensitivity analysis – NPV

Cost Item	QBC ($'000)	TT ($'000)	BRT ($'000)	wLRT ($'000)	LRT con($'000)
Base Case	(881,423)	(2,392,098)	(2,379,823)	(2,641,781)	(2,669,441)
Construction cost increase 25%	(998,099)	(2,728,073)	(2,712,728)	(3,028,480)	(3,063,055)
Construction cost decrease 25%	(774,748)	(2,056,124)	(2,046,917)	(2,255,082)	(2,275,827)
O&M costs increase 25%	(1,056,514)	(2,786,633)	(2,774,357)	(3,050,284)	(3,077,944)
O&M costs decrease 25%	(706,333)	(1,997,564)	(1,985,288)	(2,233,278)	(2,260,938)
Discount rate up 1%	(773,093)	(2,136,044)	(2,124,825)	(2,362,679)	(2,388,682)
Discount rate down 1%	(1,017,140)	(2,707,849)	(2,694,426)	(2,984,695)	(3,014,139)
Revenue up 10%	(856,859)	(2,339,105)	(2,326,829)	(2,587,878)	(2,615,539)
Revenue down 10%	(905,987)	(2,445,092)	(2,432,817)	(2,695,684)	(2,723,344)

16.4. Financial assessment summary

This financial assessment analysed the capital and operating expenditure required and revenue earned for the following five Reference Projects – QBC, TT, BRT, wLRT and LRT. All five Reference Projects will require significant funding during the delivery stage to accommodate the infrastructure development required. The LRT option, as the most capital intensive, requires the highest investment during the delivery and operational stages. None of the Project options generate sufficient farebox revenue during the appraisal period to recover capital or operating costs. A further detailed cost estimate will be required for the preferred Reference Project(s) during the Detailed Business Case stage.

A summary of the financial assessment results for each option is below.

16.4.1 QBC summary

The risk-adjusted (contingency approach) capital cost required for the QBC Project option equates to $493 million in nominal terms, and $426 million in PV terms. The risk-adjusted O&M costs, excluding farebox revenue is $1.3 billion in nominal terms and $700 million in PV terms. The farebox revenue is assumed to total $481 million in nominal terms, and $246 million in PV terms over the 30-year operating period assessed. Net risk-adjusted (contingency approach) whole-of-life project costs over the assessment period (i.e. delivery and operating stage costs, less farebox revenue) are estimated to be $1.3 billion in nominal terms, and $881 million in PV terms.

The NPV of this option is most sensitive to changes in the O&M costs, discount rate and construction costs.

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16.4.2 TT summary

The risk adjusted (P50) capital cost required for the TT Reference Project option equates to $1.5 billion in nominal terms, and $1.3 billion in PV terms. The risk-adjusted O&M costs, excluding farebox revenue is $2.9 billion in nominal terms and $1.6 billion in PV terms. The farebox revenue is assumed to total $1.0 billion in nominal terms, and $530 million in PV terms over the 30-year operating period assessed. Net risk-adjusted (P50) whole-of-life project costs over the assessment period are estimated to be $3.5 billion in nominal terms, and $2.4 billion in PV terms.

The NPV of this option is most sensitive to changes in the O&M costs, construction costs and discount rate.

16.4.3 BRT summary

The risk adjusted (P50) capital cost required for the BRT Reference Project option equates to $1.5 billion in nominal terms, and $1.3 billion in PV terms. The risk-adjusted O&M costs, excluding farebox revenue is $2.9 billion in nominal terms and $1.6 billion in PV terms. The farebox revenue is assumed to total $1,028 million in nominal terms, and $530 million in PV terms over the 30-year operating period assessed. Net risk-adjusted (P50) whole-of-life project costs over the assessment period are estimated to be $3.4 billion in nominal terms, and $2.4 billion in PV terms.

The NPV of this option is most sensitive to changes in the O&M costs, construction costs and discount rate.

16.4.4 wLRT summary

The risk adjusted (P50) capital cost required for the wLRT Reference Project equates to $1.8 billion in nominal terms, and $1.5 billion in PV terms. The risk-adjusted O&M costs, exclusive of farebox revenue, is $3.1 billion in nominal terms and $1.6 billion in PV terms. The farebox revenue is assumed to total $1.0 billion in nominal terms, and $539 million in PV terms over the 30-year operating period assessed. Net risk-adjusted (P50) whole-of-life project costs over the assessment period are estimated to be $3.8 billion in nominal terms, and $2.6 billion in PV terms.

The NPV of this option is most sensitive to changes in the O&M costs, construction costs and discount rate.

16.4.5 LRT conventional overhead power supply summary

The risk adjusted (P50) capital cost required for the LRT Reference Project equates to $1.8 billion in nominal terms, and $1.6 billion in PV terms. The risk-adjusted O&M costs, exclusive of farebox revenue, is $3.1 billion in nominal terms and $1.6 billion in PV terms. The farebox revenue is assumed to total $1.0 billion in nominal terms, and $539 million in PV terms over the 30-year operating period assessed. Net risk-adjusted (P50) whole-of-life project costs over the assessment period are estimated to be $3.8 billion in nominal terms, and $2.7 billion in PV terms.

The NPV of this option is most sensitive to changes in the O&M costs, construction costs and discount rate.

16.5. Funding strategy

The Project will address future public transport travel capacity constraints within the Sunshine Coast Urban Corridor, resulting in increased value for the majority of stakeholders affected. There will also be potential opportunities for private sector funding, reducing costs for Government and simultaneously stimulating private sector investment. Project funding will be achieved through a combination of farebox revenue and Government grants. To achieve an optimal funding allocation, further investigation is needed into the merits of various sources of funding and the funding mix. A high-level representation of a potential funding strategy is demonstrated in Figure 112.

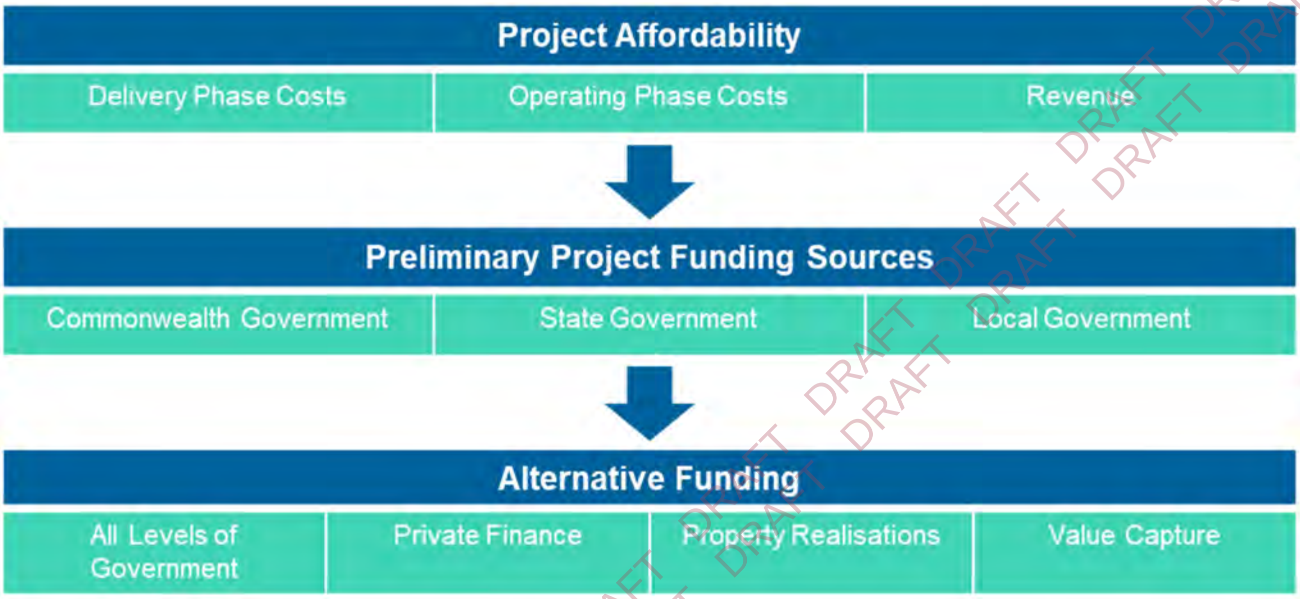

Figure 112 – High level funding strategy

16.6. Affordability analysis summary

The whole-of-life net funding requirement for the five options in PV terms are:

- QBC $1,345 million
- TT $3,456 million
- BRT $3,440 million
- wLRT $3,793 million
- LRT $3,826 million.

