Sunshine Coast Council

A line in the sand:

The Sunshine Coast Light Rail Project
Pre-feasibility and Rapid Economic Appraisal Report
Version 4.2 – August 2012

Version	Date	Changed by	Status	Nature of amendment
4.0	24 Jul 2012	Ken Deutscher	Draft	Initial version
4.1	2 Aug 2012	Ken Deutscher	Draft	Minor amendments
4.2	15 Aug 2012	Ian Gordon	Final	Minor amendments

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Executive Summary

"You never know what you have got until it's gone. Here on the Sunshine Coast we know what we have got: lifestyle second to none; beautiful beaches and lovely hinterlands; the best the world has to offer. For this to remain we need to make sure that our planning is friendly to the environment. The light rail project is one step in this direction."

Professor H B Harrison, Light Rail Taskforce community representative

This report is a collaborative effort by a broadly based taskforce convened by the Sunshine Coast Council in February 2012. The Taskforce comprised key industry and community representatives, as well as several community members selected from an expression of interest process. It also embodies input from the community made through an interactive web based "hub" labelled sunshinecoastlightrail2020.com.au. The Taskforce has been supported by an expert professional team employed by the Council.

The Taskforce believes a sleek modern rapid transit system, such as light rail could be a 'game changer' for the Sunshine Coast. This pre-feasibility report aims to show how this project would be much broader than a means of moving people and potentially be:

- Catalytic and capable of creating economic growth and social benefit;
- A flagship transport option that protects our relaxed way of life and benefits the whole Sunshine Coast; and
- If supported by visionary, policy such as strategic urban consolidation along growth corridors could provide a broader diversity of lifestyle opportunities and reduce the present emphasis on urban sprawl protecting farmland and natural habitat.

The report demonstrates how this new rapid transit system would support other key regional projects such as the airport expansion, hospital, university, convention centre and the Maroochydore Principal Activity Centre and would be capable of spearheading behavioural change where travellers rely more on public transport and less on their cars; reinvigorating business development; and linking vital work, health, tourism and education hubs.

Most importantly, the report sets out how the system can be delivered, how it can be afforded and how it will benefit not just those travelling, but the entire region.

The need – why change?

As one of the fastest growing regions in Australia and Queensland's third largest urban area, the Sunshine Coast needs to plan for a future that protects its lifestyle and environment. For every three residents we have now, there will be two more by 2031. We also want our tourist industry to grow, bringing more people to visit the region.

More people means more transport demand, and with 86 per cent of trips currently made by private car and only 3.6 per cent on public transport, managing growth means planning for new forms of transport.

The temptation is to simply keep building more roads, developing housing at the urban fringe, and placing more stress on our environment. In a growing region, heavy car reliance leaves us vulnerable to increased congestion, reduced urban amenity, rising fuel prices, climate change and the increasing mobility needs of an ageing population.

If we are to achieve our vision of Australia's most sustainable region, we must reduce the need to rely on car transport, improve public transport and encourage walking and cycling. This will support vibrant, diverse urban development focussed on people, invigorate business and create great urban places to suit people, not traffic. Council adopted its sustainable Transport Strategy in 2011 to develop a framework for changing course.

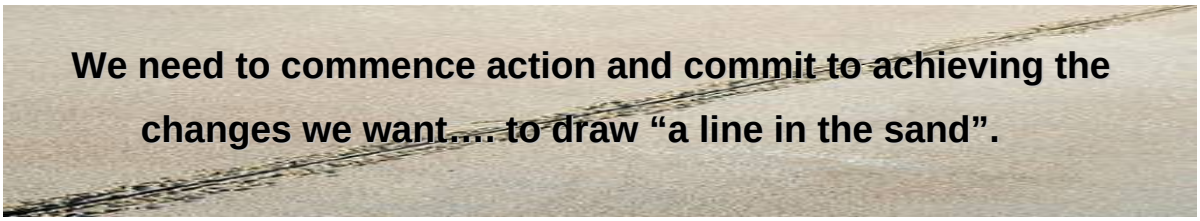
As part of this approach, a modern rapid transit system, such as light rail, could be a 'game changer' to help reshape our region as it grows.

A key challenge is to understand the link between a new rapid transit system and the economy. Light rail could act as a catalyst for sustainable economic growth and diversification on the Sunshine Coast by encouraging development in the right places and protecting valuable farm land and natural habitat. It is also to bring the Sunshine Coast community on the journey. To clearly communicate: the impact of a 'do nothing' approach; the need for change; and the 'why light rail' on the Sunshine Coast.

Why act now?

A new rapid transit system would form the backbone of the region's public transport for the next century. It will take time to plan and implement and is not the easiest option. The easiest and cheapest option is to do nothing. But a 'do nothing' decision will come at a cost within two decades: the population will increase, grow older and less mobile; opportunities will be lost to plan and develop precincts; road congestion, urban sprawl and our carbon footprint will grow even further; business centres will be congested and disconnected; parked cars will enjoy the best views and tourists will find getting around difficult.

We should not wait to experience the impacts of elevated freeways, high traffic volumes and excessive car parks before acting. We need to create the future vision we want on the Sunshine Coast and campaign for it: with the community; the government; and private enterprise**.**



The vision for sleek, modern rapid transit on the Sunshine Coast

Connecting people - creating great places - building our local economy

- **A more sustainable region – encourage regeneration and economic development for the next 100 years or more;**
- **Improve access to centres, employment, education, key attractions and tourism hubs;**
- **Generate new forms of urban development providing lifestyle choice;**
- **Enhance and protect the environment reducing dependence on fossil fuels;**
- **Sleek, modern, rapid transit system for a large regional city and premier tourist destination;**
- **Reduce congestion in the coastal development corridor;**
- **Provide the backbone of the public transport system and increase its role across the Sunshine Coast region;**
- **Integrate smoothly with the existing bus system and regional rail linking to future rail in the south, the university, airport, hospital and major coastal centres;**
- **A strong partnership between the Commonwealth Government, the Queensland Government and Sunshine Coast Council.**

The options for a new rapid transit system

There is a range of public transport options based on varying technology to move people around the Sunshine Coast. Each has different characteristics relating to traffic priority, right-of-way, how many people each vehicle can carry and likely costs to build and operate. The reference case established by Council when it resolved to establish the Sunshine Coast Light Rail Taskforce is Light Rail at-grade, operating at street level but in its own right-of-way. This is similar to the project being constructed on the Gold Coast which is scheduled to open in 2014. However this report includes six technology options studied in the pre-feasibility phase:

1. CoastConnect: improved bus priority and stations in key parts of the public transport network;
2. Bus Rapid Transit: a dedicated system of diesel or hybrid diesel-electric buses that operate largely within their own right-of-way and look more like light rail, but without overhead power;
3. Light Rail at-grade: the reference case; a dedicated light rail system operating largely within its own right-of-way but sharing intersections with traffic and other road users;
4. Elevated light rail: a fully segregated electric railway system that operates above the surrounding community;
5. Monorail: a fully segregated system that operates above the surrounding community on a concrete beam; and
6. Hybrid light rail: an option of at-grade and elevated light rail, to integrate with other development at ground level but using elevated track in parts of the system where rapid running is required.

Key corridors where the new system could go

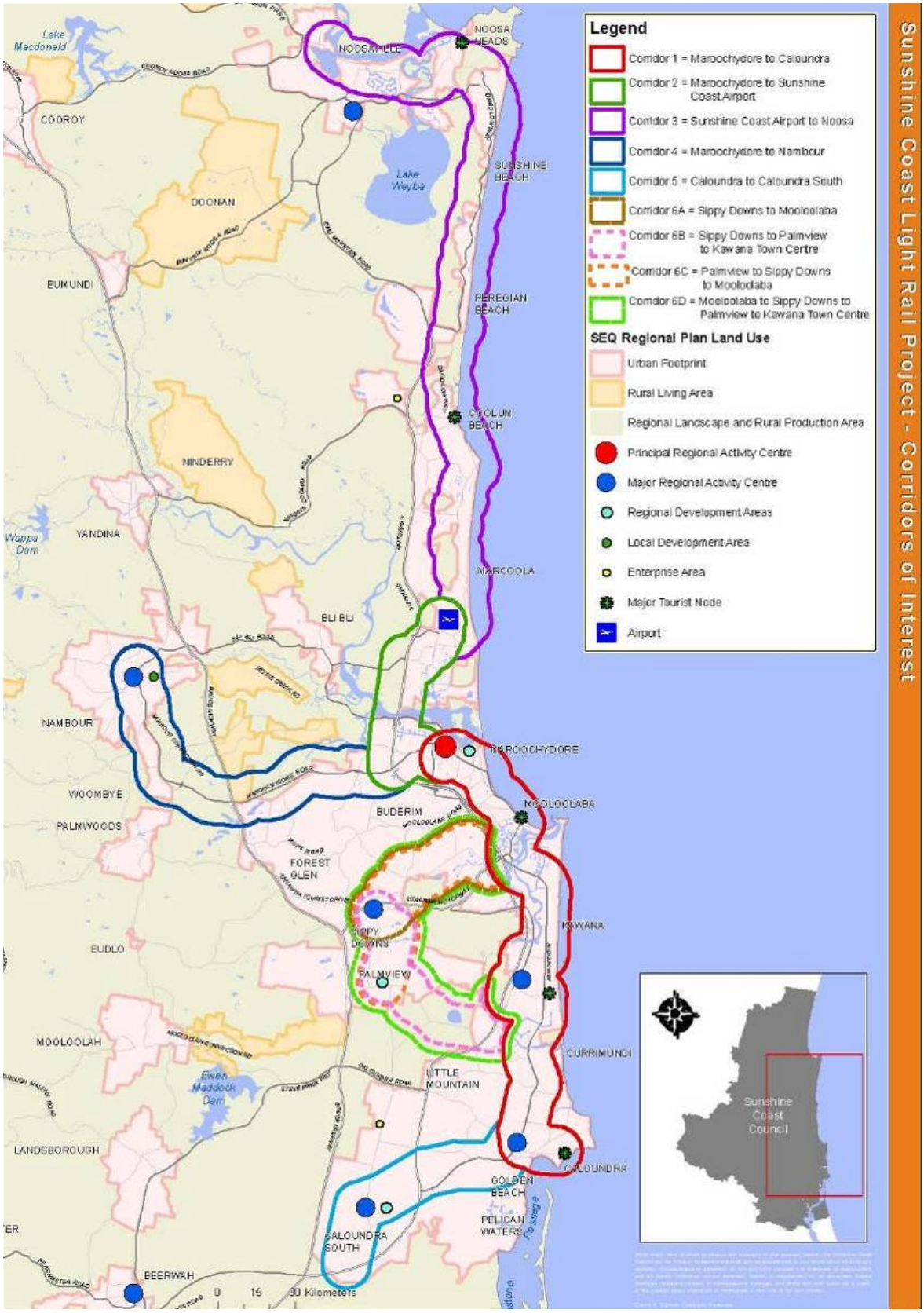
Where options would go, who it should serve and the number of people likely to use it were all key questions considered by the Taskforce in this pre-feasibility phase. The Taskforce recommendations take into account current and future land use planning; key attractions and amenity; population growth; residential, employment and activity precincts; challenges and risks; local context; environment; and costs.

However the benefits would not be localised. The new rapid transit system would become a flagship for delivery of improvements to bus and rail public transport across the whole region. It would be supported by an improved bus network including a new type of frequent, direct bus service connecting all the region's major movement corridors to the rapid transit service. There would also be park and ride opportunities for people travelling from the rural communities to the coast to access the rapid transit and avoid the possibility of congestion and shortage of parking in the busy parts of the region.

The light rail system would be for local travel, within the urban parts of the region. It would connect with the future regional link known locally as CAMCOS at several locations. The two projects are complimentary, not competing. The light rail project aims to avoid the need for major urban freeways to be built locally, and the CAMCOS project would avoid the need to continually upgrade the Bruce Highway to cater for growth of trips between Queensland's first and third cities.

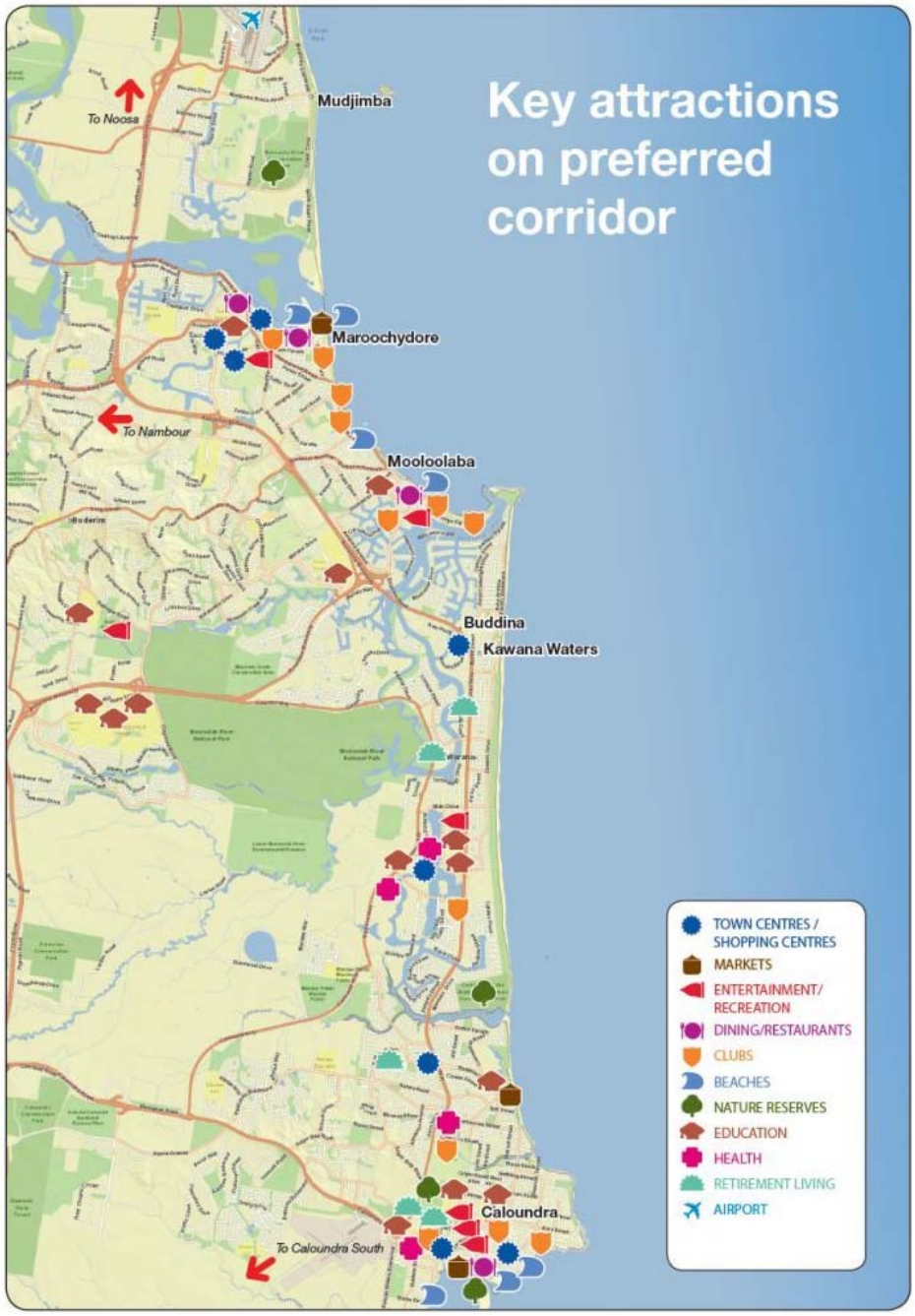
Six corridors were assessed in the pre-feasibility phase and are listed below and illustrated on the map overleaf:

- Corridor 1: Maroochydore to Caloundra;
- Corridor 2: Maroochydore to Sunshine Coast Airport;
- Corridor 3: Sunshine Coast Airport to Noosa;
- Corridor 4: Maroochydore to Nambour;
- Corridor 5: Caloundra to Caloundra South; and
- Corridor 6: Sippy Downs to Mooloolaba or Kawana Town Centre (Options A, B, C and D).


Sunshine Coast Light Rail Project - Corridors of Interest
Legend
Corridor 1 = Maroochydore to Caloundra
Corridor 2 = Maroochydore to Sunshine Coast Airport
Corridor 3 = Sunshine Coast Airport to Noosa
Corridor 4 = Maroochydore to Nambour
Corridor 5 = Caloundra to Caloundra South
Corridor 6A = Sippy Downs to Mooloolaba
Corridor 6B = Sippy Downs to Palmview to Kawana Town Centre
Corridor 6C = Palmview to Sippy Downs to Mooloolaba
Corridor 6D = Mooloolaba to Sippy Downs to Palmview to Kawana Town Centre
SEQ Regional Plan Land Use
Urban Footprint
Rural Living Area
Regional Landscape and Rural Production Area
Principal Regional Activity Centre
Major Regional Activity Centre
Regional Development Areas
Local Development Area
Enterprise Area
Major Tourist Node
Airport
Lake Macdonald
NOOSAVILLE
NOOSA HEADS
COOROY
Lake Weyba
SUNSHINE BEACH
DOONAN
EUMUNDI
PEREGIAN BEACH
COOLUM BEACH
NINDERRY
Wappa Dam
YANDINA
MARCOOLA
BLI BLI
NAMBOUR
MAROOCHYDORE
WOOMBYE
MOOLOOLABA
BUDERIM
PALMWOODS
FOREST GLEN
SIPPY DOWNS
KAWANA
EUDLO
PALMVIEW
MOOLOOLAH
CURRIMUNDI
Ewen Maddock Dam
LITTLE MOUNTAIN
LANDSBOROUGH
CALOUNDRA
GOLDEN BEACH
PELICAN WATERS
CALOUNDRA SOUTH
BEERWAH
0 15 30 Kilometers
Sunshine Coast Council

The preliminary assessment work indicates the preferred location and staging for the project is in Corridor 1, from Maroochydore to Caloundra via the new hospital precinct. This corridor, illustrated in the map below, contains the majority of business and tourist attractions in the core coastal precinct. To achieve economies of scale yet reduce the call on government funds, two initial stages could be adopted:

- Stage 1 from Maroochydore to Kawana Town Centre and the new Sunshine Coast University Hospital; and
- Stage 2 from the new Sunshine Coast University Hospital to Caloundra Town Centre.



Possible future stages identified included connecting to the Sunshine Coast Airport and the University of the Sunshine Coast at Sippy Downs and on to Palmview. A link between Caloundra and the new Caloundra South town centre could also be considered if the Maroochydore regional rail line is not built. In the future, once the system is established,

further connections could be investigated to other major centres such as Nambour and Noosa. Further work would be needed to establish firm priorities and timing.

Who would use it?

Projections made for this pre-feasibility study show a light rail service from Maroochydore to Caloundra would need to carry over 60,000 passengers each weekday if the Sunshine Coast is to meet a goal of increasing the market share of public transport from 3.6 per cent of all trips to a modest 10 per cent of all trips in 2031. This would improve the performance of the entire region's public transport system and potentially remove more than 50,000 car trips per day from the corridor. In the longer term, the demand will be even higher and could remove up to 70,000 car trips by 2051.

The rapid transit system would be used primarily for trips within the urban areas of the region, for residents going about their daily business to access schools, workplaces, recreation and shops, as well as day and overnight visitors. As and when the regional rail is extended from Beerwah to Kawana and Maroochydore, the rapid transit would connect directly to it, enabling travellers smooth access to other parts of south east Queensland.

The estimated capital costs

A rapid appraisal of options has been included in the report. The high level cost estimates to construct the 6 technology options in corridor 1 are summarised in the following table.

Option	Estimated capital cost ($M)		Total (M)
	Stage 1	Stage 2	
1. CoastConnect	$370[1]		**$370**
2. Bus Rapid Transit	$1,030	$540	**$1,570**
3. Light rail at-grade	$1,300	$710	**$2,010**
4 Elevated light rail	$2,280	$1,300	**$3,580**
5. Monorail	$2,030	$1,140	**$3,170**
6. Hybrid light rail partially elevated	$1,790	$820	**$2,610**

Rapid Economic Appraisal – defining the benefits

In order to justify an investment of the scale required there has to be significant and real value for the Sunshine Coast community and the economy. It has to be quantifiable, robust and to offer benefits for years to come. It must also be sustainable in terms of environmental and social impacts.

A rapid economic appraisal of all options was completed as part of the pre-feasibility phase and included three types of assessments: a Cost Benefit Assessment (CBA); an Economic Impact Assessment (EIA); and a Social Impact Assessment (SIA). The CBA assessments cover a 40 year period, however the residual calculations are projected over

[1] CoastConnect is not a continuous system and includes significant sections of buses in shared running with traffic. As such it does not lend itself to two discrete stages but could be constructed in a large number of stages.

the much longer time-frame of 100 years to account for the full economic life of the project.

Cost Benefit Assessment

A CBA includes all possible costs and benefits that can be converted into a monetary value. In this sense, options under consideration can be easily compared. The costs included both the capital costs shown above, plus estimated operating costs. The results are presented in a Benefit Cost Ratio (BCR).