Farebox revenue for all five options recover a limited amount of the required net funding costs.

TT, BRT, wLRT and LRT options will require significant funding contributions from the Government, likely at all three levels. QBC as an option, on a relative scale requires approximately 30 to 40 per cent of the funding proportionate to the other options. However as noted in Chapter 10, it is not able to meet the full range of Project objectives.

Value capture mechanisms may be applied, especially in the case of the TT, BRT, wLRT and LRT options and should be investigated further as a means of reducing net funding costs. While not a sole source of funding, these may offer supplementary funding options.

Matters that need to be further investigated and finalised during the Detailed Business Case stage include the ability to acquire property and the potential of surplus land sale value attributable to the Project.

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PRELIMINARY DELIVERY MODEL ANALYSIS

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17. Preliminary Delivery Model Analysis

17.1. Purpose

Analysing potential and appropriate delivery and procurement models is an important step of the Options Analysis process. The key objective of the delivery model assessment is to identify, assess and select the most appropriate delivery model (including the packaging and procurement approach) that is likely to provide the best value for money outcome, while meeting the Project's service needs and objectives.

The purpose of this chapter is to identify the packaging, staging, procurement approach and delivery model options available for the Project. Areas that may require further analysis during the Detailed Business Case stage are also considered. This assessment is preliminary only and subject to detailed assessment and confirmation through the Detailed Business Case, including a market sounding process.

17.2. Methodology

The methodology for assessing the preferred delivery model for the Project is based on state and national guidelines, including:

- Queensland Government's PAF
- BQ's BCDF
- National Public Private Partnership (PPP) Policy and Guidelines.

17.3. Procurement objectives

The objectives of the procurement undertaken in relation the Project include:

- Capture long term value for the Sunshine Coast economy
- Procure services that will deliver assets and services with safer outcomes
- Assist to deliver a single integrated transport network that is accessible to everyone
- Optimise the value of new and existing assets in terms of net present capital costs and lifecycle costs, while also meeting Project objectives and service needs
- Adopt a risk profile that balances market ability to efficiently price risks with the Government's preference to minimise its exposure to delivery risks
- Adopt a delivery model that embeds sustainability into the planning, design and construction so that environmental, social and economic outcomes are achieved for the Council
- Maximise opportunities to capture value through market innovation
- Procure assets and services that will deliver a mass transit system that satisfies long term operational, maintenance and capacity requirements of the region's transit network, particularly in relation to the targets and goals set out in *ShapingSEQ* and the Sunshine Coast Regional Economic Development Strategy 2013 – 2033
- Incorporate the requirements of the Queensland Government's Ethical Procurement Policy (2019).

17.4. Procurement objectives

This section describes the scope of services to be delivered for each transport mode. The services are presented in Table 100 for the different stages of the Project lifecycle and are used as the basis for a packaging assessment.

Table 100 – Scope of proposed works for each option

	LRT	BRT	QBC
Overview	The light rail option will be an integrated solution to design, construct and operate a PT system. There is a high level of integration between the built asset and the operating vehicles.	The BRT option will be an integrated solution to design, construct and operate a PT system. There is a high level of integration between the built asset and the operating vehicles.	The bus option will involve operating buses in bus lanes or general traffic lanes. There is little integration between the built asset and the operating vehicles.
Operations	Operating an integrated light rail system including maintaining all assets and systems required for light rail operations including: • Operating LRVs • Recruiting, training, managing drivers and operational staff • Light rail control systems, and rail signalling systems • Maintaining and operating ticketing and client supplied systems • Routine and lifecycle maintenance of vehicles, stations and track assets • Maintaining accreditation to operate a light rail system.	Operating an integrated BRT system including maintaining all assets and systems including: • Operating BRT vehicles • Recruiting, training, managing drivers and operational staff • Maintaining and operating ticketing and client supplied systems • Routine and lifecycle maintenance of vehicles, stations and pavement assets • Maintaining relevant operational accreditation.	Operating a bus network within the Sunshine Coast Region including: • Operating a fleet of buses including higher specification buses on trunk routes • Recruiting, training, managing drivers and operational staff • Maintaining and operating ticketing and client supplied systems • Routine and lifecycle maintenance of vehicles • Maintaining relevant operational accreditation.
Delivery	D&C of all light rail assets including: • PUP relocations and protection • Earthworks and site preparation • Track slab and embedded rails • Traffic management • Road works including interfaces with road network • Rail systems and signalling, traffic signal integration • Traction power system including substations • Depot, stabling, and maintenance facility • Light rail stations • Landscaping and urban form • Interfaces with ticketing systems and other client supplied systems at stations.	D&C of all BRT assets including: • PUP relocations and protection • Earthworks and site preparation • Pavements and running way • Traffic management • Road works including interfaces with road network • Traffic signal integration • Depot, stabling, and maintenance facility • BRT stations • Landscaping and urban form • Interfaces with ticketing systems and other client supplied systems at stations.	D&C of bus lanes and road infrastructure including: • PUP relocations and protection • Earthworks and site preparation • Pavements and running way • Traffic management • Road works including interfaces with road network • Traffic signal integration • High quality bus stops • Landscaping and urban form.

17.5. Delivery model options

There are several delivery models that could be used to deliver the Project. Differentiating factors relate primarily to how each model apportions risk between the client and the contracted party or parties. Traditional delivery models involve the Government retaining responsibility for funding, demand risk, and asset ownership at the end of the construction. These models differ primarily in their risk allocation throughout the Project lifecycle. Traditional delivery model options include:

- Construct only
  - Early Tenderer Involvement (ETI)
- Design and Construct
  - Collaborative D&C
  - Dual Early Contractor Involvement (ECI)
- Design, Construct and Maintain (DCM)
- Design, Construct, Maintain and Operate (DCMO)
- Alliance
- Managing Contractor
- Operating contract (bus operations).

A PPP model involves private financing and transferring risks to the private sector as they would be responsible for managing the design, construction, maintenance and operation of the asset. PPP delivery model options can include a broad scope of assets and services subject to the requirements of the Project sponsor.

17.5.1 Delivery model components

There are four components of work that every project involves:

1. Design, involving the concept and detailed design of the asset prior to construction
2. Construction, including the contract for building the assets, with potential for early works
3. Maintenance, including ongoing major and minor upkeep of the asset over a specified contract period
4. Operations, including the ongoing operational responsibilities of the asset and potentially revenue generation/collection over the contract period.

All delivery model options include these four components in various combinations, with the PPP options including the potential to involve private sector finance.

17.5.2 Traditional delivery model options

Each model considered in this analysis is described in Table 101.

Table 101 – Delivery Model Options

Delivery Model	Description
Construct Only	A Construct Only model involves the State tendering for a construction contractor and maintaining responsibility for separately outsourcing for the design and O&M.
ETI	ETI is a subset of the Construct Only model and is a procurement method applied to standard construction contracts. ETI involves selecting two or three competing contractors to participate. The focus of the ETI procurement is to improve the design and constructability of the Project.
D&C	A D&C model involves the State preparing a design brief outlining the key functional and service requirements, then requires tenderers to complete the detailed design consistent with the brief and to construct the works.

Delivery Model	Description
Collaborative D&C	A collaborative D&C model is a subset of the D&C model where the State and a private party actively collaborate to ensure the design is fit and designed for purpose. A collaborative D&C is applied after the preferred tenderer is selected.
Dual ECI	The ECI model is best suited in a project where there are perceived scoping and output benefits of early involvement of the contractor. The ECI delivery model tender stage is generally followed by a two-step interactive process to negotiate a D&C contract. An Expression of Interest is developed and industry response to non-price criteria is sought. A shortlisting process then occurs through a series of interviews and workshops. It is a collaborative approach to contracting where contractors are engaged in the early stages of the project process to develop a tender for construction. It allows two preferred contractors to be selected and work with the State to develop the project design, assess the risks within the project and develop a risk adjusted tender price.
DCM	A DCM contract involves an augmentation of a D&C contract to include ongoing minor and major maintenance to the asset. Maintenance is for a specified period of time over a set contracted period of usually ten to 30 years.
DCMO	A DCMO contract is a DCM contract with a requirement to also operate asset for a set period of time.
Alliance	In project alliancing, the Project owner collaborates with one or more non-owner parties (e.g. a designer and constructor) to share the risks and responsibilities in delivering the construction stage of a project. Non-owner parties are typically guaranteed reimbursement of their direct project costs and payment of corporate project overheads in an open-book arrangement. Targets for cost, schedule and other key parameters are developed jointly during the pre-construction stage.
Managing Contractor	A Managing Contractor involves the State contracting a single entity to manage the entire DCMO process and the contractors involved. The contract generally involves a fixed payment.
PPP – Design, Build, Finance and Operate (DBFO)	A PPP is a long-term contract between the Government and a private party (usually a special purpose vehicle) to DBFO an infrastructure project and provide the specified services to the Government. In a PPP contract the private party takes on project and service delivery risk in return for availability payments by the State. Under this model, the State will only pay for services delivered.
PPP Build, Own, Operate and Transfer (BOOT)	Under a BOOT delivery model, the Government would contract with a consortium to carry out all project activities, including financing the project. The consortium would receive the revenue that the project generates (i.e. fare box and advertising revenues). Where there is a short fall in relation to costs, the Government may provide capital or on-going contributions to improve the project's viability. This delivery model allows for the highest level of risk transfer including all construction, commissioning and whole of life asset risks, and importantly revenue risk, however, is not common in Australian PT projects.
Operating contract (bus Operations)	The Queensland Government acting through TransLink has established bus service contracts in SEQ. Private bus operators provide bus services including privately owned buses and depots where operators are responsible for fleet maintenance. Under this model, revenue risk is retained by TransLink and the operators are paid for services provided. Operators employ all drivers and operational staff.

17.6. Assessment of delivery models to be updated

Precedent projects have confirmed that stakeholder engagement is crucial to successful delivery of a mass transit project. Learnings from these projects have shown that for strong contractor agreement, the delivery model needs to have a high level of collaboration with the contractor. Leveraging learnings from precedent projects, this section outlines the assessment of delivery models for the Project. Findings here are preliminary and will be tested and confirmed through the Detailed Business Case stage.

17.6.1 QBC

17.6.1.1 Operating bus services

Bus services are provided by operators in SEQ contracted by the Queensland Government, with TransLink as the contracting party. TransLink has recently completed negotiation and execution of the Fourth Generation (4G) contracts with bus operators, with the contracts operational until June 2023 and an option to extend to June 2025. Through the 4G contract negotiation, the contracts were standardised across SEQ to improve consistency of service standards, and to increase transparency of pricing and therefore, value for money to the Government.

Key features of the current (4G) bus service contracts include:

- Bus operators are contracted on long term (five plus two year) contracts to provide bus services
- Bus routes and services are specified by TransLink and schedules and pricing is agreed by the bus operators
- The contracts are performance based and operators are only paid for services that run
- Bus operators are responsible for providing vehicles and depots, the cost of these is included in the service contract payments
- TransLink retains demand and patronage risk and bus operators are responsible for fare collection and using ticketing systems
- New bus routes and services can be added to the contracts through an agreed change mechanism.

The options for the expansion of the bus services would either be undertaken using an existing 4G contract, or by negotiating a new contract with an incoming operator for the QBC component alone.

17.6.1.2 D&C of road infrastructure

D&C of road network changes is undertaken by the relevant state or council authority including TMR, TransLink, and Council depending on the owner of the road in question. Under the QBC option, it is expected the proponent for any infrastructure works contracts would be the Queensland Government (TMR or TransLink), and the works would be delivered using a traditional delivery model because of the lower level of complexity involved. Bus operators are not responsible for the D&C of road infrastructure assets including bus lanes, bus stops, busway infrastructure, changes to traffic signals, and general road infrastructure, though they may be consulted by the relevant authorities including TMR and councils.

The preferred delivery model for these works would be a Construct Only or ETI model with the works being contracted to a locally based construction company.

17.6.2 TT, LRT and BRT options

The delivery model analysis has been structured to consider two types of contracting strategies:

- Disaggregated delivery using a number of separate contracts for the design, construction, operations and maintenance of the infrastructure and services
- Aggregated or bundled delivery models that provide integration between the delivery stage and the operating stage.

One of the key differentiators between the delivery of LRT and BRT options is the acquisition and O&M of the relevant rollingstock/vehicles.

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17.6.2.1 Rollingstock

Rollingstock needs to consider the maintenance period in terms of whether it covers defects and a nominal period after full delivery of all vehicles or to mid-life (approximately 15 years) or for full life of frame. Components of the vehicles also need to be considered. For example, for electric TT and BRT vehicles it is likely the battery packs will expire before ten years and consideration needs to be given to how such life expired componentry is handled and costed.

The options for procuring and delivering rollingstock can be categorised into the following options:

- Design and build which is effectively a supply only option
- Design, build and maintain, applied for a specified maintenance period, taking into account the aforementioned considerations
- Design, build, operate and maintain, which includes operations and systems, so the operator takes responsibility for the integration and technology. The public sector would be required to pay for the assets upfront, however the operator works with the original equipment manufacturers to procure a vehicle to their requirements and specifications. This would work well with an early operator involvement contract.
- Design, build, finance, operate and maintain, which may include finance of the rollingstock and systems only, separately, or could be part of the operational setup and commissioning.

17.6.2.2 Disaggregated delivery models

Table 102 presents a high-level delivery model analysis of disaggregated delivery models for the BRT and LRT options.

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Table 102 – High-level disaggregated delivery models for TT, BRT and LRT options

Delivery model		Infrastructure Assets	Rollingstock	Risks	Advantages
Construct Only	✗	This delivery model would require separate contracts for design, construction, supply of vehicles, and operation of the system. There is limited opportunity for innovation in design with separate contracts. The public sector would retain full control, including stakeholder interfaces and timing. This assessment is the same conclusion for both LRT and BRT options.	Construct only would require the owner to specify the rollingstock.	The public sector is ultimately exposed to significant interface risk, particularly with regard to: • PUP • Wheel to rail interface for light rail • Rail systems integration for light rail • Traffic signal control risk for journey time. Given these risks and that the construction contractor would have little or no input into the design, there is no market precedent for this delivery model.	Requires a well-defined contract, thereby increasing tenderer competition and decreasing price. While this model is not suitable for complex works, it may be applicable for smaller, easily defined works packages, such as an early works package.
ETI	✓	ETI promotes value engineering and refinement of the preliminary or concept design through early involvement. However, it demands a longer process with design being refined and amended with two or three contractors prior to the tender being finalised and released to market. Based on learnings from precedent projects, while contractors are hesitant to bid on tenders with lengthy procurement processes, the opportunity to have a level of insight and collaboration on the proposed design is a strong incentive for the private sector. The assessment for this delivery model is the same conclusion for both LRT and BRT options.	ETI needs the rollingstock to be known so the interface and infrastructure can be designed properly. For instance, on BRT and LRT different floor heights and axle loads and turning radii will impact on the design development.	This model will reduce PUP risk, however it will not adequately address wheel to rail interface, rail systems and traffic signal risks.	Seen as a good way to manage uncertainty around scope by involving tenderer early. Also soon as a good way to promote innovation where a contractor's experience adds value to the design.
D&C	✓	By bundling the responsibilities for D&C with a single entity, the associated risks are	The rollingstock type needs to be known for this, particularly as the contractor is warranting	This delivery model may not be appealing to the market because of precedent projects	Allows potential for contractors to add value and innovation to

Delivery model	Infrastructure Assets	Rollingstock	Risks	Advantages
	transferred to one party and greater collaboration between the D&C functions can be achieved. There is a high level of market precedence for this model, however the market is increasingly demanding a level of risk sharing, particularly around design and PUP.	that design. Also need to consider what maintenance period needs to be included in the D&C contract.	and level of bid costs associated with estimating design fees. This model will reduce PUP and traffic signal risks but will not adequately address wheel to rail interface and rail systems risks.	the design stage of the Project.
Collaborative D&C ✓✓	May be more appealing to the market than a traditional D&C as contractors are given the opportunity to further amend and refine the design as needed. Key aspects include: • Despite high upfront costs, a collaborative D&C model allows innovation and contractor input. • Scope creep and risk of design changes due to unknown PUP circumstance is a significant risk. • More opportunity for design innovation with a collaborative D&C, driving better solution and feedback from engineers. This model will reduce PUP, traffic signal and rail systems risks, however it will not impact wheel to rail interface risk.	The rollingstock type needs to be known for this, particularly as the contractor is warranting that design. Also need to consider what maintenance period needs to be included in the D&C contract.	The contractor assumes risk of design compliance and construction works completed to the brief, within timeframe and cost. On the other hand, the owner would retain the risk of project scope, scope change, unknown site conditions and whole-of-life asset ownership.	This model is suitable for parts of the Project so as long as adequate risk sharing is achieved. The public sector would need to carefully consider which risks it retains and which are transferred to the tenderer.
Dual ECI ✓✓	Dual ECI offers an efficient, competitive environment that enables proponents to develop an optimised value for money offer. This model may require additional resources through the two-stage process and would	The rollingstock type needs to be known for this, particularly as the contractor is warranting that design. Also need to consider what maintenance period needs to be included in the D&C contract.	The contractor assumes risk of design compliance and construction works completed to the brief, within timeframe and cost.	Key advantages of this model include: • Promoting innovation in developing each stage, including design, programming and management.