Economic Impact Assessment

An economic impact assessment determines the expected impact on the local, regional and State economies from implementing an option. The three outcomes used to assess the options included: stimulation to the output of the economy; stimulation to the valued added of the economy; and the expected number of jobs likely to be supported by the option.

Social Impact Assessment

A social impact assessment is used to describe the likely social impacts of an option. This can include both qualitative and quantitative impacts.

Results of the Rapid Economic Appraisal

		Options					
		1. Coast Connect	2. Bus Rapid	3. Light Rail At Grade	4. Light Rail Elevated	5. Monorail	6.Light Rail Hybrid
CBA - Discount Rate 6%							
Total Costs	PV ($ million) 6% DR	$390	$940	$1,100	$2,000	$1,800	$1,500
Total Benefits	PV ($ million) 6% DR	$740	$2,600	$3,600	$3,200	$3,200	$3,400
Net Present Value	PV ($ million) 6% DR	$350	$1,700	$2,400	$1,100	$1,400	$1,900
Benefit Cost Ratio	(10% DR - 6% DR)	1.1 to 1.9	1.7 to 2.8	1.8 to 3.1	0.9 to 1.6	1.1 to 1.8	1.4 to 2.3
Economic Impact Assessment							
Construction Impacts							
Total Output - Sunshine Coast	($ million)	$730	$3,100	$4,000	$7,100	$6,200	$5,100
Total Value Added - Sunshine Coast	($ million)	$400	$1,700	$2,200	$3,900	$3,400	$2,800
Total Employment - Sunshine Coast	(jobs)	1,500	6,800	8,600	15,400	13,600	9,800
Operational Impacts							
Total Output - Sunshine Coast	($ million, pa)	$5	$6	$6	$6	$6	$6
Total Value Added - Sunshine Coast	($ million, pa)	$4	$5	$5	$4	$4	$5
Total Employment - Sunshine Coast	(jobs)	250	250	210	200	200	210
Social Impact Assessment							
Overall Social Assessment		-	✓	✓✓✓	✓✓	✓✓	✓✓
OVERALL RAPID ECONOMIC ASSESSMENT		×	✓ (?)	✓✓✓	×	×	✓✓

* PV = Present Value
* DR= Discount Rate

Options worth pursuing given assessment

Potential option worth pursuing given assessment

The results of the rapid economic appraisal suggest that Light Rail at-grade and the Light Rail Hybrid are projects worth pursuing. Both projects would deliver significant value to the Sunshine Coast and achieve a robust BCR under all discount rates assessed.

They are also likely to produce significant economic impacts with regard to output, value added and employment, improving productivity and business and community interaction.

They also deliver positive social benefits, particularly as a catalyst to enhance community identity and amenity; place making and intensification; assisting social inclusion; and enabling positive outcomes for the environment.

An argument could be made for Bus Rapid Transit as this option has a positive BCR under all scenarios and good economic outcomes with respect to jobs supported and value added to the economy. However, it does not deliver strong social impacts when compared to light rail. A similar option was recently ruled out after exhaustive analysis in the detailed Gold Coast feasibility assessment as it was not able to satisfy the requirements to move very high numbers of passengers.

The other options are not considered competitive as they do not deliver sufficient positive outcomes under all the discount rates assessed and/or do not deliver the level of social benefits desired.

How would it look?

The new system would be either a light rail or a bus rapid transit option, provided the latter can demonstrate its ability to meet the projected long term patronage demands in the key corridors. The rapid transit system would operate mostly at-grade (street level) in its own right-of-way. It would share intersections with other road users but would benefit from traffic signal priority, where the signals are programmed to anticipate the arrival of the vehicle and minimise its delay through the intersections. Under option 6, the light rail hybrid option, parts of the track would be elevated above street level to avoid intersections and improve running speed. This would considerably reduce travel times but would add cost and result in more noticeable visual and amenity impacts.

The vehicles would be either:

- Modern fully low floor modular electrically powered light rail vehicles about 30 to 40 metres long; or
- 14.5 metre long rigid or 18.5 metre diesel articulated buses if a Bus Rapid Transit option demonstrates it can meet the longer term passenger demands. These would be semi-low-floor buses.

Vehicles would operate at a maximum speed of 80 km/h.

The light rail options would have overhead power at low voltage 750 v DC, and many of the existing higher voltage overhead power lines would be put underground, resulting in less clutter overall. Bus options would be diesel powered, although cleaner technology may become practicable in the future.

There would be specially designed stations spaced about one kilometre apart, with a platform height of about 300 mm. The vehicles would stop close to the platform at the exact grade with minimal gap and would meet disability standards.

Passengers would benefit from real-time passenger information and integrated TransLink fares using *go card* fare collection or they may be able to pre-purchase other ticket types approved by TransLink. They would not interact with the driver and would possibly validate their cards/ tickets before boarding. Real time information technology would provide passengers with certainty of travel times and frequencies.

Despite being on the coastal corridor, the new system would become a flagship for delivery of improvements to bus and rail public transport across the region. It would be supported by an improved bus network which includes a new type of frequent, direct bus service connecting all the region's major movement corridors to the rapid transit service.

The way forward

In a challenging economic climate there could be a temptation to support the smaller scale CoastConnect bus option. The rapid economic appraisal demonstrates the greater economic, social and environmental benefits of light rail over bus and the potential light rail has to attract patronage and shift behaviour. We need a "game changer" that can draw attention away from the present dominance of traffic planning and car-dependant urban form. Improved buses do not provide that "game changer".

The economic assessments undertaken in the rapid appraisal have provided a comprehensive basis for moving forward to full business case. In proceeding to Phase 2, the full business case, more detailed investigation and data/information will be required.

This will include:

- Engineering feasibility and risk controls;
- Sophisticated transport modelling outputs from a multi-modal transport model;
- Review / updating of all assumptions made for the rapid economic appraisals including utilisation of the 2011 census data upon its release; and
- Detailed costing of the preferred options to be taken forward.

The expected benefits of an improved rapid transit system such as light rail far exceed the capital and on-going costs required to implement it. Nonetheless, the initial upfront investment required is significant. There are several key factors and strategies that can positively influence affordability:

- Private Public Partnership (PPP); building on the franchising model developed for the Gold Coast, a PPP for the Sunshine Coast project could be designed to ensure that private sector investors' risks are minimised in a way that can be controlled by Government. This lessens the expected call on public funds, while maximising private sector investor interest;
- Risks to private sector investors can be minimised by Government taking responsibility for risk management of issues such as community support, land acquisition and service integration leaving the private sector to control risks such as construction and operating costs. Further investigation of PPPs will be considered should the project proceed to the next phase;
- The new rapid transit system aims to replace up to 70,000 car trips each day by 2051. This means the costly road infrastructure previously envisaged to meet projected transport needs can be avoided or significantly reduced; and
- Other funding avenues have been broadly investigated. Land Uplift Capture, the public transport levy and revenues from advertising in the corridor are all potential funding streams.

A unified approach will be fundamental to the success of such a major public transport improvement project. It will require business and community support and all levels of government working together.

The Commonwealth Government recently committed $500,000 to the development of a full Business Case in Phase 2. This grant would enable funding for the next stage to be covered by the Department of Infrastructure and Transport and the Sunshine Coast Council with further funding to be requested from the Queensland Department of Transport and Main Roads in 2013/14. Should the project move to the construction phase, greater State and Federal Government involvement is envisaged in the form of a 'whole of government' partnership.

The communications strategy for Phase 2 needs to be implemented alongside the technical and business case studies. The dialogue already established with the community should be built upon so the debate centres on matters relevant to the need to improve public transport, the role of roads and traffic in the future, and the consequences of not acting.

Recommendations

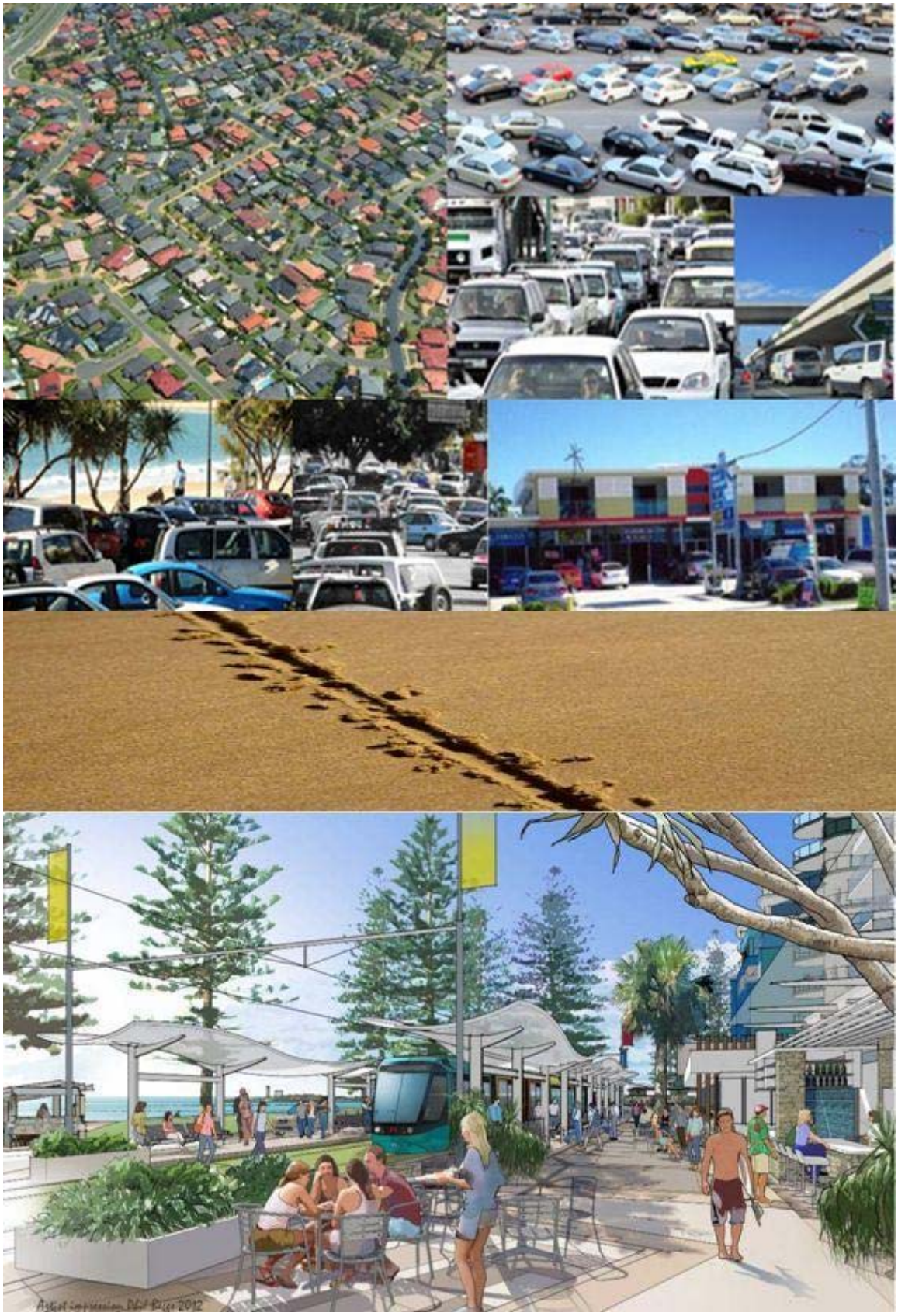
A new rapid transit system, such as light rail, is a "game changing" project with the potential to transform the future of the Sunshine Coast.

The Taskforce recommends Council endorse the next step toward the Sunshine Coast Light Rail 2020 vision by proceeding to Phase 2, full feasibility and business case.

The options to be considered should include:

1. ***The reference case; light rail at-grade;***
2. ***A hybrid option for light rail with some sections elevated to improve running speeds; and***
3. ***Possibly a bus rapid transit option if it can be demonstrated it has the potential to meet the longer term requirements for public transport patronage.***

PART I – The project background and objectives



1 What this report is about

The Sunshine Coast Council has convened a Taskforce representing business, the community and the Council to prepare this pre-feasibility report. Its focus is on whether a light rail system or other similar type of high quality rapid transport system should be developed as a focus for changing the way people move across the region.

This pre-feasibility report by the Taskforce aims to determine the objectives of this future public transport system and whether such a project would have a reasonable chance of success on the Sunshine Coast.

It is a high level investigation. Key matters investigated include: potential locations; options for public transport technology based on light rail and bus; likely costs; and potential demands.

Before a final decision can be taken to commit significant funding to a new rapid transit system, more comprehensive feasibility investigations will be required. The next phase of investigation beyond this pre-feasibility report is to move to a full engineering feasibility and business case that meets the requirements of funding approval for major projects in Queensland. Since these subsequent feasibility investigations will require significant commitment of public resources, it is important the pre-feasibility report establishes whether there is a case to proceed.

The pre-feasibility work has considered several potential corridors for a light rail or similar system, within the major urban development areas centred on Maroochydore, Mooloolaba, Kawana and Caloundra. It also considers other potential corridors for future development of light rail to connect with important destinations in the region.

The project is of regional significance and its 'catchment', influence and benefits would not be limited to these corridors. Connections across the entire Sunshine Coast region have been considered with a strong focus on how the new trunk rapid transit system could be developed as part of an overall integrated public transport system, with:

- Improved high frequency bus services from areas not directly served by the rapid transit;
- Trunk bus connections to the North Coast Line regional rail system that presently connects Nambour to Brisbane; and
- Coordination with the proposed Sunshine Coast Line, a rail spur connecting from the present North Coast Line at Beerwah to Maroochydore.

The focus of this report is a reference scheme based on light rail, a modern form of electric passenger rail with the flexibility to operate in a large range of urban environments. However, bus-based solutions with technology already well known to the Sunshine Coast, elevated railways and a monorail option have also been evaluated to compare costs and benefits.

2 Learning from other places

"The proposed light rail project while visionary for the Sunshine Coast, is a mode of transport that so many other communities now take for granted as part of everyday business life. The coast has a car culture and it will take transformational projects such as light rail to change that to a public transport culture."

Ross Hepworth, Institute Director Sunshine Coast TAFE and Light Rail Taskforce member

The Sunshine Coast faces unique challenges as it grows to become one of Queensland's major regions. These challenges include: proximity to Australia's third largest city with its large pool of jobs; diverse geography which includes major river systems; coastal towns, inland towns and a green hinterland; generating a new local economy with a broader base; and maintaining its attractiveness as a place to live and visit.

However the region is not the first to experience sustained growth in population that sees the continual crossing of activity thresholds and increasing congestion. Many places have had to deal with the sustained growth in transport activity that is an inevitable result of increased population. An important part of long-term local planning for future urban growth is to understand how other places have handled the linkages between transport activities, the ways in which that activity is catered for, and the type of community that results.

The Taskforce has considered the experience of a number of other cities that have adopted major public transport projects. Three such cities are discussed below. All have some similar conditions to those that will occur on the Sunshine Coast, while they differ in many other ways. All have a strong tourism focus and a need to protect lifestyle and amenity advantages.

In studying best practice from other places, the fact that they may be different does not mean lessons cannot be learned from them. Best practice ideas are not confined to a single place, they are found almost everywhere in different forms.

The objective is to learn from the experience of others, not to copy them.

2.1 The Gold Coast

Although the Gold Coast differs from the Sunshine Coast in many respects, it is located in the same region of south east Queensland, and has identical legal, administrative and taxation arrangements. As a city approaching 600,000 residents, it caters for around 60,000 extra visitors each day, and provides relevant lessons in what to expect as a place grows, and how far ahead planners should look.

The Gold Coast City Council launched its first ever integrated transport plan in 1998, when its population was about 360,000 people. That is similar to the present day population of the Sunshine Coast region. A signature of that plan was a major new trunk public transport project that linked the city's major centres and emerging residential communities and integrated with buses and the regional Gold Coast Railway line.

After extensive consultation, the Council adopted the scheme, based on light rail, as a preferred option in 1999, and progressed planning. Until then, the rapidly growing and intensively developed coastal precinct, from Southport to Broadbeach had been the target of private sector schemes for a coastal freeway system built either along or over the beachfront, and for major upgrade plans for the Gold Coast Highway. The Council led light rail project effectively ended such speculation. The Council drew a “line in the sand”.

In 1999, to prepare for light rail, Council also began renovating the roads and streetscape through Surfers Paradise, taking control of the roads from the Department of Main Roads. Through-traffic was removed by establishing the Surfers Paradise Boulevard. This act alone encouraged very significant private investment in Surfers Paradise, though it was accomplished some 14 years before the light rail service will eventuate.

That same year Council adopted a transport levy from which it determined to fund future planning and capital contributions for light rail, as well as a large range of general multi-modal road and public transport projects.

In 2001 Council enlisted the support of the Queensland and Commonwealth Governments to fund a full feasibility study that was completed in 2004. That study confirmed light rail as the preferred option, from a new regional rail station at Parkwood, west of Southport, to Broadbeach.

Negotiations between the three spheres of government then resulted in a formal business case to meet State and Commonwealth requirements in 2006. A fundamental assumption of the business case was that the project would have broadly based objectives relating to making the Gold Coast a better place to live and improving the quality of the environment, as opposed to a narrower focus on the best way to move people.

The business case evaluated in extensive detail a light rail and a bus rapid transit option and was completed and endorsed in early 2009. It recommended light rail proceed. The route for stage one was shortened to terminate at the Griffith University and the new University Hospital at Southport Parklands. A proposed future link to the existing Helensvale rail station was preferred as an alternative to the development of a new Parkwood station as suggested by the previous feasibility study. Connection to the rapidly growing Gold Coast Airport is also a part of future staging.

The Council had already committed $120 million of funding for stage one in 2008, and in 2009 the Commonwealth committed $365 million, followed soon after by a commitment of $464 million from the Queensland Government.

The project proceeded to delivery phase, and stage one will be completed in late 2014.

Successful planning and delivery of light rail was used as an important feature to demonstrate how the Gold Coast could plan and effectively deliver for the Commonwealth Games. The proposed Games village was also sited at Parklands on the light rail route, although it is understood this decision may be reviewed.

The Gold Coast City Council and the Queensland Government have also planned for future phases which are yet to proceed to business case. Key objectives for subsequent phases will be to link to:

- The rapidly growing Gold Coast Airport, the sixth busiest in Australia, with plans to grow from 5 million passenger movements in 2010 to over 16 million in 2031; and
- The regional railway to Brisbane which is experiencing ongoing very high growth.

2.1.1 Key learnings from the Gold Coast

The progression of the Gold Coast light rail project has demonstrated some important lessons for the Sunshine Coast:

- Planning can take some years and a long term vision and approach is required;
- Council started planning when its population was a similar size to the present day Sunshine Coast;
- A project can be developed and led by a Council and subsequently progressed in partnership with other spheres of government;
- Broadly based “city building” and environmental objectives are important;
- Establishing a major transit project can be a catalyst for other supporting development projects and a demonstration that not all attention needs to be devoted to roads and traffic;
- It is important to engage and educate the community through all phases to help with understanding the impacts of a ‘do nothing’ approach; and
- A large transit project can demonstrate a community’s ability to get things done and encourage other complimentary economic development initiatives.

2.2 Portland, Oregon

Portland Oregon is a city of 590,000 people on the north-west coast of the United States. The City is at the heart of the broader Portland metropolitan area which has a population of over 2.2 million. With its temperate climate, Portland has been a destination for lifestyle choice for some decades, particularly for people wishing to avoid the impact of very high growth being experienced in California.

Portland City Council drew its “line in the sand” in 1974 when it determined to close the waterfront Harbor Drive expressway and turn it into a downtown pedestrian and tourist area. The Council also terminated the Mount Hood Freeway project directing its funding instead towards building a downtown transit mall and to begin a light rail scheme for the city. Both of these decisions were taken against strong advice of traffic planners who had forecast major traffic growth on both facilities.

Construction of the first 24 kilometre line commenced in 1982 and was completed in 1986. The light rail system is currently 84 kilometres and has 85 stations. It is supported by an extensive system of rapid and local buses. Recently, funding for the expansion of a further 11 km was approved.

The need for a new urban vision to support the light rail plans was recognised from the earliest planning phases. Portland's urban growth boundary (UGB) was adopted in 1979 to separate urban areas, where high-density development is allowed, from traditional farm land, where restrictions on non-agricultural development apply. The original UGB restrained urban sprawl but was heavily contested on housing affordability arguments. In 1995, the Oregon State government passed a law requiring cities to provide enough undeveloped land for a

20-year supply of future housing at projected growth levels. While the urban growth boundary has been controversial, it has helped constrain the majority of city growth to a higher density core that is well served by the light rail and a frequent bus system.

2.2.1 Key learnings from Portland

The experience of Portland shows:

- It is possible to reverse decisions to build major freeways and use the space and funding for mass transit systems instead without causing the collapse of the city's transport system;
- Long timelines affected the development of the light rail project similar to those found on the Gold Coast;
- A vision of a less car dominant city was at the heart of the light rail plans;
- Buses must be an integral part of the public transport system;
- There needs to be a balance between new 'greenfield' car dependent housing and more diverse, higher density lifestyle choices that trade off space for high levels of local accessibility; and
- Properties along the light rail corridors, particularly near stations, have significantly increased in value.

2.3 Montpellier, France

Montpellier is a city of 420,000 in the south of France, and is one of the country's fastest growing cities. It is a place admired for its lifestyle and climate, and the population has been increasing by 1,000 each month since the 1980s. By 2020 the population will increase to over 700,000. Although located in France with a 1,000 year history, it is a coastal city with rapid population growth and of a similar size to the Sunshine Coast, and provides some useful comparisons.

In the late 1980s the impacts of growth began to undermine the city's quality of life and the local government adopted a new urban development vision based on containing sprawl and relying heavily on mass transit. The City Council drew a "line in the sand". It decided to focus on public transport rather than catering for cars through building roads and expanding car parking. There are 0.44 cars per head of population and in 2002 the mode share for the car was over 90 per cent of motorised trips. A major public transport system was needed to move thousands of people across the city, encouraging them to leave their car at home for at least some trips.

The light rail system or "tramway" also became a key part of the new urban redevelopment vision developed by the local government. The City Council examined Bus Rapid Transit (BRT) and Light Rail Transit (LRT) options before choosing LRT. The major reasons for choosing LRT over BRT were:

- The desire to redefine urban development and ensure a less car dependant style of housing. The LRT was depicted as a "tool to define a new city";
- Concern with the capacity of the bus-based option to meet growing needs, and the high number of vehicles needed relative to LRT. BRT would not have been able to cater for the forecast 150 per cent growth in patronage by 2020; and
- The need to support a revitalisation of the city centre which was choking on traffic. BRT would not have been able to achieve business support for the level of land use-transport integration in the city centre or to create such a pedestrian friendly centre.

From a land use perspective, the Montpellier LRT has supported regeneration of Mouson; new urban development at Melbosc and revitalisation of the City Centre, which is now a place where people congregate.

The buses were reorganised and there are now very few buses in the city centre.

2.3.1 Details of the Montpellier System

- The LRT has four lines - the final line began operating in April 2012;
- Line 1 is 15 kilometres, in service since 2000, and the framework for the future network on the major development axis, it includes a 180 metre tunnel;
- Line 2 is 20 kilometres, in service late 2006, is built on the historical axis of communication lines;
- Line 3 is 22 kilometres and extends to the coast; and
- Line 4 is 8 kilometres and is a city loop connecting across the three radial lines.

Total 2012 ridership is expected to be 220,000 passengers per day. In Montpellier's case, local artists were employed to design a corporate livery which the city believes encapsulates its qualities of warmth, conviviality and dynamism. The swallow motif featured on line 1, pictured left, is said to evoke freedom, youth and vitality.

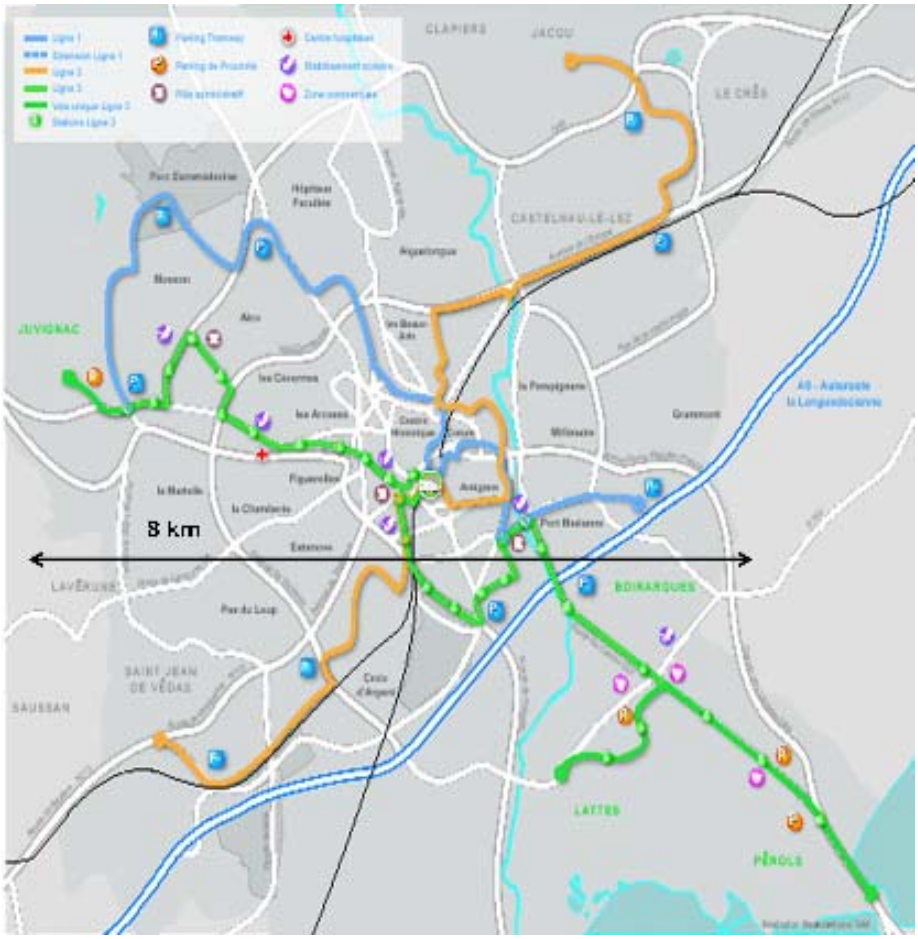
The striking floral livery for Line 2 is pictured right, and denotes the fields of wildflowers found on the route. All lines make use of grass centres. The grass dampens noise by 4-5 dB and discourages cars from driving on the track.

2.3.2 Key learnings from Montpellier

- The project was a key part of a city revitalisation vision based on lifestyle and jobs; “a tool to define a new city”;
- The installation of LRT has been done in parallel with a total review of the road network. Traffic management of the town centre was a particular focus;
- City traffic organisation was part of the project – so it now flows better, 70 per cent satisfaction rate with reorganisation;
- Strong integration between LRT/ bus and buses use LRT platforms when required;
- LRT integration with pedestrians, cyclists and town centre commerce is clearly demonstrated, and town centre quality is a model for all cities;

- Marketing of the system is particularly strong and the system has been embraced by the community;
- The importance of park-and-ride and the restructuring of the bus network to feed in the provision of an effective rapid transit system are demonstrated in Montpellier;
- Full priority through traffic lights is provided for the system, and this is essential to maintain the running speeds of an average of 20km/h; and
- Central control system for the tram and bus is coordinated and very high tech.

Figure 2.1: The Montpellier LRT system showing all 3 radial lines in place



3 The Sunshine Coast story so far

"Light rail has the ability to add a unique "quirk" factor to our tourism mix and more importantly a plus for our community in terms of connecting and protecting lifestyle and values"

Steve Cooper, CEO Sunshine Coast Destination Ltd and Light Rail Taskforce member

To support its vision of overall economic, social and environmental sustainability, Council developed its Sustainable Transport Strategy 2011-2031. It aims to offer real choices to the private car and to protect the lifestyle values of the region.

On the Sunshine Coast the State Government provides the public transport infrastructure and operates the trains and buses. However, Council has long been proactive in its quest to improve public transport throughout the region. Council signified its commitment and willingness to play a leadership role alongside State and Federal departments when it introduced the Public Transport Levy in 2009 to help influence and accelerate improvements in infrastructure, services and patronage. The levy also enables Council to build stronger partnerships with the state through policy development, improved advocacy, infrastructure projects and improved public transport investment.

3.1 A vision for transport on the Sunshine Coast

In 2031 the Sunshine Coast is recognised as Australia's most sustainable region, which fosters the protection and enhancement of our natural environment, meets the social, health and learning needs of the community and facilitates prosperity for our economy and local businesses. Our community is supported by a sustainable, highly efficient, integrated and safe public transport system. This innovative transport system is embraced by the community and has changed travel patterns to reduce car dependency. It enhances quality of life and contributes to the sustainability of the region.

(Sunshine Coast Council Sustainable Transport Strategy 2011-2031)

3.2 The role of public transport in achieving the vision

Public transport currently plays a minor role moving people on the Sunshine Coast, accounting for around 3.6 per cent of all trips. Based on an estimated population of 320,000 in 2011, that's around 40,000 daily trips. More than half of these are bus trips to and from schools. As the Sunshine Coast population is rapidly increasing, and becoming more urbanised in key precincts, the role of public transport, and its capacity will need to increase.

An innovative and improved rapid transit system supported by frequent and direct buses could play a much greater role. It offers a sustainable alternative to the private car. It could certainly move more people, but it could also deliver greater economic, environmental and social benefits.

The need for improved public transport is driven by key factors such as rising congestion, increasing urban sprawl, the cost and impact of providing roads and parking for high numbers of vehicles, the need to insure against potential shortages in future oil supplies, and the concern about the relationship between climate change and carbon emissions from transport.

3.3 Key council initiatives

Council's proactive approach to improving regional public transport through the Public Transport Levy has included:

- Free Holiday Bus services;
- Council Cabs - affordable transport for people with disabilities or over 60;
- FlexiLink on-demand bus service;
- New and trial local bus services; and
- New bus stops and facilities to support these services.

3.4 A line in the sand – a focus on people, not cars

Throughout Australia's recent past, the approach adopted by city planners assumed the development of a car dominated community. The Taskforce believes this approach must change. It is important that these changes begin now before planning and land use is further developed, the Sunshine Coast community becomes much larger, and its activity centres become dominated by large roads, traffic and parking.

This is not a vision that excludes cars, though they would be less dominant in our major centres. It is a vision based on putting the human experience first, and the means of transport second. It recognises people will need to move around by efficient and reliable means, but gives them more choices to use frequent public transport, or walk or cycle to local destinations.

Most importantly, **we need to prioritise our actions, rather than have an "each way bet"**. Too often traffic planning suggests a road solution is needed irrespective of whether public transport is improved, while town planning laws require minimum levels of car parking. This simply ensures people will continue to drive, irrespective of how much public transport is improved, and ensures the *status quo* is maintained.

A quote famously attributed to Albert Einstein defines insanity as "doing the same thing over and over again and expecting a different result". We need a circuit breaker that establishes a new direction and we need to have confidence the solution will work; a line in the sand.

The Taskforce believes that "game changer" solution is a sleek and modern rapid transit system supported by:

- A system of frequent and direct feeder buses covering major transport routes that are not served by the rapid transit; and
- A new focus on generating modern forms of Sunshine Coast styled urban development that supports efficient public transport and does not require occupants to drive a car for virtually every trip.

4 The case for taking action on the Sunshine Coast

"We try very hard to bill the Coast as 'unique or iconic ' and if we are to progress forward and retain these values then we should build an "Iconic Transport" system for our region. We could debate for weeks, months and even years about the pro's and cons, costings, viability, etc., etc. but one fact remains, if you don't build the light rail, people won't use it."

Ashley Gear, Light Rail Taskforce community representative

There is a compelling case for a major shift from the present "low key" approach to public transport on the Coast to one that can take the region into the future. It centres on:

- Protecting quality of life and environment from excessive growth and dependence on motor traffic;
- Developing an economy based on a broader range of clean industries
- Creating more lifestyle choices that rely less on driving; and
- Responding to the risks posed by energy shortages, oil depletion and climate change.

4.1 Protecting our quality of life

We should not wait to experience the impacts of elevated freeways, high traffic volumes and excessive areas of car parking before acting.

The Sunshine Coast is one of the best places in one of the best countries in the world. Its climate, relaxed lifestyles and beautiful environment attract a range of people to live, work and holiday in the region. Despite the present downturn in the world economy creating slower growth and reduced development pressures, there is a long term trend for Australians to settle in coastal cities and towns. This trend is likely to accelerate as our population ages. It seems almost certain the Sunshine Coast will continue to grow over the next few decades, with its population expected to grow from about 320,000 in 2011 to about 500,000 in the year 2031. So for every seven people living here in 2012, there will be another four by 2031. Each person makes about 3.6 trips per day, and most of those are by car.

By 2031 there will be an extra 550,000 trips each day on our roads and transport system.

And of course, 2031 is simply a forecasting date currently used for much of our planning. If we look back 20 years, to 1992, it doesn't seem that long ago. The region will continue to grow throughout the 21st century. By 2051, it could have a population exceeding 700,000.

Like many places that have developed primarily in the post-World War II era, the Sunshine Coast region's growth has been based almost completely on the assumption of infinite and viable private car transport. New development proposals risk continuing this trend and many urban settlement providers remain focused on delivering low density, segregated land uses with large road networks and large areas of off-street car parking.

It is simply easier for each new development to incrementally add a few more roads and car parks. This simpler and almost 'hands off' approach embeds the car culture and makes it much harder to explain the need for change, let alone change travel behavior.

Consistent with much of Australia, provision of trunk public transport systems usually lags well behind new development and is sometimes seen as a social service, provided primarily for those who are too old, too young or too poor to utilise private car transport.

More and more cars require bigger and bigger roads, and consume valuable areas of activity centres for car parking. Each car spends most of its time parked somewhere and requires on average, three car parking spaces somewhere in the region. When large car parks are built, people are less likely to walk around the centres, because of the increased space between activities. This means local businesses don't benefit from opportunistic walk-up trade; people simply drive to the one business and then drive away.

Many cities around the world have tried to "build their way out of congestion". None have succeeded and most have realised the undesirable effects of this approach. We should not wait to experience the impacts of elevated freeways, high traffic volumes and excessive areas of car parking before acting. We should begin now and steer a steady course of change to a more sustainable transport system that protects the things we value.

4.2 The need to offer more lifestyle choices and protect valuable land

As our population matures and seeks more diversity, the Taskforce believes it will be necessary to offer the community a broader range of lifestyle choices. This can be achieved by orienting our communities around transport and people rather than cars, particularly in the iconic coastal precincts. Lifestyles become more about choice with options that rely less on driving, with easy access to local services by walking or cycling.

For longer trips to major centres, these communities would be oriented around a high quality, very frequent and reliable rapid transit system. The type of rapid transit suggested as a reference case by the Sunshine Coast Council for this role is a modern light rail system, similar to those found in hundreds of cities around the world. **Focusing future development around these growing coastal precincts also protects rural food producing areas and natural habitat** while still offering residents larger-style, rural properties if that is their choice. Bus based options might also be able to achieve this "urban redesign", although they generally have a lesser capacity to move people in a confined corridor, and may eventually need to be replaced by a rail system.

4.3 The risks posed by energy, oil depletion and climate change

Climate change could result in major challenges for coastal cities like the Sunshine Coast. Council's *Climate Change and Peak Oil Strategy 2010-2020* provides direction for responding to climate change and peak oil risks and challenges, and to develop resilience to future impacts. Reducing carbon emissions is an important mitigation strategy. Since transport activity accounts for about 22 per cent of carbon emissions in South East Queensland[2], we need to anticipate a continuing focus on reducing carbon emissions. As a result, car travel could become more expensive and less convenient in future years.

Energy from all sources could become more expensive in the future. Many experts point to the high likelihood of increased cost and/or reduced supply of oil-based motor fuels. This could result from the rapid expansion of Asian automobile markets and the predicted

[2] ICLEI Local Government for Sustainability 2009 South East Queensland Regional Plan Climate Change Project: Phase 2 Emissions Analysis

slowing of growth in oil production. Even alternative power sources like electric cars could be affected by rising energy costs reducing the affordability of travelling long distances.

Relying on car-dependent lifestyles, carbon intensive urban settlement patterns and transport using large amounts of fossil fuels, exposes us to major risks in the future.

4.4 It's time to act

It takes time to plan and implement a major rapid transit system. This is appropriate. We need time to allow full and frank community conversations, and time to change our planning intentions to support a vastly improved public transport system that is a ***preferred choice, not an afterthought***. We also need to develop a transition plan, to take us smoothly from a car based region to one with more choice and much better public transport.

The time to act is now, before the region is fully developed around car transport. We need to spell out the future we want and campaign for it; to draw ***a line in the sand.***

5 Creating the Sunshine Coast Light Rail Taskforce

Council resolved on 24 August 2011 to establish a Sunshine Coast Light Rail Taskforce with representation from Council, business and community with its role to be the development of the business case for light rail on the Sunshine Coast.

An extensive cross-section of interested business and community members offered their experience and passion for the Sunshine Coast by volunteering their time and commitment to the Taskforce when membership was publicly advertised in January 2012. Applications were assessed and the Taskforce composition was announced in March.

5.1 Taskforce membership

A diverse group of four people represent the community: Ms Marta Botta, a former Board member of Sippy Downs District Community Association and post graduate student of Sustainability and Futures; Mr Mitchell Kesby, a public transport supporter who has grown up on the Sunshine Coast and will ensure a youthful perspective; Mr Ashley Gear, long-time resident, transport industry worker and active community advocate; and Professor Herbert (Barry) Harrison, a passionate conservationist, recently retired after an illustrious career in education and commercial practice.

Taskforce members representing key industry and community sectors include: Mr James Birrell, landscape architect and light rail advocate; Professor Mike Hefferan, Pro Vice-Chancellor (Engagement) and Professor Property and Development of the Sunshine Coast University; Professor Ian Lowe, Adjunct Professor of the USC and President of the Australian Conservation Foundation; Mr Ross Hepworth, Institute Director Sunshine Coast TAFE; Mr Stephen Dittmann, Chair of the Sunshine Coast Chambers of Commerce Alliance and member of the Sunshine Coast Economic Development Advisory Board; Mr Steve Cooper, CEO Sunshine Coast Destination Limited; Ms Natasha Hart, Public Transport Advisory Group, Sunshine Coast Representative; Ms Sandy Zubrinich, Chair of the Sunshine Coast Business Council; and Mr Tony Vella, representative of the Urban Development Institute of Australia.

The Council also convened an expert team to support the Taskforce. This included the Council's Project Director Transportation Strategy, Mr Graeme Krisanski, and an experienced urban planner, Mr Ian Gordon. The team leader is an independent transport specialist, Mr Ken Deutscher. The team's economist was Ms Vanessa Bennett. Communications was provided by Ms Judi Lalor and administration and research support by Ms Helen Hutchieson. Expert support was also provided by Council's Transportation Strategy Branch and Mr Ross Hunter for rail engineering and Mr Dan Blake for engineering drawing.

5.2 Taskforce meetings

The Taskforce met four times in 2012 during the pre-feasibility phase covering a range of topics included in the report. The table shows the meeting content.

Meeting date	Key issues/topics covered
19 March	Project overview and deliverables; Governance; staging; technology options for review; Community engagement
23 April	Overview of international examples; Links to land use planning and importance of managed density to protect coastal lifestyle; Strategies for encouraging light rail support; Role of light rail in broader regional transport systems; Potential corridors; and review criteria
21 May	Light rail comparison with other modes; Benefits; demand; social impacts; cost benefits; Strategic partnerships; risks and mitigation; Potential revenue streams; budgets and timing
2 July	Finalise recommendations and report

6 About the Sunshine Coast Light Rail Project

"*We are reaching a critical point in the evolution of the Sunshine Coast and we have an opportunity, with this mass transit solution, to not only develop our economy but to also preserve our environment, quality of life and the much loved identity of the unique villages that make up our whole region*."

James Birrell, Sunshine Coast Landscape Architect, light rail advocate and Light Rail Taskforce member

The Sunshine Coast Light Rail Project aims to provide a new sleek and modern rapid transit system as the backbone for the future public transport system for the emerging and dynamic regional city and its surrounding towns. Eventually the rapid transit system could link all the major destinations and attractions within the urbanised coastal precincts and connect with bus and passenger rail across the region.

The Council launched the project in late 2011 and determined that a modern light rail system running in its own right-of-way but sharing intersections with other road users, similar to that being constructed on the Gold Coast, was to be the reference case. However the Taskforce noted the considerable interest shown around the world in other technologies, and has ensured this pre-feasibility report considers other options. This reference case is described in detail in Chapter 12. The options are described in detail in Chapter 13.