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Delivery model		Infrastructure Assets	Rollingstock	Risks	Advantages
		need ongoing consultation with each proponent. Like a collaborative D&C, this model will reduce PUP, traffic signal and rail systems risks, but will not reduce wheel to rail interface risk.			• Encouraging delivery time reduction and cost-effective ways to meet project objectives and maximise value for money. • Facilitating public sector interaction with each proponent throughout the tender stage and stage one stage, to communicate the owner's project requirements. • Allowing interaction with the contractor throughout stage two to limit tensions between State and contractor and to resolve issues on a mutually satisfactory basis.
Alliance	✓	An alliance model is best suited in high risk or complex projects with unpredictable outcomes. It also allows high degree of collaboration. Key market considerations include: • Design needs to be locked in with contractors given incentives around risk/reward. • All stakeholders, especially TMR and Council would have vested interest in the Project, thereby making collaboration a smoother process for contractors. An alliance form of contract could be used to deliver the infrastructure assets for the BRT and LRT options, which could then be operated under a separate contract.	An alliance would work where the rollingstock is unknown and would allow it to be separately procured as well but built into the design development stage. This model will reduce PUP and traffic signal risks but will not adequately address wheel to rail interface and rail systems risks.	The public sector would have to accept a higher level of risk as all project delivery risks are shared by the alliance participants. The public sector would be expected to be flexible and offer a high level of collaboration with the contractor. While innovation would likely be achieved, an alliance model would expose the public sector to high risk in delivery outcomes.	An optimal solution that protects the public sector from risks while still providing the market with access to and collaboration with key delivery partners.

While it may be technically possible to separate the contracts for the design, construction and O&M for the TT, BRT or LRT options, a number of interface risks would be introduced if this was the case. Due to the nature of the LRT option, the high attention on wheel to rail interface and O&M contracts, a disaggregated model would not be suitable. Based on the analysis in Table 102, the use of a disaggregated delivery model is not recommended for the delivery of TT, BRT or LRT primary due to the high level of integration required between the infrastructure assets, vehicles, control systems, stations and the broader network including the traffic signals. This high level of integration would introduce significant interface risks between the Project Team and the multi-party contractors, which the State and Council would ultimately be responsible for managing.

1.1.1.1 Aggregated delivery models

Table 103 presents a high-level analysis of aggregated delivery models for BRT and LRT.

Table 103 – Assessment of Aggregated Delivery Models BRT and LRT

Delivery model		
DCM	✓✓	A DCM model allows: • Single point of responsibility for the design, construction and maintenance of the asset. • Transfer of greater lifecycle risk to the contractor leading to design efficiency and construct quality. This increases upfront capital expenditure costs in the interest of decreasing long term costs. • Strong incentives to reduce overall whole-of-life costs by driving design, construction and maintenance innovation and efficiencies. A DCM model is best suited for projects with high maintenance costs relative to capital costs, which may not be the case for the LRT or BRT option given the significant capital cost expected at the outset. The interface of having separate O&M providers on the same line may be challenging.
DCMO	✓✓✓	Under this delivery model, the Government would engage a consortium to design, construct, maintain, and operate the infrastructure and vehicles to provide the specified PT services. This delivery option is commonly referred to as an aggregated or bundled delivery model as there is primarily one overarching contract. In addition to the DCM model, a DCMO contract provides further efficiencies and reductions in whole-of-life costs which can be achieved by adding the operations component to a DCM contract. A single point of accountability is established in a DCMO contract. It would be ideal for the O&M to be managed by the same party. Under this delivery model, the Government would finance the Project and it would manage the draw down and payment process for D&C, and make periodic payments to cover maintenance and operating costs.

The analysis in Table 103 indicates that it is preferable to use an aggregated delivery model for the TT, BRT and the LRT options. A bundled contract ensures that the proponent manages the high-level integration components of the scope of work and that the associated risk is adequately transferred from State and Council. A bundled contract also offers the opportunity for collaboration and innovation.

17.7. PPP Assessment

Under the PAF and BQ's BCDF, the Options Analysis must assess the potential for value for money to the procuring authority as a result of the Project being procured as a PPP. PPPs and their many contractual variations (DBFO or Boot etc.) are arrangements that bundle the delivery stage of a project with ongoing service provision and include private sector partnering with Government in:

- Financing and funding all or part of the cost of the delivery of a project
- Operating and/or maintaining the project over an agreed concession period (generally in excess of 15 years)
- Being paid upon service delivery either by end users or through availability payments from the procuring authority.

A PPP is generally applied where there is a clear focus on service delivery and outcomes that, when combined with the delivery discipline that comes of private sector financing, is determined as providing value for money for Government. It requires additional benefits, including a risk transfer to the private sector that more than offsets the premium of private sector debt and equity funding costs.

The procuring authority's responsibilities for managing the Project are therefore different from other delivery models. The Government becomes a purchaser of asset-based services that are paid for according to performance. The Government allocates certain risks to the private party, locks in whole-of-life budgets and quality standards and focuses on its core business. Table 104 details the appropriateness of a PPP model to the Project when compared against the value drivers outlined in the PAF.

Table 104 – PPP Assessment

Value Driver	Applicable	Comment
Risk allocation	✓✓✓	Given the scale and complexity of the likely build, there is a high level of risk allocation benefit from a PPP over traditional delivery via a D&C contract. The Principal is able to achieve a fully integrated project solution and thereby allocate the delivery risk to the private party. This applies to risks associated with the technical solution and the whole of life operations, including the: • In-ground and out of ground risks (track slab, wheel rail interface) • Rail systems and power systems • Journey time and interface with the road network.
Whole-of-life costing	✓✓✓	The PPP model allows for a single entity to design, construct, maintain and operate the Project and for the Government to obtain cost certainty through this model. O&M responsibilities are often better bundled in the same contract to drive a whole of life approach to the assets.
Innovation	✓✓	The integration of the D&C and the O&M for the Project may increase the level of innovation between the built form and the operating assets, compared to a traditional disaggregated model. Precedent projects have observed greater innovation with PPP contracts due to the involvement of the operator in the bidding process. The greater scope for innovation on a PPP also arises from allowing the Government to focus on outcomes and the use of output/outcome specifications.
Measurable outputs	✓	There is potential for a PPP availability payment model, however premium financing costs may add to total costs (i.e. the ability to offset higher finance costs against value for money efficiencies is considered limited). A PPP would offer some benefits through a performance-based approach however the performance would need to be managed against the expectations and contractual covenants stipulated by the public sector. Under this model, payments may be reduced in accordance with an agreed formula in the event that passenger services are not provided to the required standards (e.g. where services run late).
Asset utilisation	✗	There is limited opportunity for a private party to generate additional revenue from the assets apart from the core services intended.
Competitive market	✓✓	There is a demonstrated market of proponents that would participate in a PPP.

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17.8. Summary

This chapter provides a preliminary assessment of the potential delivery model options for the Project.

While it may be technically feasible to separate the contracts for the design, construction and O&M for the TT, BRT or LRT options, a number of interface risks would be introduced. Due to the nature of the LRT option, the high attention on wheel to rail interface and O&M contracts, a disaggregated model is not considered suitable. Instead, it is considered preferable to use an aggregated delivery model for the TT, BRT and the LRT option, as a bundled contract ensures the proponent manages the high-level integration components of the scope of work, and that the associated interface risks are adequately transferred from State and Council.

The TT option represents a new vehicle technology that is in early operations in China, with other similar vehicles being developed in Europe. The availability of a suitable TT vehicle in Australia will need to be tested as part of the market sounding process undertaken during the Detailed Business Case stage.

The chapter demonstrates there is a precedent for the use of a PPP contract to deliver the Project and that a PPP contract may delivery value for money for the State and Council. The Detailed Business Case will involve market sounding including meetings with potential proponents and contractors for the Project. The Detailed Business Case will include further analysis of the potential delivery models and will leverage learnings from current (2019/2020) projects including SLR, Parramatta Light Rail, Canberra Light Rail, and GCLR Stage 3.