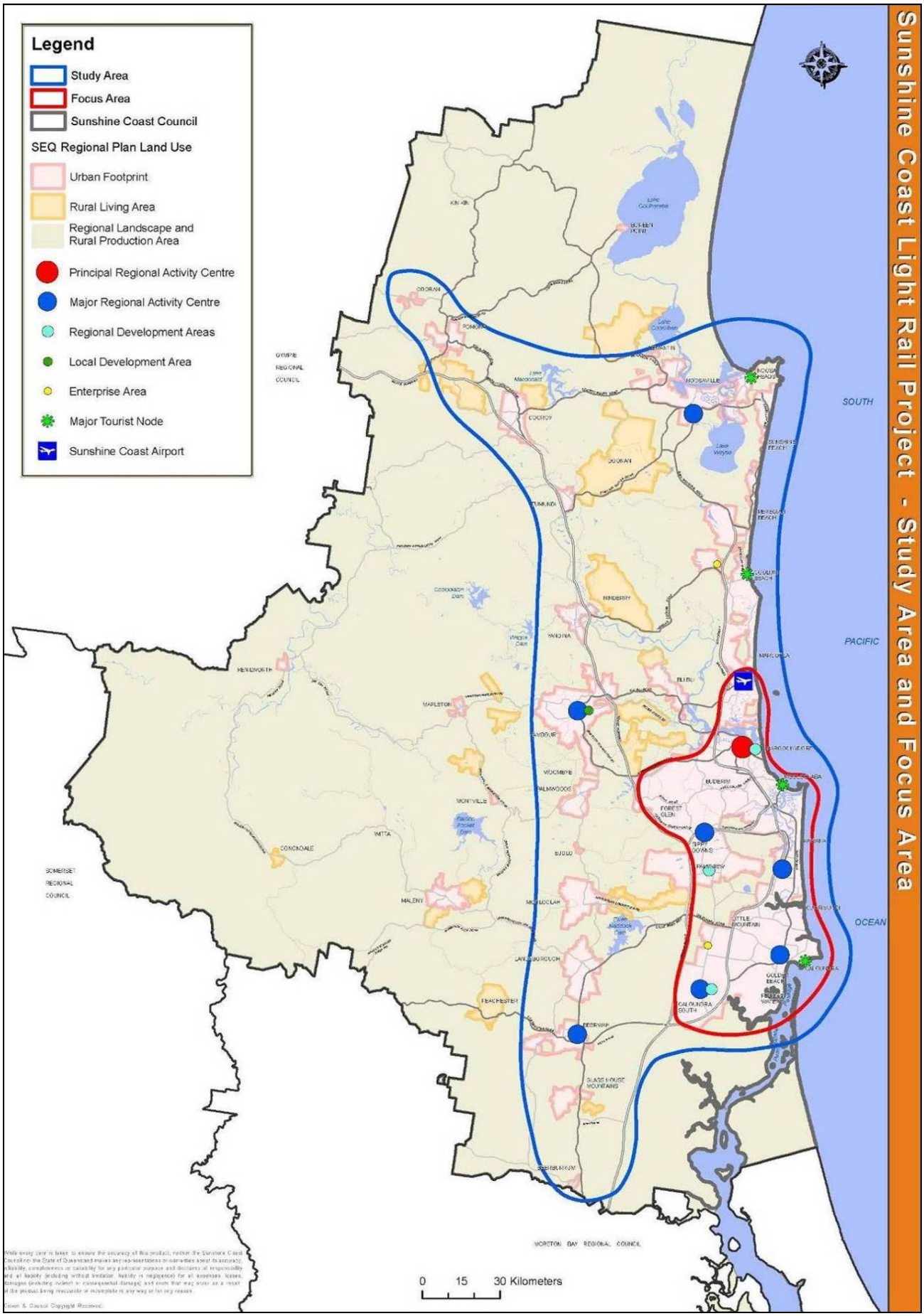
6.1 Vision – a catalyst for defining change in the Sunshine Coast region

Connecting people - creating great places - building our local economy

- A more sustainable region – encourage regeneration and economic development for the next 100 years or more;
- Improve access to centres, employment, education, key attractions and tourism hubs;
- Generate new forms of urban development providing lifestyle choice;
- Enhance and protect the environment reducing dependence on fossil fuels;
- Sleek, modern, rapid transit system for a large regional city and premier tourist destination;
- Reduce congestion in the coastal development corridor;
- Provide the backbone of the public transport system and increase its role across the Sunshine Coast region;
- Integrate smoothly with the existing bus system and regional rail linking to future rail in the south, the university, airport, hospital and major coastal centres;
- A strong partnership between the Commonwealth Government, the Queensland Government and Sunshine Coast Council.

The project study area is shown on the map on the following page. It also includes a focus area; that area that will form the main urban development in the region.

Figure 6.1: Study area and focus area



6.2 Understanding the 'why' – the benefits of the light rail reference case

The potential of light rail is much bigger than just transport. It can change the look of a town or city; it is a marketable commodity; a plus for tourism and a driver of productivity. It can improve liveability. As a transport system, light rail makes it easier to get around. It increases mobility and choice for commuters. It's modern, fast, efficient and high capacity and sits comfortably with other modes of traffic and public transport. It is reliable, and simple to use with certainty of destination and frequency.

Light rail also has market appeal and the capacity to contribute to the value of a place's brand and personality. Its attractiveness to locals and tourists adds to its sustainability and sets it apart from other modes. It has the potential to change behaviour and to shift people from cars to public transport with its modernity, comfort, reliability and strong visual presence. This visibility is an important distinction over general route buses – the physical tracks give the user confidence and security because they can see the route and understand the direction and destination much more clearly.

With the ability to transform and revitalise a region or city, light rail is a catalyst for urban regeneration and growth. It encourages interaction and brings communities closer together and is one of the most energy-efficient and environmentally sustainable transport modes. It stimulates investment opportunities by sparking commercial, residential and place-making projects adding value to the surrounding area. Added local prosperity can also be captured through increased property values along a light rail corridor. The potential of increased returns makes an area more attractive to would-be residents and investors and if managed strategically this density in turn supports light rail patronage and improves its viability.

> *"The notion of efficient, clean, safe, reliable and leading edge transport will add significantly to the awareness and strength of the Sunshine Coast brand. It is no coincidence that the brand proposition of 'Naturally Refreshed' strongly resonates with such a modal offering."*
>
> **Steve Cooper, CEO Sunshine Coast Destination Ltd and Light Rail Taskforce member**

Good public transport can dramatically improve the visitor experience and enhance a place's reputation. The region's 7.9 million annual visitors, around one million or more arriving without a car, seek flexible and high frequency transport options to move efficiently between key points of attraction and interest. Other cities have adopted public transport systems as part of their brand. Melbourne has its iconic tram system, Brisbane its Citycats and London its "tube". The Sunshine Coast's domestic and international market would be well served by a transport mode such as light rail and a significant proportion are already accustomed to this mode of travel as it is already established in their places of origin.

What features would encourage people to shift some of their trips from car to public transport? The services need to be easy to use and understand and go where people need to travel. Some obvious features that are already available or are being planned by council and TransLink include:

- Easily accessed information on routes and services including where possible, “real-time” passenger information;
- Good service coverage so passengers have only a short walk to and from services and can travel where they need to go;
- Frequent services to minimise waiting times;
- Safety, comfort and cleanliness;
- Reliability, so services turn up when expected;
- Integrated fares and ticketing, so there is no fare “flagfall” for changing between services;
- A well-connected network and convenient transfers between services; and
- Friendly staff that offer good customer service.

6.3 The importance of linking with an improved bus and rail network

Even if fully developed over a series of corridors, the new rapid transit system would never be able to provide a convenient “walk up” access to parts of the Sunshine Coast. It must connect with bus services covering the rest of the region, and the regional “heavy” rail service.

A fundamental premise of the Sunshine Coast Light Rail project is its development in tandem with an improved bus network. The buses would include the present local services operating through the local communities, as well as a major new type of bus service that is frequent, reliable and direct so it can encourage people to choose public transport rather than car travel. **This vastly improved bus network will also provide connections between the new rapid transit and the regional rail service to Brisbane from Nambour and Landsborough.** And the route of the rapid transit will allow smooth transfers to the planned Maroochydore regional rail for longer trips, as and when that project is constructed.

Redesign of the public transport network is a key feature of the Gold Coast Rapid Transit project. When the light rail opens in 2014, bus services currently operating in the light rail corridor will not compete with it but will be redeployed to provide more frequent and direct bus services to other parts of the Gold Coast not served by the light rail. As with present bus and rail services, there will be no fare penalty or “flagfall” for transferring between services. This is all easily achievable under TransLink’s integrated contracting system, which also applies to the Sunshine Coast.

Chapter 18 of this report provides a clear plan for how the Sunshine Coast’s public transport system can be designed around a core rapid transit system that links the region’s major destinations and attractors, is supported by a high frequency and direct bus network, and provides park and ride access from the non-urban areas.

7 Project phases and roles

The Sunshine Coast Light Rail Project will need to be progressed in four major phases outlined below in table 7.1. This is based on the key decision "gates" utilised by the Queensland Government in its *Project Assessment Framework* (PAF).

7.1 Key project deliverables and milestones

Phase 1 has concentrated on pre-prefeasibility, and building a case to invest significant funds into a detailed feasibility study and business case. If agreed, Phase 2 would be conducted over a two-year period. If approved, the Phase 2 detailed feasibility and business case would lead into a third phase of detailed design and tendering incorporating best practice financing arrangements. The fourth and final phase is the commencement of construction in 2017.

It is envisaged the first stage of light rail, probably connecting Maroochydore to the Kawana Town Centre and Sunshine Coast University Hospital, could be completed in 2020. Construction of subsequent stages would be subject to further funding but could proceed throughout the 2020 decade and into the 2030s.

Table 7.1: Project milestones

Phase	Activities	Completion	Delivery agent
1	Pre-feasibility and rapid economic appraisal	July 2012	Sunshine Coast Council
2	Feasibility, community engagement, concept design and business case	June 2014	Proposed partnership SCC, DIT and DTMR
3	Detailed planning, tendering, and contracting	June 2017	Proposed partnership SCC, DIT and DTMR
4	Construction of first stage of light rail	June 2020	Proposed partnership SCC, DTMR & PPP partner

7.2 The role of pre-feasibility

Phase 1 pre-feasibility of the Sunshine Coast Light Rail Project has aimed to provide information on the decision whether to proceed to a full feasibility business case. Since the full feasibility phase will require significant time and resources, the pre-feasibility aims to provide enough information to ensure the project has a reasonable chance of success. It has also provided a clear basis for understanding the need for the project, and the likely high level costs and benefits.

7.3 The role of rapid economic appraisal

Undertaking a full business case is expensive and needs to be undertaken only for projects that have a reasonable chance of success. Rapid economic appraisal can provide the key business case information that is worth knowing and at a suitable level of accuracy for a pre-feasibility study.

7.4 The role of future phases

The purpose of the *business case development* phase is to undertake a more detailed, comparative analysis of the shortlisted project scope and delivery options identified during the pre-feasibility (or *preliminary evaluation)* phase, to identify the project scope and delivery option most likely to provide the best value for money outcome. It includes a

community engagement process of the pre-feasibility report. The *business case development* phase enables government decision makers to make an informed decision regarding whether to invest in the proposed project**. It is a go/no-go stage.**

The detailed planning and tendering phase would only proceed once the business case and the required funding were approved. This phase would need to make maximum use of opportunities for government to take on and mitigate appropriate risk so as to encourage private sector investment.

The construction phase would adopt current best practice for project delivery. This is likely to include some form of public private partnership that allocates key tasks and risks to the private sector.

8 Phase 1 methodology – the pre-feasibility phase

Investigation during the pre-feasibility phase has included technical studies, rapid economic appraisal and community and stakeholder engagement.

8.1 Technical pre-feasibility studies

The focus of the pre-feasibility technical studies is on whether the project can be practically constructed, taking into account risks and constraints, and whether it has a reasonable chance of achieving its objectives.

The methodology included identifying, developing and assessing:

- Potential problems and opportunities;
- Objectives and service requirements for a preferred solution;
- Alternative solutions;
- High level review of solutions to determine potential to meet project objectives;
- Potential future demand for the system;
- High level risks, issues and impacts including possible mitigation;
- A suggested range of solutions for full feasibility investigation; and
- A pre-feasibility report.

8.2 Rapid economic appraisal

The pre-feasibility phase has rapidly considered and assessed six public transport options for the Sunshine Coast: CoastConnect; bus rapid transit; light rail at-grade; elevated light rail; monorail; and a combination of at-grade and elevated light rail, known as a hybrid. The rapid assessment compares costs and community benefits on an economic, social and environmental scale arriving at a ‘net value’ for each option.

The rapid economic appraisal has included preliminary evaluation of the following:

- High level benefit cost assessment;
- Rapid economic impact and opportunities; and
- Rapid social impact and opportunities.

8.3 Communications and stakeholder engagement

Awareness and support from the Sunshine Coast community is fundamental for light rail; to get it started and to sustain it. Building relationships and educating key target markets is an investment in future patronage and will contribute to a shift from almost complete car dependence to a growth in more sustainable transport options.

The initial consultation phase included:

- An introductory Sunshine Coast Light Rail Strategy workshop with Sunshine Coast Councillors, senior officers and representatives from the business, education and community sectors to achieve broad support and awareness;
- A series of briefings with business, community and other interest groups across the Sunshine Coast region;

- Creation of an on-line consultation hub and regional advertising to establish community awareness and a database of those interested in the project leading to ‘project friends’ and advocates;
- A community consultation program included: discussion forums; opinion polls; on-line newsletters; regional advertising; and leveraging and linking to other social and advocacy channels;
- The establishment of the Light Rail Taskforce, including external members recruited via an advertised expression of interest process, the Project Steering Committee and the Project Team. Four meetings were held during the pre-feasibility phase, with the Taskforce contributing their diverse skills and knowledge to the report.


Sunshine Coast
Council
lightrail
2020

PART II – Option definition and analysis

9 Land use planning to support light rail

> *"I think the main point is to ensure the Sunshine Coast community really understands the implications of Light Rail – of course as a people mover but also as a fundamental urban design development tool."*
>
> **Professor Mike Hefferan, Pro Vice-Chancellor (Engagement) and Professor Property and Development, University of the Sunshine Coast and Light Rail Taskforce member**

The Taskforce did not start with a project to move people. It started with development of a new urban vision for a developing Queensland community. The Sunshine Coast Light Rail project aims to be a catalyst for defining change in the region. The important elements of a new urban vision for the proposed rapid transit system include:

- Encouraging regeneration and economic development;
- Generating new forms of urban development that provide lifestyle choices and protect valuable farmland and natural habitat;
- Improving access to the employment, education and tourism hubs; and
- Improving the quality of life and image of the region.

If the region was to continue to develop all of its new communities and major activity nodes based almost solely on car access, there would be no point in pursuing a major rapid transit project. The new system would never be viable. Part of drawing "a line in the sand" is to understand the other opportunities for modern and attractive forms of new urban development that support a vibrant coastal lifestyle and yet promote sustainable mobility. Living choices that rely less on car transport can have many benefits for some people through:

- More opportunities to access local activities by walking;
- Less need to drive and face the stresses of traffic and parking;
- Less need to run a car; and
- Benefits to the environment like less pollution and emission of carbon.

And it's a two-way street; public transport benefits from transit oriented developments because they improve its efficiency and attractiveness.

To attract passengers out of cars, public transport must be an effective means of travel; frequent, affordable and reliable. There is a strong relationship between land use and effective public transport. The mix and diversity of land uses and the density of development affects its ability to sustain a frequent, reliable, affordable service, without the need for very large subsidies.

By developing new areas to be "transit oriented", a *virtuous cycle* can be established; higher densities and better mixes of land uses support higher patronage which allows higher frequencies of service. Higher frequencies of service in turn encourage more people to live near public transport and so the cycle continues.

This chapter demonstrates what type of benefits might be achieved by more "transit supportive" forms of urban development that locate employment and other activities close to the rapid transit. It also provides guidance on how these new forms of development might look, as the **Taskforce recognises the relaxed lifestyle, environment and look and feel is highly valued by Sunshine Coast residents.**

A key point is that a less car-dependent lifestyle does not require people to live in high rise buildings. There are "low key" forms of building development that fit in with the Sunshine Coast way of life and provide opportunities for people to live close to quality public transport and local attractions so they do not have to rely on car transport.

9.1 Review of existing and planned land use policy

A land use review was conducted to help determine if sufficient densities were likely to be achieved to support a major new rapid transit system on the Sunshine Coast. The analysis considered historic growth and development patterns and the current planning intentions for future urban development. The review identified the key land use factors that can influence the effective operation of public transport and reduce the very high level of car dependence. The review concluded there is a clear need for effective long-term local planning to provide a broader range of lifestyle choices if car dependence is going to be reduced.

9.1.1 Why is change needed?

The population of the Sunshine Coast is forecast to increase to approximately 500,000 by 2031. It is expected to keep growing well into the 21st century, and its population could eventually reach one million people in the next century. Approximately 67 per cent of future urban growth and development on the Sunshine Coast is planned to occur in the southern coastal area east of the Bruce Highway extending from Maroochydore to Caloundra South, a continuous urban strip of approximately 37 kilometres. This area includes:

- Maroochydore the Principal Regional Activity Centre;
- Four Major Regional Activity Centres (Caloundra, Caloundra South, Kawana, Sippy Downs);
- Major residential development areas of Palmview and Caloundra South;
- Two major tourist nodes (Mooloolaba, Caloundra);
- The future Sunshine Coast University Hospital;
- The University of the Sunshine Coast; and
- The Sunshine Coast Industrial Park.

It is expected that this southern area will have a population of at least 275,000 people by 2031, approximately 55 per cent of the forecast total population of the Sunshine Coast region at that time. With policies to consolidate urban development in this area, its population could easily exceed 300,000.

While there has been considerable growth in higher density urban development along the coast, the predominant form of urban development since the 1960s has been suburban and rural residential communities. This development type separates people from services and employment and is based on very high levels of car-based mobility. In many communities, walking and cycling connectivity is also poor and public transport is less efficient because of weak passenger demand, indirect winding street layouts and long dead-ended roads.

Even in areas where people can access many of their day-to-day needs locally, the multiple employment centres across the region mean work commute patterns are more complex than in a classically-shaped city with a single strong centre. The multi-centred

settlement pattern disperses travel demand, making it difficult for public transport services to focus on any one centre.

The long term trend to develop large areas of greenfield land for urban development also has significant implications for the future transport network. It limits the potential for future urban infill development and reduces the ability to achieve an urban form that supports high frequency public transport in the coastal corridor.

To achieve a more sustainable transport future, we need to work towards a more compact and diverse settlement pattern that can focus activities in agreed centres and along major public transport corridors. This would reduce the need to drive, improve public transport effectiveness and increase the potential for people to walk or cycle.

9.2 Changing urban planning policy to achieve sustainable mobility on the Sunshine Coast

Land use on the Sunshine Coast currently supports a high level of dependence on private vehicles and low levels of public transport patronage. While recent planning for major urban growth areas is based on achieving more transit oriented developments, significant ongoing changes to land use policy for the entire Sunshine Coast region must also contribute to an urban settlement pattern that supports sustainable mobility. To substantially increase the role of public transport, and ultimately support the viability of a new rapid transit system, it will be essential to:

1. Limit the expansion of urban land in areas that are remote from existing transport infrastructure;
2. Concentrate and prioritise future urban development in and around major centres and in identified 'transit corridors'; and
3. Ensure that development of any committed greenfield urban areas achieves sustainable transport outcomes.

9.2.1 Limit the expansion of urban growth

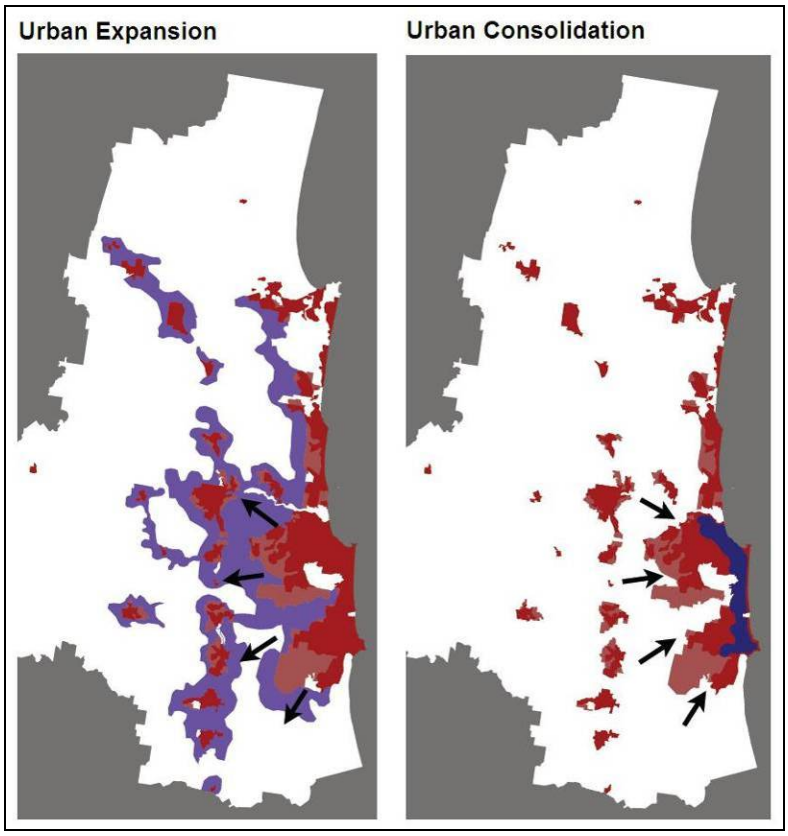
Current planning for the Sunshine Coast includes both broad hectare urban expansion and an intention to increase the amount of infill and redevelopment in existing urban areas. While the focus on consolidating urban growth is already evident in current planning, the success of this planning objective can be compromised by prioritising infrastructure to large areas of greenfield land supply.

The *figure 9.1* demonstrates conceptually the different approaches possible as the region expands its urban population. The *urban expansion* figure on the left shows indicative areas of new development in purple. This would disperse public transport resources and be more difficult to operate frequent and efficient transport. The *urban consolidation* figure on the right shows new urban development concentrated along a rapid transit corridor from Maroochydore to Caloundra[3].

National and international experience shows containing or limiting urban expansion is the most effective means to achieve a compact urban form that supports public transport and improved urban sustainability. Essentially, this principle seeks to limit greenfield development in locations that requires extension of the transport network to new areas, and supports urban development where it will compliment and support existing urban areas.

[3] This corridor is already designated as a "Priority Transit Corridor" in the Queensland Government's Connecting SEQ 2031.

Figure 9.1: Conceptual representation of urban expansion vs. urban consolidation



9.2.2 Concentrate and prioritise urban development near public transport

According to the SEQ Regional Plan, approximately 40 per cent of the Sunshine Coast's future growth to 2031 is planned to occur as infill development in or around the network of major centres. This is a critical shift towards development that is more supportive of public transport. However, a significant increase in the role of public transport requires not only travel demand to and from major centres, but also activity along the route of major transport corridors, particularly for Bus Rapid Transit (BRT) or Light Rail Transit (LRT). The best way of achieving this is by locating increased residential and employment densities at key nodes along transport corridors.

9.2.3 Ensure committed greenfield areas support sustainable transport

While it may be difficult to increase the density in established urban residential areas, the development of greenfield urban areas is an opportunity to ensure more sustainable settlement patterns and lifestyles are created from the outset. This opportunity is recognised by Council's recent planning for Palmview and Caloundra South. The ability of these areas to achieve sustainable transport outcomes will depend on:

- Mix and density of urban uses;
- Development of road networks that are not designed for maximum traffic efficiency but prioritise public and active transport (i.e. delivery of the north-south greenlink from Palmview to Sippy Downs via the existing Energex easement);
- Provision of public transport services from the start of development; and
- Location of land uses to support active transport.

9.3 New styles of housing that support public transport

Some people assume a type of housing that supports less car dependent lifestyles needs to be high rise apartments. This is not correct. **New forms of housing can be developed within the corridor of the rapid transit system that offer quality living consistent with the Sunshine Coast way of life, without packing people into large buildings.**

What is needed is an understanding of the trade-offs in housing and lifestyle choice. Low density car-based communities offer space for families and larger group households to spread out, and to have privately owned outdoor spaces for gardens and pools. Because they are segregated from other uses by large distances, most trips even to a local shop require the use of a car. Transit oriented housing offers the chance to walk to local attractions, to use public transport to get to work and for other trips like shopping and recreation, and the option of owning either no car or less cars. In short, space is traded off for easy access to local services and less need to drive. While this housing choice might not suit some traditional market segments like the nuclear family, these groups will actually constitute a minority of households in the future. It's about providing choices, not assuming the market is only for suburban houses.

In terms of increasing the housing options within an existing residential area, it is important to also consider that tall buildings are not automatically denser than low-rise buildings; plot ratio and site design will also affect density. Sydney's Paddington (low-medium rise) is denser than Melbourne's docklands (high rise). In this regard it is identified that where future planning looks to increase housing diversity within an existing low density area, as a general principle, a low-rise 3 storey building height may be sufficient. In some cases there may be opportunity to utilise taller forms (of say 3 – 5 storeys) where amenity or other guiding principles justify greater scale.

Figure 9.2: Low-rise built form scale at light rail stop

9.4 Changes to land use planning to support sustainable mobility

The decision to implement a major new rapid system on the Sunshine Coast will have a considerable bearing on the future land use of the entire region, and in particular the areas within the light rail corridor. A number of overarching strategic land use policies is essential to achieve a high frequency public transport system, most importantly the need to consolidate rather than expand urban growth.

At the corridor wide scale, the relationship between land use and public transport function is critical. To maximise the benefits of a light rail system it will be critical to increase the number of people who directly access the service.

Future land use planning must provide for a transition from current land use patterns to land uses that support improved public transport.

It is important to recognise that transit oriented development must be applied in context to each individual location and its transport function. The objectives of future land use planning of the rapid transit corridors on the Sunshine Coast should be to:

- Increase the population that is located within direct access to the services;
- Maintain Sunshine Coast lifestyle and appeal;
- Increase housing choice and diversity;
- Establish a greater range of business environments that complement the network of major centres and support economic development;
- Achieve a built form scale and appearance that is acceptable to the community's desires;
- Increase the quantity and quality of public open spaces available to the residents of the transport corridor;
- Improve connectivity; and
- Maximise the benefits that can be obtained from areas of high amenity like beaches and important community services and facilities.

These objectives are generally consistent with Transit Oriented Development which aims to maximise the economic, social and environmental benefits of integrating land use and transport infrastructure.

10 Corridor selection – where could light rail go?

A number of potential corridors have been considered as part of an ultimate Sunshine Coast rapid transit network. The corridors are detailed in Figure 10.1 and include:

- Corridor 1: Maroochydore to Caloundra;
- Corridor 2: Maroochydore to Sunshine Coast Airport;
- Corridor 3: Sunshine Coast Airport to Noosa;
- Corridor 4: Maroochydore to Nambour;
- Corridor 5: Caloundra to Caloundra South; and
- Corridor 6: Sippy Downs to Mooloolaba or Kawana town centre (Options A, B, C and D).

These corridors were assessed to identify those with the greatest potential for rapid transit based on light rail or a similar option. Assessment included comparison and initial prioritisation and identified possible staging options. A shortlist was developed identifying corridors for pre-feasibility evaluation and those to be further investigated in more detailed feasibility studies. The shortlist also identifies the corridors that are considered premature and would need further investigation.

10.1 Corridor assessment methodology

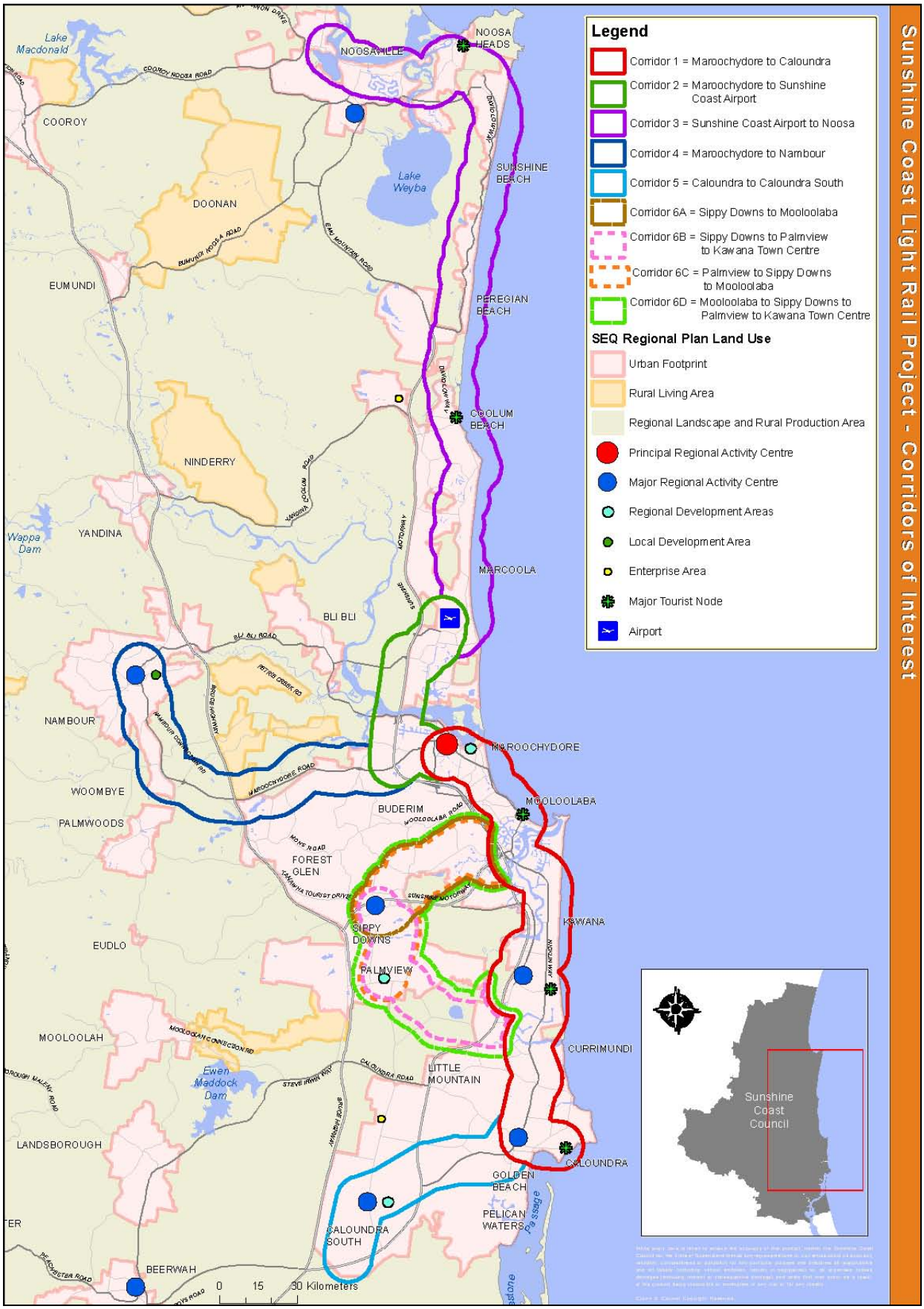
The corridor assessment was based on the principle that urban density is the strongest predictor of travel demand, and in particular that public transport is dependent on the density of residential and employment uses. The assessment therefore evaluates the amount of existing and planned urban settlement to identify the corridors most likely to support high frequency public transport. The geographic context of each corridor has also been taken into account.

Key criteria used in the assessment of corridors included:

- Length of corridor;
- Percentage of urban land within corridor;
- Population within corridors at 2011 and 2031;
- Corridor density ratio of average population per kilometre; and
- Number of major destinations and attractions (employment/education/attractors).

Corridors have been defined as the area within a one kilometre radius of a corridor route. These routes have been determined primarily by the location of the most densely urbanised areas to maximise the amount of urban land within the corridor. The assessment of corridors has not considered factors such as the mix of urban land uses, employment density or urban connectivity of individual areas. The corridor density ratio has not been identified to determine densities that are considered necessary to support rapid transit, but rather as a measure to assist the prioritisation of corridors.

Figure 10.1: Corridors of Interest



10.2 Corridor assessment results

This section identifies and discusses the assessment results for all corridors.

10.2.1 Corridor 1: Maroochydore to Caloundra

The coastal strip between Maroochydore and Caloundra is the largest continuous urban area on the Sunshine Coast. It has two spines of higher urban density, one extending from the southern edge of the Maroochy River to Cotton Tree, Alexandra Headlands and Mooloolaba, the other extending around Caloundra's southern waterfront areas from Golden Beach to Kings Beach. Corridor 1 contains multiple major destinations and the most frequent bus service on the Sunshine Coast, the Maroochydore to Caloundra 600 service.

Table 10.1: Corridor 1 Assessment Results

Item	Corridor 1 Maroochydore to Caloundra
Corridor Length (km)	23 km
Proportion of Corridor within SEQ Urban Footprint	91.6%
Corridor Population 2011	74,795
Corridor Population 2031	97,686
2031 Corridor Density Ratio (Population:Length)	4,247 persons / km
Major Destinations	• Maroochydore • Alexandra Headland • Mooloolaba • Buddina • Kawana Town Centre • Sunshine Coast University Hospital • Bokarina Beach • Caloundra

The density of urban land use in Corridor 1 is planned to increase from 2011 to 2031, particularly in and around the major centres of Maroochydore, Kawana and Caloundra. Of each corridor assessed, Corridor 1 has the highest proportion of urban land (91.6 per cent), the highest corridor population at 2031 (97,686 persons), the highest ratio of population per kilometre of corridor length at 2031 (4,341 persons / km) and the most major destinations.

Corridor 1 is considered to be the most suitable for high frequency public transport on the Sunshine Coast. This is supported by the State Government's Connecting SEQ 2031 integrated regional transport plan, which identifies the corridor between Maroochydore and Kawana as a *'Priority Transit Corridor'* and the corridor between Kawana and Caloundra as a *'Transit Corridor'*. This suggests that connection from Maroochydore to Kawana may be a preferred staging ahead of connection from Kawana to Caloundra.

10.2.2 Corridor 2: Maroochydore to Sunshine Coast Airport

The primary destination of Corridor 2 is the Sunshine Coast Airport. Major expansion is planned from 2020 onwards with the development of a new east west runway and a number of commercial precincts associated with the airport and aviation industry.

Table 10.2: Corridor 2 Assessment Results

Item	Corridor 2 Maroochydore to Sunshine Coast Airport
Corridor Length (km)	9.4 km
Proportion of Corridor within SEQ Urban Footprint	72 %
Corridor Population 2011	13,315
Corridor Population 2031	19,201
2031 Corridor Density Ratio (Population:Length)	2,042 persons / km
Major Destinations	• Sunshine Coast Airport

Although it has the lowest 2031 population (19,201) and only 2,042 people per kilometre at 2031, the airport's value to the future of the Sunshine Coast's economy makes its connection to high frequency public transport a priority. The planned expansion bringing international visitors will necessitate connection to the major accommodation and tourist destinations at Maroochydore, Mooloolaba and Caloundra. Corridor 2 is a priority corridor that warrants further investigations to consider route, technology and staging options for connecting the Sunshine Coast Airport south to the Principal Regional Activity Centre at Maroochydore.

10.2.3 Corridor 3: Sunshine Coast Airport to Noosa

Corridor 3 contains the tourist destinations of Noosa and Coolum as well as a number of individual coastal communities. By 2031 Corridor 3 is expected to have a population of approximately 56,000 people. While this is a significant portion of the Sunshine Coast population at 2031 and one of the region's major tourist destinations, the length of Corridor 3 is the longest at 33.8 kilometres. There is a low proportion of land within the SEQRP urban footprint (58 per cent) resulting in a very low ratio of population per km of corridor length at 2031 (1,535 persons / km).

Table 10.3: Corridor 3 Assessment Results

Item	Corridor 3 Sunshine Coast Airport to Noosa
Corridor Length (km)	33.8 km
Proportion of Corridor within SEQ Urban Footprint	58 %
Corridor Population 2011	45,079
Corridor Population 2031	51,893
2031 Corridor Density Ratio (Population:Length)	1,535 persons / km
Major Destinations	• Coolum • Noosa

The population of Corridor 3 is unlikely to warrant the cost of light rail over its length. To change this position considerably higher urban density would be needed between the Sunshine Coast Airport and Noosa and the ability to create such density is limited by the extent of ecologically protected land. Increasing urban densities in this corridor is also inconsistent with iconic place legislation under the *Sustainable Planning Act 2009* (SPA), as well as the UNESCO designation of the former Noosa Shire as a biosphere reserve. Corridor 3 is therefore not considered an initially suitable corridor option for light rail in the short to medium term. Coolum and Noosa would be more suitably serviced by a frequent trunk bus service directly connected to other major destinations and transport modes (Refer to chapter 18).

10.2.4 Corridor 4: Maroochydore to Nambour

Nambour is a major employment location on the Sunshine Coast, containing the Nambour General Hospital, State and Local Government offices, town centre commercial areas and the Nambour regional rail station.

Table 10.4: Corridor 4 Assessment Results

Item	Corridor 4 Maroochydore to Nambour
Corridor Length (km)	15.1 km
Proportion of Corridor within SEQ Urban Footprint	50 %
Corridor Population 2011	14,112
Corridor Population 2031	19,916
2031 Corridor Density Ratio (Population:Length)	1,318 persons / km
Major Destinations	• Nambour Town Centre • Nambour General Hospital

While Nambour is a major destination, Corridor 4 has the lowest proportion of land within the SEQRP urban footprint (50 per cent) and the lowest ratio of population per kilometre of corridor length at 2031 (1,318 persons / km). Other factors influencing Nambour's feasibility are its separation from the coastal urban areas and considerable hilly terrain west of the Bruce Highway. It is considered Nambour would be more suitably serviced by a frequent trunk bus service with direct connections to other major destinations and transport modes including the core light rail system (Refer to chapter 18).The regional rail station at Nambour provides the opportunity to connect public transport from other areas of the Sunshine Coast to the regional rail network. This station is likely to remain a key regional connection to Brisbane, which could be enhanced by improved trunk bus services.

10.2.5 Corridor 5: Caloundra to Caloundra South

An anticipated community of approximately 50,000 people and a major regional activity centre at Caloundra South will require frequent public transport connections to other areas of the Sunshine Coast. The major destination within Corridor 5 is the future Caloundra South town centre. Importantly, Caloundra South is located on the North Coast Rail Line (CAMCOS). The potential for Caloundra South to be connected to Beerwah, and beyond to Brisbane, by regional rail highlights the possibility of light rail connecting into the regional rail line at Caloundra South instead of the currently proposed Maroochydore. The provision of light rail to Caloundra South could replace or delay the need for costly extensions of the regional rail further north.

Table 10.5: Corridor 5 Assessment Results

Item	Corridor 5 Caloundra to Caloundra South
Corridor Length (km)	10 km
Proportion of Corridor within SEQ Urban Footprint	70 % *
Corridor Population 2011	659
Corridor Population 2031	23,538
2031 Corridor Density Ratio (Population:Length)	2,353 persons / km
Major Destinations	• Caloundra South

** Proportion of urban area within the SEQ Urban Footprint has been reduced to reflect areas deemed not suitable for urban development.*

While almost the entire area of Corridor 5 is located within the SEQRP Urban Footprint, a significant portion of this land has been identified as unsuitable for urban development. It has been estimated that based on current planning, approximately 70 per cent of land in Corridor 5 is suitable for urban purposes.

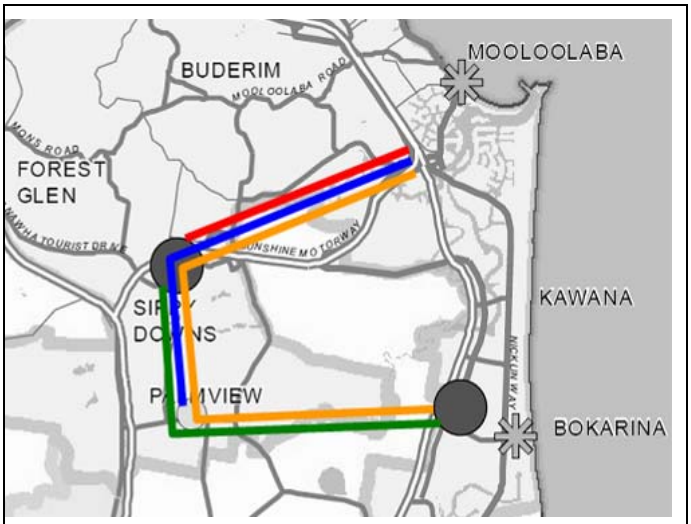
Most of the urban development and population growth in Corridor 5 is expected to occur over the long-term period from 2011 to approximately 2051. Recent projections indicate Caloundra South will grow to a population of approximately 19,000 people by 2031 which would result in approximately 2,542 people per kilometre of corridor length. However due to the timing of population growth development of Corridor 5, light rail or similar is considered more likely as a later stage.

10.2.6 Corridor 6: Sippy Downs to Mooloolaba or Kawana Town Centre

The University of the Sunshine Coast (USC) and future town centre will together comprise a Major Regional Activity Centre at Sippy Downs. The USC anticipates 23,000 students by the year 2020. A proposed Business and Technology precinct on adjacent land will also contain a considerable amount of employment density.

A number of corridor options were considered to connect Sippy Downs to the coastal urban areas (Corridor 1). Corridor 6A connects Sippy Downs north to Mooloolaba while Corridor 6B connects Sippy Downs south to the Kawana Town Centre via Palmview. Two further variations of these options were also considered, Corridor 6C which repeats corridor 6A but commences from Palmview, and Corridor 6D which comprises a full loop from Mooloolaba to Sippy Downs to Palmview and the Kawana Town Centre. These corridor options are identified conceptually in Figure 10.2.

Figure 10.2: Sippy Downs corridor options



Corridor 6A (North Option) - Sippy Downs to Mooloolaba

Corridor 6B (South Option) - Sippy Downs to Palmview to Kawana Town Centre

Corridor 6C (6A Extension) - Palmview to Sippy Downs to Mooloolaba

Corridor 6D (6A & B Loop) - Mooloolaba to Sippy Downs to Palmview to Kawana Town Centre

Assessment results are compared for the Corridor 6 options in table 10.6 below.

Table 10.6: Corridor 6 Route Option Assessment Results

Item	Corridor 6 Options			
	Corridor 6A Sippy Downs to Mooloolaba	Corridor 6B Sippy Downs to Palmview to Kawana Town Centre	Corridor 6C Palmview to Sippy Downs to Mooloolaba	Corridor 6D Mooloolaba to Sippy Downs to Palmview to Kawana Town Centre
Corridor Length (km)	7.4 km	10.5 km	10.7 km	17.9 km
Proportion of Corridor within SEQ Urban Footprint	85.8 %	60 % *	86.5%	68 % *
Corridor Population 2011	14,570	8,235	18,447	20,104
Corridor Population 2031	21,850	30,176	37,050	41,886
2031 Corridor Density Ratio (Population:Length)	2,952 pers. / km	2,873 pers. / km	3,462 pers. / km	2,340 pers. / km
Major Destinations	• Sippy Downs Town Centre • University of the Sunshine Coast	• Sippy Downs Town Centre • University of the Sunshine Coast • Palmview	• Palmview • University of the Sunshine Coast • Sippy Downs Town Centre	• Sippy Downs Town Centre • University of the Sunshine Coast • Palmview

** Proportion of urban area within the SEQ Urban Footprint has been reduced to reflect areas deemed not suitable for urban development.*

Of all the corridors 6A is the shortest at only 7.4 kilometres and has the third highest proportion of urban area (85.8 per cent) and ratio of population per kilometre of corridor length at 2,952 people/km by 2031.