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IMPLEMENTATION PLAN

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18. Implementation Plan

18.1. Next steps

The next stage will be to complete a Detailed Business Case for an integrated urban public transport solution for Maroochydore to SCUH. The purpose of the Detailed Business Case is to undertake further detailed analysis and stakeholder consultation with respect to the preferred Project options and delivery models identified during the Options Analysis stage. It aims to identify the solution most likely to address the strategic Project objectives and provide the best value for money outcome for the Sunshine Coast, Queensland and Australian communities.

In May 2019, the Queensland Government committed funds to help develop a Detailed Business Case for Stage 1 of the Project. The Council has also committed up to $7.5 million for the development of the DBC which should be developed in partnership with the Queensland Government as soon as possible. The DBC will include community consultation on the detailed design of the Project.

On 8 March 2021 the suite of three regional plans comprising the SEQ Regional Transport Plan was approved by the Hon. Mark Bailey, Minister for Transport and Main Roads. The North Coast Regional Transport Plan identifies key challenges for the north coast region including high reliance on cars, congestion, dispersed settlement pattern and mobility and accessibility for an ageing population. It includes the following action:

> **A2.03 Maroochydore to Caloundra integrated urban public transport**
>
> *Work in partnership with Sunshine Coast Council to develop a business case for an integrated urban public transport solution for Maroochydore to Caloundra.*

The budget allocation and timing for the Detailed Business Case will need to be agreed between the Queensland Government and Sunshine Coast Council following consideration and review of this Options Analysis by relevant State and Commonwealth agencies. This will include the undertaking of a “Gate 1” Assurance Review under Queensland Treasury’s Gateway Review process.

A Memorandum of Understanding could also be considered to document the partnership between the Queensland Government and Sunshine Coast Council, confirming common goals and the roles and responsibilities for the Detailed Business Case stage.

On current planning, it is estimated the Detailed Business Case can be delivered from late 2021 to early 2023.

18.2. Delivery timeframes

An assumed development and delivery program for Stage 1 of the Project is shown in Figure 113.

Figure 113 – Project development timeline

18.3. Supporting projects – transport network

Several major transport infrastructure projects that will integrated with, and support the outcomes of the Project are in the business case or project planning stage, namely:

- MRI and Kawana Arterial road
- Maroochydore service road and Buderim Mooloolaba interchange upgrade

The Detailed Business Case should consider the effects of these projects on mass transit implementation.

18.3.1 MRI upgrade and Kawana Arterial Road

One challenge for the Priority Area 1 is the conflict between mass transit required to support urban consolidation development and economic growth, versus the small increased delays for car users as a result of reallocated road space occurring by 2041. This issue needs to be approached in the context of the service needs, which support urban change, and moving more people in less vehicles. Catering for unrestrained traffic growth is not a service need for the Project.

The proposed MRI project extends the Sunshine Motorway to meet Kawana Way, and does offer a way of addressing limited river crossings and capacity for north-south movements crossing the Mooloolah River. A business case is currently being prepared for the MRI and if delivered, this intervention may resolve the negative impacts of lane reductions to deliver mass transit in Priority Area 1 (refer to Figure 114).

However, in the overall context of the vision for a sustainable region and meeting the service needs articulated in the Options Analysis, the development of mass transit in Priority Area 1 should not await the completion of the MRI.

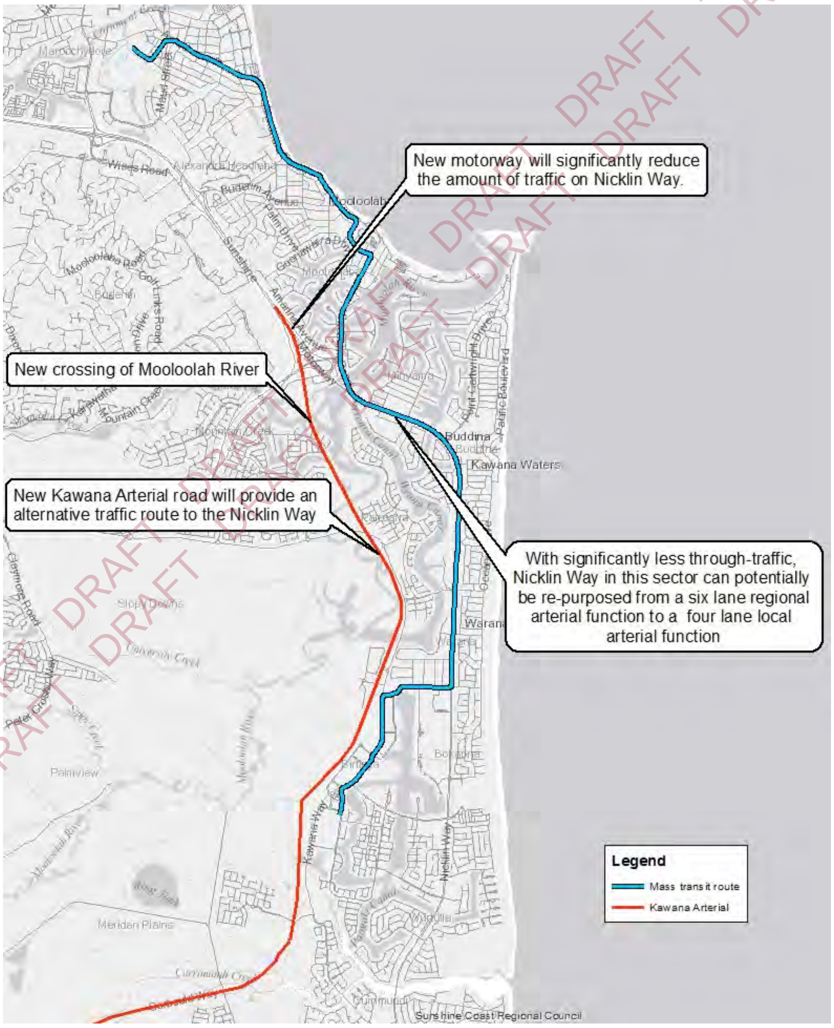

Figure 114 – Planned major road upgrades in the Sunshine Coast Urban Corridor

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18.3.2 Maroochydore local road and Buderim Mooloolaba interchange upgrade

The approved North Coast Regional Transport Plan released by TMR in March 2021 includes the following action:

> **A2.17 Maroochydore City Centre road corridor planning**
>
> *Undertake planning in partnership with Sunshine Coast Council to establish reliable and safe arterial road connections to and from Maroochydore City Centre, through cost-effective and staged intersection and link capacity upgrades to ensure that development of the principal regional activity centre, and resulting economic growth and employment opportunities, is not constrained.*

Included in this planning work is the development of a new service road and exit road connections, and an upgrade of the Buderim Mooloolaba Road interchange with the Sunshine Motorway. Presently significant volumes of through-traffic (about 8,500 vehicles per day) utilise the Alexandra Parade arterial to access the southbound motorway via Pacific Terrace.

As shown in Figure 115, this upgrade has the potential to remove considerable through-traffic from the beachside precinct of Alexandra Headland and enable a significant improvement in urban amenity in this popular precinct.