Corridor 6B has a considerably higher 2031 population than Corridor 6A (30,176 people) however the greater corridor length of 10.5 kilometres and lower proportion of urban land at 60 per cent, result in a slightly lower population per kilometre with 2,873 people.

Of the Corridor 6 options, Corridor 6C has the highest proportion of urban land at 86.5 per cent with a 2031 population of 37,050 people. It also has the highest ratio of population per kilometre of corridor length at 3,462 people per kilometre.

Corridor 6D has the greatest 2031 population of the Corridor 6 options with 41,886 people but the lowest population per kilometre with 2,340 people per kilometre due to its length of 17.1 kilometres.

The ranking of Corridor 6 options is as follows:

1. Corridor 6C – Palmview to Sippy Downs to Mooloolaba
2. Corridor 6A – Sippy Downs to Mooloolaba
3. Corridor 6B – Sippy Downs to Palmview to Kawana Town Centre
4. Corridor 6D – Mooloolaba to Sippy Downs to Palmview to Kawana Town Centre

Corridor 6C is considered the best of the Corridor 6 options because it has the second highest corridor density ratio of all corridors under consideration and a high proportion of land suitable to increased development over time.

Corridor 6A has only a slightly higher population per kilometre than Corridor 6B, the higher proportion of urban land in Corridor Options 6A and 6C indicate a greater ability for these corridors to accommodate urban intensification over time, further supporting the suitability of these corridor options over 6B and 6D.

The proximity of Sippy Downs to the coastal urban areas, combined with the future residential and student populations, indicate potentially strong support for public transport services. Accordingly, Corridor option 6C warrants further investigations to consider route, technology and staging options.

10.3 Comparison of corridors

Table 10.7 provides a comparison of corridor assessment results, including Corridor 6C as the preferred Corridor 6 option.

Table 10.7: Comparison of corridor assessment results

Item	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6C
	Maroochydore to Caloundra	Maroochydore to Sunshine Coast Airport	Sunshine Coast Airport to Noosa	Maroochydore to Nambour	Caloundra to Caloundra South	Palmview to Sippy Downs to Mooloolaba
Corridor Length (km)	23 km	9.4 km	33.8 km	15.1 km	10 km	10.7 km
Proportion of Corridor within SEQ Urban Footprint	91.6 %	72 %	58 %	50 %	70 % *	86.5%
Corridor Population 2011	74,795	13,315	45,079	14,112	659	18,447
Corridor Population 2031	97,686	19,201	51,893	19,916	23,538	37,050
2031 Corridor Density Ratio (Population : Length)	4,247 persons / km	2,042 persons / km	1,535 persons / km	1,318 persons / km	2,353 persons / km	3,462 persons / km
Major Destinations	• Maroochydore • Alexandra Headland • Mooloolaba • Buddina • Kawana Town Centre • USC. Hospital • Bokarina Beach • Caloundra	• Sunshine Coast Airport	• Coolum • Noosa	• Nambour Town Centre • Nambour General Hospital	• Caloundra South	• Palmview • University of the Sunshine Coast • Sippy Downs Town Centre

** Proportion of urban area within the SEQ Urban Footprint has been reduced to reflect areas deemed not suitable for urban development.*

10.4 Corridor ranking and potential staging

The assessment and evaluation of corridors has enabled a ranking to inform initial prioritisation and possible staging of light rail. The following table identifies the ranking of corridors and provides comment on the suitability of the corridor for further investigations.

Table 10.8: Corridor ranking, suitability and possible staging

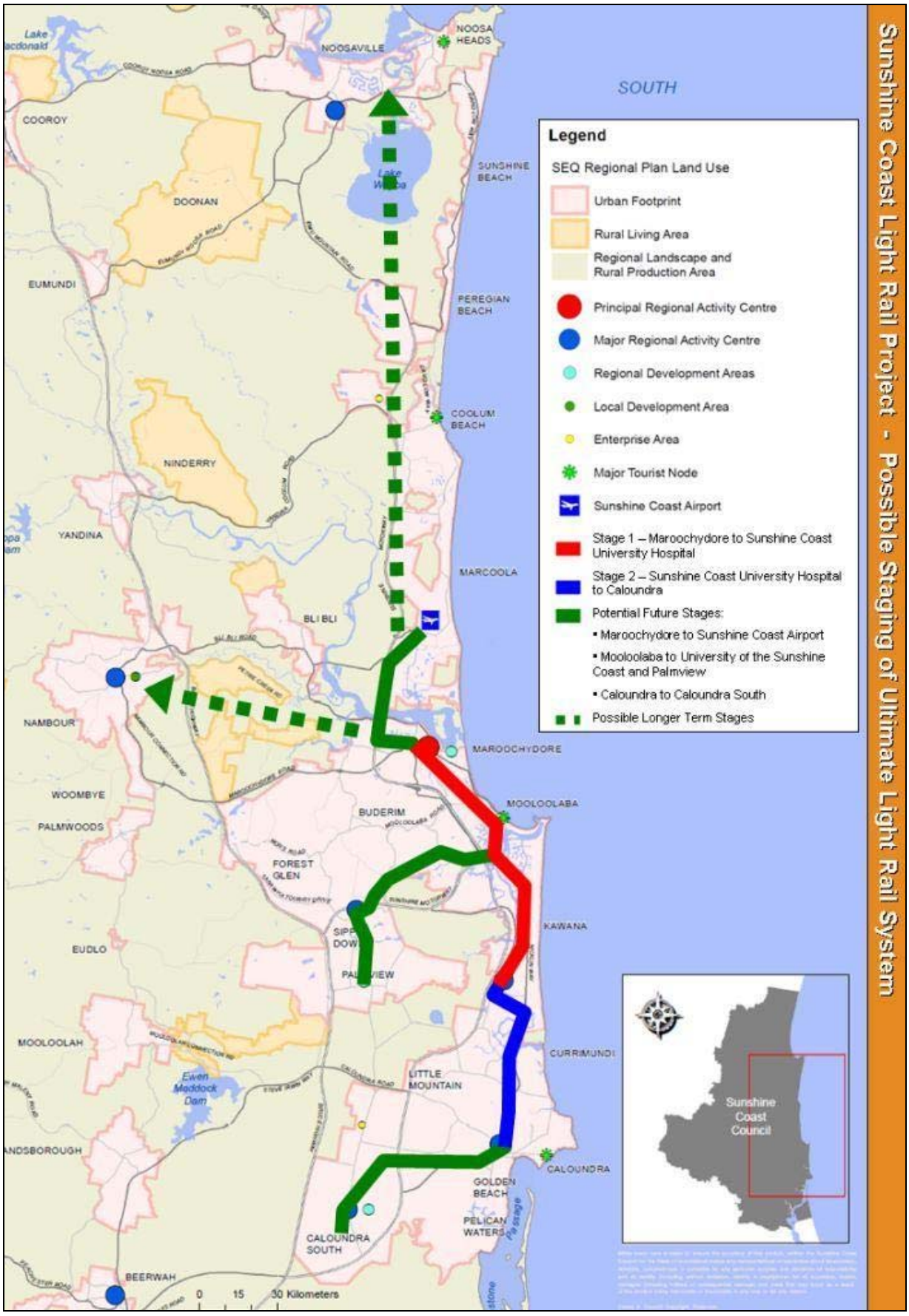
Rank	Corridor	Corridor Suitability	Comment	Staging
1	Corridor 1: Maroochydore to Caloundra	Priority Corridor	Priority light rail corridor for consideration as part of Phase 1 prefeasibility studies and Phase 2 / future detailed feasibility studies	Stage 1 – Maroochydore to Kawana Town Centre Stage 2 – Kawana Town Centre to Caloundra
2	Corridor 2: Maroochydore to Sunshine Coast Airport	Potential Corridor	Route and technology options to be considered as part of Phase 2 / future detailed feasibility studies	Potential future stage – Maroochydore to Sunshine Coast Airport
3	Corridor 6C: Palmview to Sippy Downs to Mooloolaba	Potential Corridor	Route, technology and staging options to be considered as part of Phase 2 / future detailed feasibility studies	Potential future stage – Sippy Downs to Mooloolaba Potential future stage – Palmview to Sippy Downs
4	Corridor 5: Caloundra to Caloundra South	Potential Corridor	Potential suitability long term - Route, technology and staging options to be considered as part of Phase 2 / future detailed feasibility studies	Potential future stage – Caloundra to Caloundra South if Maroochydore rail line not constructed
5	Corridor 3: Maroochydore to Noosa	Potential longer term Corridor	Not suitable for light rail in medium term – Trunk bus services connecting to core light rail system appropriate	Long term option
6	Corridor 4: Maroochydore to Nambour	Potential longer term Corridor	Not suitable for light rail in medium term – Trunk bus services connecting to core light rail system appropriate	Long term option

10.5 Summary – prioritisation of corridors

Summary of findings:

- **Corridor 1 connecting Maroochydore to Caloundra is the priority light rail corridor and focus of prefeasibility studies;**
- **Corridor 2 to the Sunshine Coast Airport is a potential future corridor that warrants further consideration as part of further feasibility studies;**
- **Corridor 6C to Sippy Downs and Palmview is also a potential future corridor that warrants further consideration as part of further feasibility studies;**
- **Corridor 5 to Caloundra South has potential if the Maroochydore rail link is not constructed; and**
- **Corridor 3 to Noosa and Corridor 4 to Nambour are considered lower priorities, however as the role of public transport grows in the future, there could be a case for extending the system to connect these important centres with the rest of the urbanised areas. In the short to medium term they should be connected by frequent and direct bus services to the core light rail system.**

Figure 10.3: Corridors of interest – staging of ultimate LRT system



11 Technology options for the public transport system

"With peak oil looming on the horizon and with constantly rising petrol prices, one day it may be financially prohibitive to drive a vehicle on a daily basis, so planning for a sustainable and efficient public transport makes a lot of sense".

Marta Botta, Light Rail Taskforce community representative

There are a range of technology options available to move people around the Sunshine Coast in the selected transport corridors. Each has different characteristics relating to how much priority they have, how many people each vehicle can move, and of course the likely costs to build and operate them.

11.1 Determining the possible technology types

Public transport systems are most often classified by the broad type of technology employed (sometimes called a "mode"). The commonly used terms include bus, bus rapid transit (BRT), light rail transit (LRT), heavy rail, regional rail, metro rail and various more specific descriptions such as monorail or subway.

To meet the needs of a feasibility style investigation, it is usually better to rely on a more detailed classification scheme that includes the operating environment and the type of service provided. This more complete scheme is based on how a mode of public transport performs in respect of three primary characteristics[4]:

- Right-of-way category (ROW);
- Technology classification; and
- Type of service operated.

11.1.1 Right-of-way category

Although most discussion about technology type performance centres on whether it a bus or a train, it is the ROW category; or where it runs that most influences performance, attractiveness and cost. This is because the speed and reliability of service, two of the most important factors in attracting passengers, are primarily affected by "what gets in the way". There are three levels of ROW commonly applied:

- **Category "C"** - sharing with general traffic – the public transport service may benefit from priority measures such as a "B" signal, but is generally not segregated from other traffic. This means a large range of other road users, including large volumes of private cars, can tend to "get in the way". The commonly used technical term for category "C" is street transit. This can include buses or streetcars such Brisbane's old tram system.
- **Category "B"** - horizontal (or longitudinal) segregation from other traffic - by kerbs, bollards, or visual barriers, but with at-grade crossings for other traffic, notably at intersections. Again priority measures such as signal priority may be offered. This means other road users who need to cross in front of the vehicles tend to "get in the way", though this can be better managed through coordinated traffic signals for some types of technology. Operating speeds are likely to be limited to the speed limit on the adjacent road system. The commonly used technical term is semi-rapid

[4] Vuchic. 2007. P 47.

transit.

- **Category "A"-** fully controlled or exclusive ROW - there are no at-grade crossings or entry by other vehicles. This allows fast operation of vehicles limited only by the need to stop for passengers, and the management of a suitable headway to avoid collisions with other vehicles on the right of way. Speeds can be quite high, depending on the distance between stations which of course affects acceleration and braking times. Category "A" systems often employs signals to reduce collision risk in the higher speed operating environment. The commonly used technical term is rapid transit.

11.1.2 Technology classification

Technology classification considers the mechanical features of the vehicles and their rights of way. The features are considered by:

- **Support:** how the vehicle contacts the riding surface. This is commonly rubber tyre to asphalt or steel wheel to rail. Monorail vehicles straddle a concrete beam, with rubber tyres on concrete;
- **Guidance:** how the vehicle is controlled laterally. This can be steered by driver or guided by rail or other fixed track such as a monorail beam;
- **Propulsion:** power source and method of traction. Typically there are internal combustion and electric motors. Friction through tyres or wheels is the most common method of traction. Cable, rotor and propeller are found in other transport modes; and
- **Control:** the means of regulating the passage of vehicles relative to stops and other vehicles. There are manual-visual or manual-signal, through to fully automatic.

11.1.3 Service type classification

This relates to the coverage of the transit mode, and/or the stopping schedule. There are broad descriptions including:

- Short haul transit such as a local or CBD only service;
- Citywide transit relating to the entire city; and
- Regional transit covering a larger metropolis or region of cities, or linking large cities to one another.

Categorisation can also be made by stopping schedule or type of operation including:

- Local or all stops;
- Accelerated or skip stop (limited stops);
- Express, for point to point travel; and
- Hybrid, local-express, as in a rocket bus service which serves all stops in a local area then runs express to a major centre.

11.2 Public transport technology considered for the Sunshine Coast

The key task of public transport on the Sunshine Coast would be to service trips within the urban area. The aim is to fit in seamlessly and improve the quality of the urban environment. For the purposes of this pre-feasibility study, the service type for all options has been assumed to be:

- Citywide; and

- Local or all stops (although those stops are likely to be further apart than conventional bus stops, with spacing of about 1 kilometre).

The technology options considered appropriate are shown in Table 11.1. Light rail at-grade is the Sunshine Coast Council's suggested reference option as the best placed public transport system to meet the region's future travel task and contribute to the transformation of the coast's urban settlement. Light Rail at-grade therefore represents the reference scheme adopted by the Taskforce. However, this report includes five other technology options which were studied in the pre-feasibility phase. It is expected no more than two or three technology options will be taken to the full feasibility phase, should progression be approved.

Table 11.1: Public transport technology options considered for the Sunshine Coast

Option Code	Technology Type	Right of Way Category	Description
Base case Diesel buses	Bus in traffic with priority over traffic where possible	"C" – street transit	Upgraded bus system with kerb side running and limited priority through bus lanes
1. CoastConnect	Diesel or hybrid buses provided with continuous priority through kerbside lanes	Mostly "B" – semi-rapid transit though will share some areas with traffic	Project as proposed with running Maroochydore to Caloundra on continuous bus or transit lane, with formal stations
2. Bus Rapid Transit (BRT)	BRT in dedicated busway and common lanes in limited situations	"B" – semi-rapid transit	Dedicated bus only corridor completely separate from other vehicle lanes. May share limited common lanes.
3. Light Rail Transit (LRT) at-grade	LRT in median running with shared zones and common lanes in very limited situations, with overhead electric power	"B" – semi-rapid transit	Conventional LRT project similar to Gold Coast. Separate corridor but intersections at-grade.
4. Elevated Light Rail Transit (LRT)[5]	Electric passenger rail on concrete structure and /or tunnel running, with overhead or third rail electric power	"A" – rapid transit	Elevated rail project segregated from traffic and pedestrians
5. Monorail	Monorail straddling a concrete beam with integrated power rail, fully grade-separated	"A" – rapid transit	Elevated monorail system segregated from traffic and pedestrians
6. Hybrid Light Rail Transit (LRT): at-grade / elevated	Light rail with some sections at-grade and some sections elevated to improve travel speeds, overhead electric power	"B" – semi-rapid transit and "A" – rapid transit	Light rail project with a mix of segregation using full versatility of light rail technology

[5] Possible options could be powered by either overhead wires or a "third rail" which is beside the tracks and is live.

11.3 Does the light rail mean we don't need a regional rail connection?

The Taskforce does not consider light rail and planned regional heavy rail to be mutually exclusive and envisages both services would have differing roles. They should be connected and complimentary. If a light rail service was introduced it would transport people within the Sunshine Coast. A potential heavy rail service could transport people predominantly to and from the Sunshine Coast and link to light rail services.

A regional rail spur service operated by Queensland Rail is already planned for the Sunshine Coast. A corridor has been protected as far as the Sunshine Coast Airport however, commitments to deliver this infrastructure by successive State Governments have continued to slip, over the last decade. It would connect from the present North Coast Line at Beerwah to a new station at Maroochydore, with intermediate stations including Caloundra South, Caloundra, and Kawana town centre. This corridor, locally known as CAMCOS after the *Caboolture and Maroochydore Corridor Options Study* commissioned in 1996, could be more correctly referred to as the *Maroochydore Rail Spur Line*.

Another option to upgrade the present North Coast Line between Beerburrum and Nambour has also been investigated and a corridor preserved.

Characteristics of this regional or inter-city service would include:

- Queensland Rail Inter-urban Multiple Unit (IMU) or its successors, operating three car train sets typically married to form a six car train consist. The six cars can seat 440 passengers and for journeys less than 20 minutes, fully loaded capacity including those standing is 720 passengers. The vehicles operate on cape gauge rail (1067 mm)[6] with a maximum operating speed quoted at 130 km/h;
- A fully laden six car IMU weighs around 300 tonnes and on dry rails would require about 550 metres to stop from its top speed of 130 km/h. This is well beyond the safe stopping sight distance achievable on an alignment considered by this report, necessitating signals and full grade separation to protect the trains from collision risk;
- The vehicles utilise 25 kV AC power, and are manually controlled with signal regulation; and
- Regional rail in this format is a highly efficient and effective longer haul mode that can compete with car travel due to its speed, dedicated ROW and comfortable travel style. The vehicles must however be signal controlled due to their mass and speed, and the very high voltage power requires full segregation of overhead lines from other user spaces.

Regional rail has many advantages for fast travel over longer distances. However the Sunshine Coast Light rail project requires a mode of transport that can perform a different task, fitting in with surrounding communities and connecting local attractions. The need for full corridor separation and high voltage lines makes regional rail inappropriate for the iconic coastal corridors of the Sunshine Coast. The need to serve a variety of closely spaced destinations along the corridors would also negate the speed benefits of a regional rail option.

[6] Cape gauge is sometimes termed "narrow" gauge, but there are many formats for narrow gauge, with 1067 mm and 1000 mm the most common.

11.3.1 Options for a regional rail interface with the Sunshine Coast Light Rail project

This present pre-feasibility study for the Sunshine Coast Light Rail project does not rely on a decision whether or not to proceed with the Maroochydore Rail Spur Line project. This decision on when to proceed with an improved rail connection to Brisbane will rest with the Commonwealth and Queensland Governments and could be closely associated with decisions about the need or otherwise to upgrade the Bruce Highway to Brisbane to cater for inter-city travel.

However because the regional project has been proposed for some years, and recognising the important role it could play in the south east Queensland transport system, the Taskforce decided to review options for connections between the two projects. The objective was to optimise the combination of investments between regional rail and light rail that provides the best overall mix for the Sunshine Coast.

It should be noted the current North coast line has been upgraded only as far north as Beerburrum, meaning the single track and poorly aligned line from Beerburrum to Nambour can only provide a lower frequency rail service during the peak periods.

The regional rail options considered by the Taskforce included:

1. Option 1: Upgrade the present North Coast Line to Nambour and provide bus connections from the coastal precincts. There would be no connection with the Sunshine Coast light rail project stages as presently proposed. However it may be feasible to extend and connect the light rail from a suitable location in the coastal precinct to the upgraded North Coast Line; and
2. Option 2: Upgrade the North Coast Line only as far as Beerwah and construct the separate Maroochydore spur line. This would potentially connect with the Sunshine Coast light rail project at Maroochydore and Kawana Town Centre, provided both the regional and light rail projects could be afforded.

Several other combinations of regional rail and light rail options were also developed to take account of the high cost of constructing both the regional and light rail options. These combined options were:

3. Option 3: Use the regional rail corridor as a local service only, either for regional rail or light rail. This would mean there is no improved regional rail connection to Brisbane;
4. Option 4: Construct the regional rail spur line as far north as the new Caloundra South town centre, and connect light rail to that from Caloundra. This would provide a regional rail and a light rail connection to Caloundra South and avoids duplication of investment, though passengers travelling to Brisbane by rail may find it less convenient to travel to Caloundra South first. If identified early enough, opportunities may exist to incorporate at least one other station as part of the Caloundra South development;
5. Option 5: Construct a regional rail spur to Caloundra and connect the light rail to it there. This achieves both a regional and light rail system and avoids duplication of investment but relies upon a regional rail extension along the eastern boundary of the Caloundra South development with no station opportunities and through difficult terrain, requiring significant viaducts; and
6. Option 6: Construct the regional rail spur to Kawana town centre and hospital, and connect with the light rail there. This provides a good regional connection to a major destination on the Sunshine coast, as well as the light rail project. It means some duplication of investment by providing both links from Caloundra to Kawana.