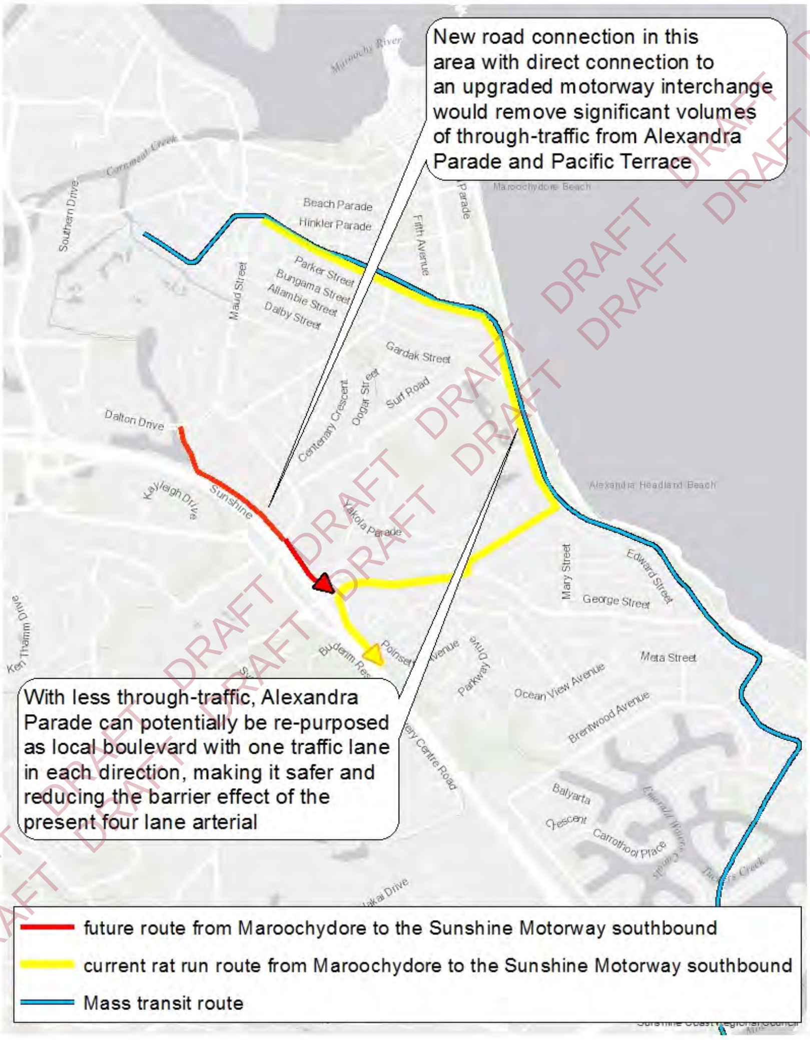

Figure 115 – Planned new road connections to the Sunshine Motorway southbound from Maroochydore

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18.4. Supporting projects – road use management

Once the relationship and timing of these major road transport initiatives is resolved, consideration can be given to a review of road use management policies and arrangements with the Sunshine Coast Region to support a sustainable transport network.

This review of traffic capacity planning will consider:

- establishment of alternative traffic routes for through-traffic that has no business in the SCMT corridor
- establishment of mass transit priority stages in planned intersection and signal upgrades to anticipate the implementation signal priority as part of intersection operations
- commitment to a principle that transport upgrade projects continue to focus on multi-modal outcomes, ensuring residents and patrons of local businesses are still able to access destinations in the mass transit catchment by car transport.

To enable these objectives to be achieved, it will be vital, as soon as commitment to the Project is achieved, for TMR and the Sunshine Coast Council to agree an integrated road use management strategy for the corridor. This integrated policy must adopt a “one network” approach so state controlled and local Government roads are considered and managed in the same framework, with the same traffic management outcomes in mind.

18.5. Supporting projects - car parking policy

A major determining factor for many people in choosing whether to use public transport is the availability of free or cheap off-street car parking close to their destination. Parking takes up valuable space that can be utilised for other human-oriented purposes or public open space. Further, large parking areas mean major activity centres are less walkable, as large car parking areas have to be walked past to get to other attractions.

In particular, long stay car parking is used by commuters, and many of these may have a choice in getting to work. Much of the need for parking regulation and parking pricing in business centres is driven by the need to ensure customers and other short stay visitors can get a car park, and that the parking is not taken up early in the day by long stay commuters.

Sunshine Coast Council has been progressing the Parking Management Plan to help reduce local traffic congestion, increase the attractiveness of urban areas and promote behavioural change through improved travel choices and encouraging greater use of public transport and more walking and cycling.

18.6. Supporting projects – urban planning and design

In preparing the more detailed reference design for the DBC, the SCMT design will need to be cognisant of the need to maintain and enhance the Sunshine Coast’s valued lifestyle, character and identity in the Sunshine Coast Urban Corridor.

Maintaining and enhancing the Sunshine Coast’s valued lifestyle, character and identity in the SCMT corridor can be achieved through suitable land use changes such as:

- promoting a series of urban villages that contain a mix of uses in local community hubs that are connected to the major centres of Maroochydore, Kawana and Caloundra
- providing for a range of desirable housing choices that suit the coastal lifestyle and offer affordable options for the community
- producing built form outcomes consistent with the Sunshine Coast’s existing setting and character and preventing excessive high-rise development.

Urban planning would also consider placemaking opportunities and around potential new station precincts to ensure the continued provision of vibrant public spaces that are green, accessible, inclusive and representative of the values of the Sunshine Coast community.

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KEY FINDINGS AND RECOMMENDATIONS

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19. Key findings and recommendations

19.1. Key findings of the Options Analysis stage

19.1.1 The findings of the Strategic Business Case are confirmed

The Strategic Business Case considered the challenges facing the Sunshine Coast Region and the solutions required to address them. It focused on the challenges of managing the expected growth in the region and the opportunity to use the Sunshine Coast Urban Corridor to deliver efficient and sustainable growth outcomes.

On 25 July 2019, the Sunshine Coast Mass Transit Strategic Business Case was approved and transmitted to the relevant Queensland and Australian Government agencies. It recommended that:

"The scope of the business case is proposed to be focused on the Maroochydore to Kawana corridor… with safeguarding for network extensions and/or connections to potential future mass transit solutions in the southern coastal corridor between Kawana to Caloundra, as well as the inland corridors between Beerwah and the Sunshine Coast Airport."[175]

This Options Analysis confirms all the recommendations of the Strategic Business Case. In particular, it:

- Identifies the major transport and urban development challenges facing the Sunshine Coast Region
- Identifies the constraints and limitations of the current public transport system and road network in the Sunshine Coast Region
- Confirms the strategic need for the Project
- Confirms the priority staging plan recommended in the Strategic Business Case
- Demonstrates the technical and economic feasibility of the Project by assessing a shortlist of options.

19.1.2 Need for the Project

- The Sunshine Coast Region's population is projected to continue to grow strongly, reaching 518,000 in 2041. This means there will inevitably be the need for the provision of major new public infrastructure, including new transport facilities.
- Transport systems shape cities, build economies, and help determine lifestyles. There is an evident link between the type of transport system provided, and the form of urban development it can serve:
  – Car-based communities tend to be set out on a large scale and are necessarily remote from attractions and jobs in other parts of the region. Public transport to these areas, if provided, will be limited to a basic level of level of service that spreads its scarce resources over a larger area.
  – Communities that rely more on public transport and active transport are necessarily compact, allowing public transport resources to provide a good level of service to a concentrated passenger market. Active transport trips need local destinations to be easily accessed.
- With the absence of a viable, accessible and efficient public transport network, the region is heavily dependent on car transport. Car ownership within the region is growing faster than almost all towns and cities in Australia. Public transport use is very low, and the current public transport system, while suited to a smaller regional community, cannot cope with the requirements of a major city region such as the Sunshine Coast.
- The region continues to rapidly expand its urban boundaries, which will see the development of new communities remote from employment nodes, entertainment and recreational precincts like beachfront areas. This will likely increase car dependence.
- Without intervention, population growth and increasing congestion will continue to put pressure on housing, transport, lifestyle, employment, social infrastructure and the environment.
- There is a real risk of a vicious circle developing as shown in Figure 116, diminishing the qualities of the region that make it an attractive place to live, work, visit, raise a family and retire.

[175] Sunshine Coast Mass Transit Strategic Business Case. p 138.

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Figure 116 – Vicious circle caused by business as usual approach

- At the highest level, the choices faced by the region as it grows, are simple:
    1. Continue a business-as-usual approach, providing a major urban freeway network and increased car parking to match urban expansion and growth in demand for private motor travel; or
    2. Adopt a strategy that can limit the expansion of car-based urban expansion and concentrate people and jobs around a significantly improved public and active transport system.
- All the planning and strategy development undertaken over the past decade by Sunshine Coast Council and the Queensland Government has determined the second choice is the only viable approach.
- Adopting a business as usual approach will constrain the region to a future where roads, car parking and traffic dominate the urban landscape, and where those who cannot access private motor transport experience considerable disadvantage. This alternative will see many existing urban areas become places catering more for cars and less for people, with their amenity and attractiveness irreparably compromised.

19.1.3 Need for a coordinated strategy and staged intervention

- The Options Analysis has confirmed the need for, and effectiveness of a coordinated strategy that can sustain the lifestyle and amenity of the region as it grows, through:
    – providing a high quality region-wide public transport system to connect the region's main residential, employment and recreational precincts, supported by an integrated feeder bus and active transport network to attract passengers out of cars
    – containing the rate of urban expansion that results in car-based suburban greenfield developments to the agreed expansion areas at Caloundra South, Palmview and Beerwah East
    – locating a significant proportion of new dwellings and employment in the catchment of the quality public transport system, while maintaining a recognisable low key Sunshine Coast character within that catchment and across the region.
- Any public transport solution for the Sunshine Coast Region will need to be delivered by the Queensland Government and funded primarily by the Queensland and Australian Governments. However Council has undertaken the initial planning and business case work recognising the need to advocate for the sustainable future of the region.
- As part of this Options Analysis, a master plan for an integrated public transport system serving the entire region, and connecting it to the rest of SEQ has been developed. This plan is consistent with the Sunshine Coast Integrated Transport Strategy, *ShapingSEQ* and the Queensland Government's North Coast Regional Transport Plan.

- A regional mass transit system has to be delivered in stages. A staging plan is proposed based on the need to service the largest travel markets first, and to arrest the growth of urban expansion by supporting the urban consolidation policies already endorsed in the existing planning strategies.
- The first stage of the public transport solution will be a local mass transit technology in the northern part of the Sunshine Coast Urban Corridor, extending 13.6 kilometres from Maroochydore to the SCUH at Birtinya town centre. Future stages include expansion of this local mass transit system to Caloundra, and linking it to the regional public transport system at Beerwah.
- Full seamless integration with the development of a mass transit system (most likely regional rail) in the CAMCOS corridor to Beerwah, connecting the region to the rest of SEQ is vital. TMR will investigate this as part of the implementation of its North Coast Regional Transport Plan. Nothing in this Options Analysis should be construed to imply a project to connect to the North Coast Rail Line at Beerwah is not required, and it should remain a very high priority in the region's transport investment program.

19.1.4 Public transport options

- To achieve the objective of changing travel behaviour and attracting passengers out of cars, public transport needs to be reliable and efficient, and not be delayed in congestion with other general traffic. A primary element affecting this is the ROW enjoyed by the public transport services. Industry standard terminology for the varying levels of ROW are:
  - Category A – the best standard, with full separation from other traffic both horizontally and vertically. The vehicles usually only need to stop to serve passengers, are not affected by congestion and can offer a reliable and efficient travel time.
  - Category B – a good standard. Separated from all other traffic horizontally but intersecting at-grade with cross traffic. If there are not too many vehicles using the ROW, traffic signal phasing to suit the vehicle can be advanced and the vehicle also proceeds smoothly through intersections. The service is reliable and travel time competitive with driving.
  - Category C – the lowest standard. The vehicle generally only runs at the same speed as other traffic, and because it needs to stop to serve passengers, it will be uncompetitive with private car travel. Bus lanes, though offering some priority, must carry other traffic and for variety of reasons, are regarded as Category C standard.
- Public transport options for the first stage of the mass transit system from Maroochydore to the SCUH have been shortlisted for consideration in the Detailed Business Case through a rigorous process involving qualitative and quantitative analysis. No Category A option is considered viable in the Sunshine Coast Urban Corridor from Maroochydore to the SCUH via Mooloolaba as it would toned to be an elevated structure which would significantly diminish the visual amenity of the area. An underground sub-way option would be prohibitively expensive and is consequently not suited to a regional location. Three mass transit technology options that would operate in a guaranteed priority ROW (Category B) are potentially best able to meet the project objectives, and provide most long term benefit to the local, state and Australian communities:
  - TT on a dedicated busway, using on-board stored energy without overhead wires (wireless)
  - LRT on a dedicated trackway with <u>either</u> overhead power line supply or on-board stored energy without overhead wires (wireless)
  - BRT on a dedicated busway using on-board stored energy without overhead wires (wireless).
- The BRT project assessed in this Options Analysis utilised the Brisbane Metro electric vehicle as its reference vehicle. This vehicle is expected in Australia as a pilot vehicle in 2021. The suitability of this vehicle will be evaluated in the Detailed Business Case stage.
- The TT project represents a new vehicle technology that is in early operations in China, with other similar vehicles being developed in Europe. The availability of a suitable TT vehicle in Australia will need to be tested as part of the market sounding undertaken to inform the Detailed Business Case.
- All the Category B options will be expensive due to the need to construct a fully dedicated trackway or busway. Accordingly, a cheaper general traffic (Category C) option can also be progressed for further analysis in the Detailed Business Case, either as a staging option or as ultimate option:
  - QBC in kerbside bus lanes. The lowest (or zero) emission buses that are commercially available should be used for this option, with low emission diesel as a fall back option if progress is not realised for electric or other technology options at the time of implementation.

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- The implementation of some of the options can be staged to reduce the initial cost, so the most effective sectors are installed first. In particular, the BRT option may be able to be delivered in stages by initially running standard articulated buses that are already approved for safe and effective operation in sections of general traffic lanes.

19.1.5 Social and environmental impacts and benefits

- A preliminary SIE and a preliminary Environmental Assessment have been undertaken at desktop level to identify potential impacts and benefits of the Project options. These will need to be more extensively evaluated and assessed during the Detailed Business Case stage.
- When completed, it is expected the Project will improve the local environment and amenity through an improved transport system and a reduction in the growth of traffic in the project catchment. Improved local air quality and reduced local greenhouse gas emissions will also likely result from this.
- The preliminary SIE and the preliminary Environmental Assessment have identified a range of potential negative impacts that will need to be managed in the future stages of the Project, including construction and operational effects.
- The preliminary SIE and the preliminary Environmental Assessment have not identified any impacts that would prevent any of the Project options from proceeding.
- The preliminary SIE and the preliminary Environmental Assessment have identified further investigations and/or monitoring recommended to refine the appreciation of potential environmental and/or heritage impacts as the Project design progresses.

19.1.6 Economic performance of options

- A preliminary economic assessment has been conducted for a range of cases involving different combinations of transport options and land use scenarios.
- Key benefits estimated relate to public transport user benefits, in particular travel time savings for existing and new users together with amenity benefits.
- Key benefits estimated relate to public transport user benefits, in particular travel time savings for existing and new users together with amenity benefits and land value change associated with future land use growth being supported in the Sunshine Coast Urban Corridor
- The LRT and wLRT are estimated to produce the highest total benefits, followed closely by TT, BRT and QBC
- When considering only transport and community benefits, the benefits estimated for the mass transit options (LRT, wLRT, TT and BRT) demonstrates that these options are able to produce greater mode shift from road, together with higher customer benefits associated with improved amenity and meeting customer preferences. In contrast the QBC principally achieves benefits for existing PT users.
- Comparing both costs and benefits, the LRT/wLRT options have the potential to achieve the highest BCR of 1.2, including land use change and WEBs.
- LRT/wLRT has the greatest potential to support land use change given the take-up it supports. Depending on the level of land use change that occurs, it could realise the highest BCR. However, BRT/TT appear able to achieve higher economic outcomes on the basis that they offer a similar level of transport quality and capacity. This should be the subject to further consideration in the Detailed Business Case.
- For the other cases, where these urban change benefits have not been accounted for, the lower BCRs are partly the result of Stage 1 of the Project occurring relatively early in the development of the region, before it reaches a critical stage where a major shift to public transport is necessary to keep the transport system moving. This means some of the Project's transport benefits tend to occur later in its life, and under the economic assessment process they are heavily discounted when reduced to present day values. The major costs of delivering the Project, on the other hand, occur much sooner and so are not significantly discounted.
- This discounting issue should not be a deterrent to intervening early, to allow the mass transit investment to help shape land use change and reduce the current prevalence of urban expansion. The results in the LRT land use change case suggest that testing development change gained by investing in mass transit should be more fully investigated during the Detailed Business Case stage. This is likely to considerably

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improve the economic performance of some cases, particularly those cases based on Category B mass transit options which have a clear ability to influence land use change.

- A major determining factor for many people in choosing whether to use public transport is the availability of free or cheap off-street car parking close to their destination. Parking takes up valuable space that can be utilised for other people-oriented purposes or public open space. Further, large parking areas mean major activity centres are less walkable, as large car parking areas have to be walked past to get to other attractions. The economic analysis in this Options Analysis has assumed a very modest increase in the cost of car parking in the major centres. However greater increases in the price of long stay car parking may be necessitated by the need to better manage public space and ensure equitable access to the car parking that is available. This will influence the economic performance of the mass transit cases in the Detailed Business Case, as mass transit will become an attractive travel mode for more people.
- All the shortlisted mass transit options include reduction of traffic capacity on some arterial roads to avoid major, expensive and impactful widening of the road reserves. The initial economic assessments in this Options Analysis are affected by the modest level of congestion theoretically resulting from this. However, it should be noted there are key projects in planning that would divert significant amounts of traffic away from the affected roads:
  - MRI and Kawana Arterial
  - Maroochydore local road upgrade and Buderim Mooloolaba Interchange upgrade: in planning stage.