11.3.2 Conclusions on regional and light rail connections

The Taskforce did not conclude on the best option, as decisions on such matters are beyond its terms of reference. However it did note that the options of either constructing the regional rail to Caloundra South, or constructing it to Caloundra, and connecting the balance of the corridor with light rail (options 4 and 5), appeared to provide a best fit combination of projects which delivered both local and regional transit options for Sunshine Coast residents and visitors. Further, the current estimates show the cost of these options would be comparable to constructing the whole Maroochydore regional rail spur line, yet would deliver potentially more local benefits. However even if a staging option such as option 4 or 5 is adopted, the corridor for the regional rail connection on to Maroochydore should also be preserved as a long term proposition.

12 Design and costs for the reference scheme

As identified in Chapter 10, Corridor No.1 connecting Maroochydore with Caloundra has been identified by the Taskforce as the priority corridor for rapid transit and the focus of pre-feasibility studies. This section identifies an indicative route and capital cost estimates for the reference scheme Light Rail Transit (LRT) at grade (option 3). Consideration is also given to constructability issues.

12.1 Light Rail Transit (LRT) at-grade – the reference scheme (Option 3)

- This technology type has been based on the Gold Coast Rapid Transit project currently under construction. It is a fully low floor, electric powered light rail system using an articulated light rail vehicle (LRV). According to Operator Franchisee, GoldLinQ, the vehicles being utilised for GCRT stage 1 are Bombardier *Flexity 2* trams, with the largest vehicles expected to be 40-45 metre long units with up to 9 modules (including 2 cab modules). They will operate on standard gauge (1435 mm) railroads and their maximum operating speed is 80 kilometres per hour. There would normally be two roads (or tracks) for safe and continuous operation in each direction. The GoldLinQ 45 metre trams would have 90 seats and standing room for 150 passengers or a total of 240 passengers per tram.
- LRVs for a Sunshine Coast option could be slightly smaller. Normally these types of vehicle are configured in a shorter style of 32.2metres to 40.6 metres. The length is usually constrained by the ability of the vehicle to safely pass through signalised intersections, and its ability to fit in with the traffic environment generally experienced in category “B” rights of way. The LRVs will operate on “all stops” city wide pattern with stations about 500 metres to one kilometre apart.

- The LRVs would be air conditioned. However it would be possible for some LRVs to include open air modules to allow passengers to experience the outdoors in good weather. The livery for colour scheme 1 of the vehicles would be chosen to represent the Sunshine Coast’s image.
- Electric power would be drawn from overhead wire at 750 volts DC.
- The vehicle would be manually controlled and obey road rules, and may utilise signals systems when running on dedicated trackage such as to and from depots. A fully laden LRV is likely to weigh around 60 tonnes. Depending on weather

conditions, braking distance from a top speed of 80 km/h is likely to be around 30 – 40 metres.

- The stations would be lower key than regional rail stations but still provide a high level of comfort for waiting passengers. They would have shelter, security systems and real time passenger information.
- Light rail in this format is easily the most versatile of modern rail technologies. Light Rail can operate at either tramway (line of sight) or railway (signalled) standard and is able to mix with all forms of traffic including pedestrians[7]. It is a classical form of urban mass transit that can run through, rather than around communities, and also operate with high efficiencies and higher running speeds when in a segregated ROW.
- Boarding arrangements for light rail are typically open stations with all door boarding. There is the ability to locate fare and *go card* vending machines either on vehicle or on the platforms. On vehicle conductors are rarely used and roving inspectors usually enforce revenue protection.

12.2 Preliminary route

The taskforce generally considers that those roads which access the most populated areas and have the greatest walkable catchment are most suitable for a rapid transit route. Accordingly, the preliminary route generally follows the major road network between Maroochydore and Caloundra. In a number of areas along this route there are a range of route options that can be considered. These areas include Maroochydore, Mooloolaba, the area in the vicinity of the future Kawana Town Centre and Caloundra. Detailed assessment of route options in these areas is proposed to be undertaken as part of further feasibility studies.

The preliminary route is considered as two separate stages identified as:

- Stage 1: Maroochydore to Kawana (Sunshine Coast University Hospital); and
- Stage 2: Kawana (Sunshine Coast University Hospital) to Caloundra.

12.2.1 Stage 1: Maroochydore to Kawana

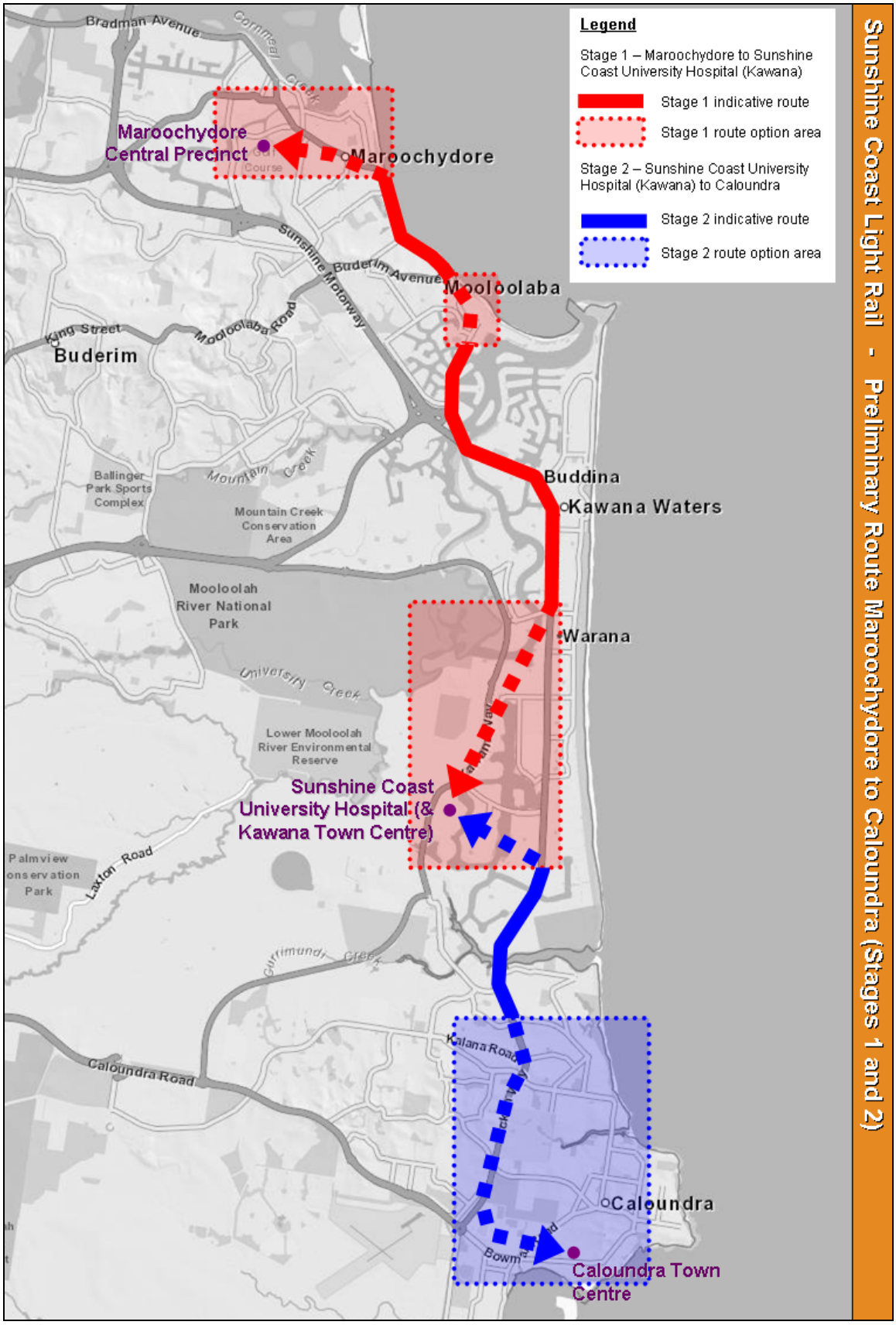
The preliminary Stage 1 route links the Maroochydore Principal Regional Activity Centre to the proposed Kawana Transport Interchange and the Sunshine Coast University Hospital, predominantly down the major coastal roads route of Alexandra Parade, Brisbane Road, and Nicklin Way. The route would link with the proposed Maroochydore Rail line at the Maroochydore and Kawana stations.

A range of route options can be considered for accessing Maroochydore and for locating a Maroochydore terminus. From Maroochydore the indicative route follows Alexandra Parade to Alexandra Headland and Mooloolaba.

At Mooloolaba route options could include a route that services the esplanade or another option that follows Venning Street and Walan Streets. The esplanade option could provide an opportunity for an iconic stop right on the waterfront, and could better serve the area's tourism and hospitality market. The Venning/Walan Street option could keep the service out of the beachfront precinct, which might be seen as advantageous by those concerned with full pedestrianisation of the area.

[7] When running a shared environment situation like a mall where pedestrians are regularly encountered, the LRV will be speed limited to 15 km/h to
reduce risks.

Figure 12.1: Preliminary Route – Maroochydore to Caloundra (Stages 1 and 2)



Artist's Impression: Mooloolaba route option - iconic stop on Mooloolaba Esplanade

Artist's impression: Mooloolaba route option - Walan Street

From Mooloolaba the route follows Brisbane Road south, crossing the Mooloolah River to follow Nicklin Way through Buddina. A large range of route options could then be considered for accessing the future Kawana Town Centre including its planned regional railway station and Sunshine Coast University Hospital.

12.2.2 Stage 2: Kawana to Caloundra.

The preliminary Stage 2 route links the Sunshine Coast University Hospital to the Caloundra town centre, predominantly along Nicklin Way. A number of options could be considered for accessing the Caloundra Town Centre. At Caloundra, proposed routes and stop locations would also need to consider possible route extensions with other key destinations such as Pelican Waters and the future development of Caloundra South.

12.2.3 Station locations

The location of stations will be an important consideration in the design of a light rail or other rapid transit system. Station locations will need to be based on proximity to major attractors, links to the surrounding walk-up catchment, and efficient average station spacing. Rail vehicles also require a flat grade at stations. There will be a need to balance the number of stops and potential of passengers to be picked up, versus the ability for the route to be quite quick to foster competition with private vehicles. It could be expected that stations would be spaced about one kilometre apart and closer in areas of greater density and activity.

12.2.4 Design criteria and assumptions for cost estimates

The primary design criteria and assumptions used for the cost estimates of an at grade LRT system are identified as:

- System is double track with central electrification; overhead wires with much of the existing overhead power system needing to be put underground;
- For areas where the rails cannot be provided with superelevation or "*cant"* due to being embedded in a roadway, route design will adopt a minimum 30 metre turn radius on the inside track. This is sufficient to minimise wheel squeal noise and rail wear and tear, provided the light rail vehicles do not exceed 15 kilometres per hour for short distances when negotiating tight curves;
- Minimum 15 metre tangents between horizontal curves;
- Route alignment is generally median running for LRT tracks;
- Stops are spaced about one kilometre apart and closer in areas of greater density and activity;
- Minimum platform length is 40 metres and 300 mm high with disability compliant pedestrian ramps at the ends of the platforms; and
- The CoastConnect bus priority lanes (if they had been constructed) would be removed and replaced with the LRT system.

12.2.5 Indicative service levels and vehicle numbers

The design vehicle for the Sunshine Coast is assumed to have a nominal length of 30 – 35 metres, with typical vehicles shown in the following table:

Table 12.1: Typical Light Rail vehicles

Supplier	Model	Length	Capacity	Recent Deployment
Alstom	Citadis 302	32.5 metres	200	Melbourne
Bombardier	Flexity Swift	33 metres	210	Melbourne

These are current generation vehicles, with low floor (30 – 40cm above rail level), articulated to facilitate taking sharp radius curves, typically powered from a 750 V DC overhead traction system, and with high acceleration and braking capability. The vehicles could be designed for local conditions, for example allowing some modules to be opened up in good weather to allow passengers an outdoor experience.

Initial service levels are expected to be based on the need to provide an attractive service frequency, rather than route capacity. Preliminary planning assumes a peak period service frequency (in both directions) of 10 services/hour (6 minute headway), with an off-peak service frequency of 4 services/hour (15 minute headway).

For the purposes of capital cost estimates and depot sizing, vehicle numbers have been assessed on estimated cycle times to deliver the peak period services, plus an allowance for spare vehicles. These are summarised as:

- Stage 1 Maroochydore – Sunshine Coast University Hospital: 17 vehicles (includes 2 spares); and
- Stage 2 Sunshine Coast University Hospital – Caloundra: Total fleet of 25 vehicles (including 2 spares).

12.2.6 Depot requirements

The first stage of light rail will require a depot site. A suitable depot location has not been finalised in these preliminary investigations and depot requirements will need to be considered further as part of feasibility studies. Depot requirements include:

- Maintenance facility for light rail vehicles;
- Secure stabling for vehicles when not in use;
- Administration offices;
- Control Centre, this could be integrated with bus control;
- Infrastructure/rail systems maintenance depot; and
- Amenities for staff and drivers.

Indicative depot requirement for a fleet of up to 30 vehicles is assessed as:

- Area required: approximately 1.2 hectares;
- Buildings: approximately 2,000 m^2; and
- Track work: approximately 1 kilometre (can be staged to suit fleet acquisition).

Ideally a depot should be located close to a terminus, and be configured to best align stabling tracks and their accesses. An elevated light rail option would require ramp access for accessing to and from the servicing depot. An allowance for site acquisition and an assumed 1 kilometre of single track access to the depot has been assumed in the preliminary cost estimates.

12.3 Capital cost estimates – Option 3 “At-grade” Light Rail

The basis of the capital cost estimates are the average unit costs expected for the current Gold Coast Rapid Transit (GCRT) project. This includes an assumption on public utility plant (PUP) relocations, civil costs and the construction cost premium for working in a brown-field environment with the need to maintain traffic flow around the works. Property acquisition is assessed as being lower for the proposed route than for the GCRT. A high level of contingency has been applied to account for the lack of detail in the estimation process.

It should be noted the Gold Coast project is being constructed under 24 hour traffic conditions, which adds very significantly to construction costs. This is driven by restricted working times, the need to provide traffic control, maintaining property access and also the need to lay temporary bituminised traffic routes. A similar situation can be

applied to the Sunshine Coast. Workplace health and safety standards in Australia are also very high. Caution needs to be exercised in comparing costs for projects in other places where a much more aggressive approach to traffic restriction may be feasible, where workplace health and safety standards are not as high, or where the light rail is constructed off-road.

Based on recent and relevant experience on the Gold Coast, the indicative capital costs (in 2012 $) are summarised as:

Stage 1: Maroochydore – Sunshine Coast University Hospital	$1,300 million
Stage 2: Sunshine Coast University Hospital – Caloundra	$710 million
Total for at-grade option Maroochydore to Caloundra	**$2,010 million**

The cost break-up is summarised in Table 12.2 below.

Table 12.2: At-grade route capital cost estimates

Item	Stage 1 $M	Stage 2 $M
Property Acquisition	90	55
Civil & related costs	410	260
Rail systems	220	140
Stations	60	30
Service Relocations	70	50
Rolling stock	140	55
Depot (including rail access & land)	90	-
Owners Cost + contingency	220	120
TOTALS (2012$)	**$1,300 M**	**$710 M**

12.4 Future stages

There are many possible staging options and route extensions, including Maroochydore to the Sunshine Coast Airport, Mooloolaba to Sippy Downs and Palmview, which includes the University of the Sunshine Coast or Caloundra to Caloundra South. This report does not focus on all the options and has not prioritised them. Because the Sunshine Coast is a major tourist destination, the possible extension from Maroochydore to the Sunshine Coast Airport was costed. For this stage the assumed service frequency is maintained at four services per hour each way resulting in the need for an extra four vehicles (including 1 spare). This stage has been costed for at-grade and elevated options.

A preliminary route to the Sunshine Coast Airport has not been identified at this stage. A range of route options is possible. The indicative capital costs (in 2012 $) are summarised as:

Future Stage: Maroochydore – Sunshine Coast Airport – At-grade	$720 million
Future Stage: Maroochydore – Sunshine Coast Airport – Elevated	$1,020 million

A detailed cost break-up is summarised in Table 12.3 below.

Table 12.3: Future Airport stage capital cost estimates

Item	At-grade – $M	Elevated - $M
Property Acquisition	55	45
Civil & related costs	300	630
Rail systems	135	165
Stations	30	130
Service Relocations	45	25
Rolling stock	35	30
Depot (including rail access & land)	-	-
Owners Cost + contingency	120	205
TOTALS (2012$)	**$720 M**	**$1,230M**

12.5 Constructability and construction impacts

The light rail network needs to be constructed in a “brownfields” environment, generally down the centre of a busy road, with limited roadway width, and limited opportunity to divert road traffic. In Australian conditions the need to maintain safe flow of high volumes of traffic adds very significantly to construction costs and complexity.

High impact construction activities include:

- Public Utility Plant relocations;
- Road (and bridge widening) to accommodate the light rail tracks, particularly in the station locations. Possible need to also strengthen bridges to incorporate track support;
- Construction of tracks (assumed to be predominantly concrete slab track);
- Construction of stations and pedestrian accesses;
- Erection of overhead electric traction system, and power supply to it;
- Depot construction and rail access to depot; and
- Modifications to road traffic control devices to maximise priority for light rail vehicles.

13 The other technology options

The Taskforce considered other public transport technology options to ensure a balanced appraisal and to take account of ongoing affordability concerns with providing infrastructure projects in Australia.

13.1 The base case

A base case is founded on the minimum that could be expected for the life of the project. TransLink has no currently available long term plans for the Sunshine Coast bus network and therefore the base case includes the following assumptions made within the light rail project:

- 3 per cent growth in annual bus service kilometres each year;
- Route buses covering the urban areas of the Sunshine Coast based on the similar route structure;
- Ongoing improvements to transfer locations and stops; and
- Buses are given priority through major areas of congestion.

For the purposes of the rapid economic appraisal, components of the costs of the base case were treated as 'avoided costs' (and therefore benefits) in the other options. Avoided costs include components of expected road costs, and parking that would no longer be needed should an improved public transport system be implemented.

13.2 Option 1 – CoastConnect

CoastConnect is the Queensland Government's current mass transit solution for the corridor from Caloundra to Maroochydore. It is an infrastructure only solution that seeks to provide appropriate priority for buses along the corridor. The focus is to provide either a kerbside bus lane or to utilise the flexibility of buses in mixed traffic. The proposed construction is concentrated along the Nicklin Way and the Mooloolah River. On many other parts of the corridor the buses would use the existing roads though they may have priority at traffic signals through "queue jump" lanes and "B" lamps. There would also be improved kerbside facilities and some actual bus stations. Other CoastConnect features include:

- Improved pedestrian and cycling facilities;
- Buses would operate either in general purpose or special purpose bus lanes, though there could be offline or "layby" stations to enable buses to pass a stopped bus; and
- Passengers would use standard boarding arrangements at open stations meaning there is the possibility of delays due to ticket purchases and driver enquiries.

Details of the project can be found at www.coastconnect.com.au

13.2.1 Bus vehicle types on CoastConnect

Buses using CoastConnect would be those commonly in use on the Sunshine Coast. The current TransLink contractor for scheduled services, Sunbus, operates standard 12.5 metre rigid urban buses, as well as some short wheel base 10.5 metre urban buses and a few midi buses. Because all new buses in Australia must be semi-low-floor and wheelchair accessible, and due to TransLink requirements for a rear door, seating capacity on a 12.5 metre rigid is limited to around 44 per bus, with approximately a further 30 standees allowed.

In future, higher capacity buses could be justified as demand grows. Available options include 14.5 m long rigid, and an 18.5 m articulated buses, seating about 50 and 60 passengers respectively, with room for about 40 more standees.

Currently most buses in Australia are diesel powered, and this technology is subject to increasingly lower emission allowances. The other commonly found technology is Compressed Natural Gas, found in Brisbane but requiring mains gas and purpose built fuelling facilities.

In other countries diesel-electric hybrid buses are in use, and there are several trials of battery powered buses being undertaken, although this is an experimental technology. A key limitation applying to both diesel-electric hybrids and electric buses is the weight of batteries which increases axle loads and reduces the passenger load available. Recharging of batteries for electric buses is also a major limitation for an in-service use which usually requires rapid turnarounds. Another experimental technology is hydrogen power which was trialled in Perth some 5 years ago. This is a very low emission technology. It is understood the technology requires further development and the cost and emissions generated in producing and transporting the hydrogen was prohibitive.

13.2.2 Key advantages of CoastConnect

- Lower cost as construction is limited and existing buses can be used;
- Providing priority through traffic congestion could improve existing bus reliability and running speed and encourage more people to use public transport;
- Because it relies on conventional buses that can also operate in mixed traffic, the project can be staged to give first priority to the most congested parts of the corridor, making the most of limited funding.