  These projects were not able to be included in the economic analysis as they are not fully committed. However, as the Detailed Business Case proceeds, this situation is likely to change, and including them should account for some improvement in the BCRs.
- The transport model used to support the economic analysis is comprehensive and valid. However, it has not benefitted from recent detailed research into the public transport preferences of Sunshine Coast residents. TMR completed this research in 2018 and 2019, and it is being used to develop a new improved transport model that will better reflect local needs. It is likely this improved model will see more people using public transport, and this model will therefore improve the economic performance of the cases in the Detailed Business Case.

19.1.7 Supporting work to ensure a quality integrated public transport system is developed and used

- Modelled projections show about 65 per cent of public transport riders use active transport, mostly walking, to access public transport. It will be vital to deliver active transport connections both to the mass transit stations, and along the mass transit corridor in accordance with Queensland Government policy and the Principal Cycle Network Plan.
- Residents who do not live in the catchment of the first stages of the mass transit system need to be able to access it. Park ‘n’ Ride facilities and improved bus connections to the mass transit stations will be vital. A public transport master plan and bus network upgrade plan have been developed as part of this Options Analysis, and Sunshine Coast Council and TMR can work together to deliver these improvements in a staged but deliberate manner.

19.1.8 Urban change in the Sunshine Coast Urban Corridor

- The land use analysis undertaken for the Project has found the right type of environmentally friendly mass transit technology can act to increase the potential for, and benefits of, consolidation of new dwellings and employment along the mass transit route. This will enable a higher proportion of projected growth to occur within the established urban footprint and allow residents to access to key destinations and employment nodes without having to drive long distances in private vehicles. In particular:
  - The Project, if based on technology with an ability to influence urban outcomes (Category B), will deliver a significant region-shaping opportunity when enabled by appropriate changes to planning provisions.
  - Investment in the SCMT, if based on a technology with the ability to influence transport accessibility and land use outcomes, will help drive a stronger, more competitive and sustainable economy and generate substantial and lasting economic, social and environmental benefits.

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- While some options are likely to have land use benefits which should be considered more fully in the Detailed Business Case, the mass transit investment will not be the sole reason for urban change in its catchment. Given the enviable lifestyle opportunities and the existence of major attractions, there should be no expectation that the Sunshine Coast Urban Corridor will remain the way it is, and that all the region's population growth can or should be accommodated somewhere else in the region. A balanced approach to urban change is required, that protects the lifestyles enjoyed by current residents, while providing opportunities for their descendants, as well as new residents to enjoy a low-key Sunshine Coast lifestyle with local employment opportunities.
- Supporting the policies in the *Sunshine Coast Planning Scheme 2014*, the relevant Sunshine Coast Council strategies, and *ShapingSEQ* that aim to contain urban expansion is an important objective of the Project.
- Urban change should be focussed on existing centres and areas close to the mass transit route that offer the greatest accessibility and potential for renewal. Importantly, urban consolidation should also focus on supporting the Maroochydore City Centre as the region's CBD, and capitalising on development opportunities in the major centres in Mooloolaba, Kawana and Caloundra town centre.
- In other parts of the corridor outside of these major centres, a carefully planned and staged approach can transform ageing and underutilised development into a modern, low key lifestyle precincts without any excessive high-rise developments that would be inappropriate for the Sunshine Coast.

19.2. Recommendations of the Options Analysis stage

The draft Options Analysis recommends:

1. Sunshine Coast Council and the Queensland Government continue to work together to deliver an integrated public transport system for the Sunshine Coast Region, including assigning a high priority to the staged development of the new mass transit system as proposed in the SBC and this Options Analysis report. The next stage of this joint work should be the preparation of a Detailed Business Case.
2. The results of stakeholder and community engagement undertaken, based on the draft Options Analysis, be included as relevant matters in the final Options Analysis and the Detailed Business Case process.
3. Feedback received from stakeholders and the community on matters outside of the scope of the Project, notably certain aspects relating to urban planning and placemaking, be incorporated in the relevant processes for addressing those matters. This will include matters relevant to the preparation of the new *Sunshine Coast Planning Scheme 2014* such as zoning, building height and density.
4. The delivery of the new mass transit system commence as soon as possible. This is due to the need to reduce the accelerating trend towards urban expansion and growing congestion in the coastal corridor resulting from employment and tourism growth.
5. Stage 1 of the mass transit system be developed as a local mass transit technology in the northern part of the Sunshine Coast Urban Corridor, extending 13.6 kilometres from Maroochydore to SCUH at Birtinya town centre.
6. The operation of Stage 1 be targeted to commence in 2027. Stage 1 should be followed by ongoing development of the mass transit network as soon as possible:
   - Stage 2 – connection from the SCUH/ Birtinya town centre to Beerwah (and the existing North Coast Rail Line) most likely as regional rail.
   - Stage 3 – extension south from SCUH along the urban corridor to Caloundra using a local mass transit technology consistent with Stage 1.
   - Stage 4 – connection from Birtinya town centre to Maroochydore City Centre via the CAMCOS corridor, most likely as regional rail.
   - Stage 5 – a longer term connection from Maroochydore City Centre to the Sunshine Coast Airport via either local mass transit or regional rail.
7. Four technology options be progressed to the Detailed Business Case stage. These four mass transit technology options for Stages 1 and 3 will operate in a guaranteed priority right-of-way (Category B),

are best able to meet the Project objectives, and provide most long term benefit to the local, state and Australian communities:

- TT on a dedicated busway,
- LRT on a dedicated trackway with either overhead power supply or
- wLRT on a dedicated trackway with on-board stored energy through batteries or hydrogen fuel cells
- BRT on a dedicated busway.

The four Category B options will be expensive due to the need to construct a fully dedicated light rail trackway or busway. Accordingly, the cheaper general traffic (Category C) QBC option should also be progressed for further analysis in the Detailed Business Case, either as a staging option or as ultimate option - QBC in kerbside bus lanes, using the lowest emission buses that are commercially viable (preferably targeting zero emissions by the time of implementation).

8. The Detailed Business Case stage give further technical consideration to a range of candidate technologies to determine the most viable option to deliver local mass transit in the Sunshine Coast Urban Corridor.
9. The Detailed Business Case consider the ability of all Category B technology options to be staged to reduce the initial cost, so the most effective sectors of the dedicated Category B mass transit corridor are installed first. In particular, the BRT option may be able to be delivered in stages by initially running standard articulated buses that are already approved for safe and effective operation in sections of general traffic lanes.
10. The Detailed Business Case have a specific focus on delivering:
    - desired land use outcomes, specifically confirming the potential ability of all the candidate technology options to influence urban change and increase urban consolidation (building on the analysis already undertaken in this Options Analysis)
    - full seamless integration with the development of regional rail in the CAMCOS corridor, connecting the region to the rest of SEQ
    - integration with the Mooloolah River Interchange and Kawana Arterial road upgrade projects to ensure through-traffic that should not be on Nicklin Way uses an alternative route
    - integration with the Maroochydore local road upgrade and Buderim Mooloolaba Interchange upgrade project to ensure traffic that should not be in Alexandra Headland uses an alternative route to the Sunshine Motorway southbound and is removed from Alexandra Parade and Pacific Terrace
    - active transport connections both to the mass transit stations, and along the corridor in accordance with Queensland Government policies and the Principal Cycle Network Plan.
11. TMR (TransLink Division) be engaged during the Detailed Business Case stage to ensure the broader Sunshine Coast Region gains maximum benefits from improved public transport services and to progress the supporting bus network through:
    - the staged roll out of the high frequency strategic bus network identified in this Options Analysis, supported by bus priority infrastructure and Park ‘n’ Ride facilities
    - incremental upgrades to the local feeder bus network
    - development of bus priority and Park ‘n’ Ride facilities to allow residents from all parts of the Sunshine Coast to access the public transport system.
12. Sunshine Coast Council undertake the following support actions:
    - Planning and delivery of an active transport feeder network to enable people to easily access the integrated public transport system.
    - Continuing the strong focus on achieving the outcomes envisaged in the Regional Economic Development Strategy, focussed on supporting the Maroochydore City Centre project, and boosting and connecting local employment opportunities in areas close to the mass transit route to allow a greater number of residents to benefit from more convenient access to their places of employment.

- Continuing consideration of the potential urban outcomes for the Sunshine Coast Urban Corridor to enable those outcomes to be taken into account in the Detailed Business Case.
- Continuing to implement the Parking Management Plan to help reduce local traffic congestion, increase the attractiveness of urban areas and promote behavioural change through improved travel choices and encouraging greater use of public transport and more walking and cycling.
- Considering the needs of patrons of local businesses, and residents, to drive their vehicles in areas located in the mass transit catchment when determining road use development.

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