13.2.3 Key disadvantages of CoastConnect

- Lack of a clear identity or brand that passengers could associate with a trunk public transport system;
- Reduced visibility and absence of tracks or a busway that give tourists and other first time users confidence and security;
- Limited ability to carry high volumes of passengers in the future as the population grows;
- Because it is a kerbside solution, the bus lane inevitably doubles as a breakdown and stopping lane for general traffic, and there can also be conflicts with left turning vehicles, impeding buses in congestion; and
- Less ‘permanency’ with a route bus-based system which leads to less certainty and security for adjoining speculative investment. Conventional bus based systems typically do not have the same ‘spark affect’ generated by fixed rail in ground systems or a dedicated busway.

13.2.4 Costs of CoastConnect

The Queensland Government released costs in 2010 suggesting a full CoastConnect would cost $350 million which when escalated to 2012 dollars this is approximately $ 370 million.

13.3 Option 2 – Bus Rapid Transit (BRT)

Bus Rapid Transit (BRT) takes advantage of the visibility and priority afforded to light rail solutions, but retains some of the cost and staging benefits of rubber tyred vehicles. Unlike light rail, BRT has many guises. It is important to note that a BRT option would have its own right-of-way and include features to mimic light rail, such as dedicated stations and pre-paid boarding. Vehicles would be higher capacity buses and would utilise special livery to show they are not simply another route bus. Features of BRT include:

- A dedicated right of way, typically at-grade or category “B”, usually termed a “busway”. Most commonly the busway runs down the median of a road as with at-grade light rail;
- Discrete stations about one kilometre apart, and often a dedicated or specially marked fleet of vehicles to mimic the legibility of rail vehicles[8];
- The same features and power options for bus technology described above under CoastConnect would apply. Currently diesel is the only practicable technology on the Sunshine Coast;
- Where demand is high, longer buses, or buses with more standing room and more doors may be deployed to speed up boarding and improve passenger capacity;
- Some BRT solutions, particularly in South America utilise closed stations like railways so passengers must purchase or validate a ticket at a gate and segregate the driver so passengers cannot engage them. The developed nations have generally resorted to open stations, much like light rail to allow boarding at all doors.

[8] Though they contain many BRT features, Brisbane’s busways are not strictly speaking a BRT system because they do not provide a dedicated fleet of buses that are distinct from local route buses. Brisbane busways are also much more heavily engineered than most other BRT systems as they are often completely separate from other roads

13.3.1 Key advantages of bus rapid transit

- Development costs for a fully connected BRT system are comparable to light rail at-grade except for the need to provide power supply and a dedicated depot and control centre;
- The ability to stage development by relying on existing sections of road; and
- Flexibility to run the vehicles off the end of the busway to set passengers down closer to their destination.

13.3.2 Key disadvantages of bus rapid transit

- More flexible and bumpy nature of bus movements is less attractive to passengers than the more stable rail vehicle;
- An articulated bus is 18.5 metres long and can carry no more than about 100 passengers. Light rail vehicles are longer, 30 to 40 metres and can carry over 200 passengers;
- Longer bi-articulated 25 metre buses are deployed on some systems but their practical safe maximum speed is generally under 50 km/hour;
- More limited capacity than light rail because the extra time taken to unload buses and the shorter vehicle means more platform conflicts that tend to propagate through the network; in the Gold Coast case it was found even a system using all articulated buses at minimum feasible headways could not meet the forecast project demand estimates of about 100,000 passengers per day;
- The need for more buses and drivers results in higher long term operating costs than light rail;
- The need to provide strengthened pavements to cater for high numbers of fully laden buses which have a very high impact on standard road pavements. In the case of the Gold Coast Rapid Transit project this cost was very considerable;
- Although the vehicles are cheaper to purchase at about $450,000 for a rigid 12.5 metre bus and $650,000 for an 18.5 metre articulated bus compared to $3.5 M for a 35 metre light rail vehicle, larger bus numbers are needed which tends to erode the cost benefit; and
- Current limitation to diesel technology, which causes local emissions of air pollution, and is exposed to potential risks of oil depletion. Other power technologies may become feasible for the Sunshine Coast in coming years, although most are at least partially reliant on fossil fuels.

13.3.3 Cost estimates for BRT option

Stage 1: Maroochydore – Sunshine Coast University Hospital	$1,030M
Stage 2: Sunshine Coast University Hospital – Caloundra	$ 540M
Total for BRT option Maroochydore to Caloundra	**$1,570M**

13.4 Option 4 – Elevated Rail

In considering options for the Sunshine Coast, the Taskforce noted that elevated rail can be faster, but it is less accessible and has a more significant visual impact. The Taskforce decided to consider elevated options due the length of the route.

The proposed stages one and two of the Sunshine Coast Light Rail Project are around 23 kilometres long. The corridor from Maroochydore to Caloundra traverses more than

40 signalised intersections and number of un-signalised intersections and pedestrian only lights. The posted speed limit ranges from 50 to 100 km/h.

This length of running for an at-grade system as per the reference case, combined with the need to stop at stations and an 80 km/h maximum speed, would limit scheduled whole-of-journey speeds to an average about 30 km/h.

A fully segregated system elevated above the surrounding roads however could operate at high speeds of at least 100 km/h, though it would still need to stop for passengers. Over the length of the corridor, a scheduled speed of 45 km/h could be feasibly attained, reducing the travel time between Maroochydore and Caloundra from about 53 minutes for the at-grade Option 3 to about 31 minutes for the elevated options.

Both elevated and at-grade rail options are likely to be much faster than driving the same journey in the peak period and locating a car park, especially in the future when the road network will be under much more pressure than it is today and quicker than the CoastConnect option. Although it should be recognised the majority of passengers would not make the full 23 kilometre journey, the comparison does show the speed advantage of an elevated system.

The “elevated” rail option assumes a two track concrete viaduct along the same route as per the “at-grade” Option 3, with the same station locations. The elevated rail option has two sub-options:

Option 4 (a): Power could be taken from overhead wires if the option to also run at-grade in future locations was to be preserved. This would be low floor light rail type of vehicle as per the reference case; hence its operating speed would be less than 100 km/h. There are few examples of this type running. Seattle’s “Link” light rail is one well known example which includes long sections of elevated trackage, though it is actually a hybrid option at-grade running and also operating in a shared bus tunnel. (See Option 6 below).

Option 4 (b): Power from a third rail would be preferred if the system was always to be fully segregated from other users. This reduces flexibility for the future because the trains must always be fully segregated from potential interaction with people and animals. It would allow high floor vehicles to be used and could therefore be slightly cheaper and could run faster. This type of fully segregated system is sometimes termed *Light Rail Rapid Transit* because it meets the requirements

of having its own right-of-way. Well known examples include the Vancouver Sky Train and the Singapore MRT.

In both options 4 (a) and 4 (b) the elevated track would be 1435 mm gauge and would have a noticeable visual impact through a “skyprint” and could of course create shaded dead spaces which would need special treatment to avoid dust and mud problems. The elevated stations would also have a much larger and noticeable “skyprint”.

13.4.1 Key advantages of elevated rail option

- Elevation allows for higher speeds and as it is not affected by other users, reliability is also higher; and
- Automation is also possible which increases development costs by at least 5 per cent due to the need to provide signals and fail-safe technology, but reduces operating costs.

13.4.2 Key disadvantages of elevated rail option

- Greater expense due to elevated structures being required for the entire route;
- Need for trackage and stations with a clearance height of at least 6 metres above the surrounding community, the structures themselves are another 5-6 metres above that;
- Obvious amenity and privacy impacts; running at first floor level past office and apartment buildings is usually not favoured;
- Noise propagates more easily from elevated structures and noise impacts could be higher than an at-grade solution;
- More difficult to access the system, requiring stairs and elevators, and the possible need to move existing larger structures;
- Dead spaces created under the trackage, potentially requiring maintenance and security surveillance;
- Elevated trackage will transmit noise; and
- Construction impacts are similar to or greater than at-grade solutions, with access required to construct piers and erect deck system, and more substantial elevated station construction works, including requirement for lifts and stairs. Building over moving traffic is restricted due to safety requirements which can increase the costs.

13.4.3 Costs of elevated rail option

The indicative capital costs (in 2012 $) for Option 4 are summarised as:

Stage 1: Maroochydore – Sunshine Coast University Hospital	$2,280 M
Stage 2: Sunshine Coast University Hospital – Caloundra	$1,300 M
Total for Elevated Rail option Maroochydore to Caloundra	**$3,580 M**

The detailed cost break-up for Stages 1 and 2 is summarised in Table 13.1 below. The cost premium includes the elevated structure and the stations. If the system was fully automated (option 4 (b) only) the capital costs could be increased by at least 5 per cent to allow for fail-safe technology to be provided.

Table 13.1: Elevated Rail capital cost estimates

Item	Stage 1 $M	Stage 2 $M
Property Acquisition	70	50
Civil & related costs	1,020	650
Rail systems	260	170
Stations	290	160
Service Relocations	45	30
Rolling stock	100	30
Depot (incl. rail access & land)	115	-
Owners Cost + contingency	380	210
TOTALS (2012$)	**$2,280M**	**$1,300M**

13.5 Option 5 – Elevated Monorail

The Taskforce also sought advice on an elevated monorail option which some members felt could be provided more cheaply than a traditional flanged rail option. A monorail option would incorporate a light rail style of vehicle operating on a fully segregated right-of-way. Monorail vehicles typically operate small rubber tyres straddling a concrete guide beam about 600 to 1000 mm wide, and take their electric power from small steel rails attached to the concrete beam. Another type of monorail uses a vehicle suspended from a steel rail. Monorails are generally elevated because the power system is live at around 750-1500 v DC and must be protected from any possibility of human contact.

Monorail meets the requirements of ROW category “A” and is therefore similar in many respects to the fully segregated light rail in Option 4 (b). In both cases the entire track and station system must be elevated above the surrounding urban development and road system at a minimum clearance height of six metres. As with the option 4 (b) the monorail could be fully automated which increases development costs but reduces operating costs.

The best known operating monorails are in Wuppertal Germany, which is a suspended monorail, and straddling monorails in Kuala Lumpur and Moscow where they form part of the local public transport network. Some airports use them and a number of boutique systems also operate in tourist locations, including Sydney and Broadbeach in Australia, although the former system is scheduled to be decommissioned.

13.5.1 Key advantages of Monorail

- Advice provided by a monorail manufacturer to the Taskforce suggested a fully automated monorail option is being developed in Sao Paulo, Brazil over a total track length of 24 km. The forecast contract cost to supply the system is US $ 1.6 billion. It is scheduled to open in 2015 and will serve as an extension of metro line 2, linking two major urban centres. (It should be noted this cost is only for the system itself and does not include the land acquisition and government costs and some service relocation costs.); and
- Relying on one beam means the trackage 'skyprint' is narrower than a traditional 1435 mm rail system on concrete structure, which can reduce the cost, the visual impact and the shadowing effects.

13.5.2 Key disadvantages of Monorail

- Monorail technology is not as flexible as other options and suffers from a key disadvantage relative to steel rail systems because its technology straddles the beam. To switch from one track to another the entire concrete beam and associated power and communications cabling has to move. In an elevated situation this can effectively prevent networked operations and make stabling much more complex. For this reason monorail is usually limited to small systems with a straight line of running between two major points or in "one-way" loops, such as between airport terminals. The project team could not locate any monorail networks of several lines anywhere in the world;
- As with the elevated rail option 4 (b), the monorail vehicles can never mix with other users, even if they have drivers and therefore the flexibility for future operations is more limited;
- Although the 'skyprint' of the track is smaller, the stations still have a large profile and suffer from the same accessibility issues at conventional elevated rail stations;
- Cost estimates for a monorail option being developed in Australia are more likely to be similar to a fully elevated light rail option, due to our much higher labour and raw

materials rates and safety requirements, and the need to construct over traffic. Although the information on Sao Paulo is interesting, there simply do not appear to be any features of a monorail that would mean it is significantly cheaper than elevated rail to establish. While the structure would be slightly smaller, it would still have all the systems and vehicle requirements and construction difficulties;

- Not the least concern is the very distinct lack of monorail applications around the world, despite the technology having been developed in the early 20th century; and
- The noted world public transport expert Vuhan Vuchic in his 2007 edition of *Urban Transit Systems and Technology*[9] comments on the public appeal of monorail systems as opposed to their technical engineering limitations. He describes the technical reasons for the failure of the large Seattle scheme in 2005. He *noted "They* [monorails] *will continue to have a certain appeal and it is likely that monorails of different designs will be used for special applications such as certain APM* [automated people mover] *services (airports, amusement parks, shuttles in major activity centres) and tourist oriented cities."*

13.5.3 Monorail option costs

Allowing for a 25 per cent reduction in track building costs for monorail over elevated rail, but assuming most other costs are similar, monorail costs are estimated as:

Stage 1: Maroochydore – Sunshine Coast University Hospital	$2,025 M
Stage 2: Sunshine Coast University Hospital – Caloundra	$1,137 M
Total for Monorail option Maroochydore to Caloundra	**$3,162 M**

Automation would add a further 5 per cent.

13.6 Option 6 – Hybrid light rail with some elevated running

To capture the benefits of elevation and improve speed by avoiding at-grade intersections, yet reduce the costs and amenity impacts of a fully elevated system, a hybrid option combining elevated and at-grade sections was considered.

[9] Vuchic V. 2007. Urban Transit Systems and Technology. Pp471-472.

13.6.1 Key advantages of hybrid rail option

The hybrid option has the flexible advantage of at-grade light rail vehicles, enabling them to run off the elevated track to mix with traffic and even pedestrians, though the automated or third rail powered options for a fully grade-separated elevated option would not be available.

A key advantage of a hybrid system is the possibility to adopt a lower impact solution at- grade where urban amenity is an issue, while allowing for elevated structure for fast running where there is no urban development planned or in areas of lower visual amenity. The elevated sections suffer from the same concerns about height, accessibility and privacy, and cost of the elevated rail option 4 (a).

13.6.2 Key disadvantages of hybrid rail option

The elevated sections would suffer from the same visual impact and amenity issues as the elevated rail and monorail options. The sections that were elevated would also need overhead power lines, increasing the visual impact slightly as shown in Option 4 a.

13.6.3 Costs of hybrid rail option

Detailed design of sections needing elevation has not been completed at this early stage and costs have been approximated midway between a fully elevated light rail, Option 4 (b), and a fully at-grade light rail, Option 3.

The indicative capital costs for option 6 (in 2012 $) are summarised as:

Stage 1: Maroochydore – Sunshine Coast University Hospital	$1,790 M
Stage 2: Sunshine Coast University Hospital – Caloundra	$ 820 M
Total for Hybrid option Maroochydore to Caloundra	**$2,610 M**

14 Demand forecasts – understanding the need

"A large proportion of young people use public transport often because they have to. A modern light rail service on the Coast gives us a unique opportunity to keep them using it because they'll want to."

Mitchell Kesby, Light Rail Taskforce community representative

This chapter reports on the use of mathematical modelling to estimate the potential demand for a high quality rapid transit service, such as Light Rail, in the corridor between Maroochydore and Caloundra.

14.1 Transport modeling

The Council project team conducted preliminary transport modelling assessments using the *Sunshine Coast Travel Forecasting Model* (SCTFM) v3.0. This model predicts probable person trips and traffic demand on the road network based on predicted population and employment distribution at key milestone years. Modelling assessments were based on the latest network and demographics used for the Department of Transport and Main Roads Sunshine Coast Transport Project (SCTP).

The SCTFM is not a "multi-modal" model and is therefore not fully capable of predicting the competing demand between cars and public transport. It can however, predict the outcome of a range of possibilities by varying the combinations of trip generation (land use), mode split (proportion of motorised trips along particular corridors that are taken by public transport) and assignment (changes to the road network).

Targets for future public transport use imply a desired number of trips to be taken each working day in the region. If the Sunshine Coast is to achieve its future targets for public transport, the system must have the capacity to carry those trips. It needs to be scaled to meet the targets, or they will never be met.

By applying targets already adopted in key planning documents, the desired demand for public transport trips in the urbanised parts of the Sunshine Coast region can therefore be estimated. The model can also be used to translate forecast demand onto the ground in key movement corridors, including those that might be served by the rapid transit system.

14.2 Future public transport aspirations

A set of aspirational public transport targets has been assumed and applied to the Sunshine Coast road network. The overall target has been set by the Queensland Government's transport planning document *Connecting SEQ 2031* to reduce the private car trips from 86.3 per cent to 72 per cent, increase public transport trips from 3.6 per cent to 10 per cent, and walking and cycling trips from 10.1 per cent to 18 per cent by 2031. For public transport, this means an increase from about 40,000 trips per day now to 175,000 across the whole region in 2031.

Although the region's population would increase by 57 per cent, the need to considerably increase public transport market share from 3.6 per cent to 10 per cent of all trips means daily patronage would need to increase by over 300 per cent.

Table 14.1: Sunshine Coast mode share split 2006 and 2031

	Public Transport		Walking		Cycling		Car	
	2006 actual	2031 target	2006 actual	2031 target	2006 actual	2031 target	2006 actual	2031 target
All trips	3.6%	10%	8.4%	10%	1.7%	8%	86.3%	72%
Work trips	2.5%	15%						

Source: Connecting SEQ 2031 – An Integrated Regional Transport Plan for South East Queensland

14.3 Population growth post 2031

A major new rapid transit system will serve the region at least 100 years into the future. This means any demand estimates used in a business case must take the long view, rather than just a forecast of what demand might be carried on opening day. Two time horizons have been considered in the transport modelling, 2031 and 2051. Queensland's population growth is still expected to continue beyond 2031 but at a decreasing rate, falling from 1.9 per cent in the 10 years to 2021 to 1.2 per cent in the decade to 2056 (medium series growth). Even adopting the lower series growth beyond 2031, the Sunshine Coast population could grow from 504,000 (2031) to 602,900 by 2051. Included in this forecast is an increase of around 20,000 people expected from the final stages of Caloundra South. An ageing population will accompany the overall growth of the region and this could lead to an increase in off peak travel demand. As people approach 75 years of age, they can also begin to experience reduced driving ability which can increase their propensity to use public transport.

14.4 Model results

14.4.1 Car trips

The car vehicle trip statistics for the base cases and future scenarios indicate progressive growth over time as well as a reduction in total trips due to high public transport aspiration targets. The results of the achievement of the increased public transport target are shown in the table below. Under trend scenarios, the number of car trips taken each day on the region's road network will increase from 889,000 to 1,325,000 in 2031 and 1,561,000 in 2031. Achieving the aspirational public transport target would mean there are 1,249,000 in 2031 and 1,472,000 in 2051, a general reduction of 6 per cent in car usage.

Table 14.2: Motorised car vehicle trip statistics

	Business as Usual Motorised Car Vehicle Trips			Aspiration Motorised Car Vehicle Trips	
	2011	2031	2051	2031	2051
Total Trips	889,073	1,325,214	1,561,489	1,249,003	1,472,626
Intra-zonal Trips	31,113	42,757	50,643	42,733	50,619
Assigned Trips	857,960	1,282,457	1,510,846	1,206,270	1,422,008
Vehicle Kilometres Travelled (VKT)	12,204,970	19,298,290	26,430,884	18,782,034	25,830,284
Vehicle Hours Travelled (VHT)	177,786	279,182	575,496	268,143	556,862

14.4.2 People trips

The number of trips people take by all modes for future year scenarios was determined by applying aspirational targets to public transport patronage and summarised by origin/destination location subsets.

Table 14.3: Aspiration motorised person trips by location

	Driver / Passenger		PT Based		% PT Motorised	
	2031	2051	2031	2051	2031	2051
Sunshine Coast	1,563,350	1,740,175	142,625	165,275	8.36%	8.67%
South East SC	772,775	888,725	124,950	146,200	13.92%	14.13%
Corridor	224,550	265,250	42,375	55,725	15.88%	17.36%

The percentage mode share trips are calculated on the assumption that the *Connecting SEQ 2031* 18 per cent walk / cycle mode (active) share has been achieved.

Table 14.4: Aspiration mode share % by location

	Driver / Passenger		PT Based		Active	
	2031	2051	2031	2051	2031	2051
Sunshine Coast	75.14%	74.89%	6.86%	7.11%	18.00%	18.00%
South East SC	70.59%	70.41%	11.41%	11.59%	18.00%	18.00%
Corridor	68.99%	67.76%	13.01%	14.24%	18.00%	18.00%

14.4.3 Public transport trips

Public transport demand has been estimated for the coastal corridor between Maroochydore and Caloundra. Demand for public transport has been estimated on two bases; one showing only demands directly attributable to the corridor served by the rapid transit system, and the demand that would be added by judicious improvement of feeder bus routes. There are several public transport feeder links which, if designed and managed appropriately, would increase patronage along the coastal corridor. Strategically positioned park and ride stations would also improve feeder bus demands.

Table 14.5: Corridor and feeder route public transport person trips

	Business as Usual			Aspiration PT	
	2011	2031	2051	2031	2051
Corridor Only	2,025	3,150	3,675	42,375	55,725
Feeder Routes	525	1,200	2,000	20,525	24,925
Corridor Total	2,550	4,350	5,675	**62,900**	**80,650**

14.5 Summary of results

The modelling shows the very high potential of a new rapid transit system in the very busy coastal corridor between Caloundra and Maroochydore. By 2031 the assumed mode splits have resulted in an overall public transport mode share for the Sunshine Coast of 6.9 per cent, for the south east urban area of 11.4 per cent, and for the Maroochydore to Caloundra corridor of 13.0 per cent. **This results in potential demand of over 62,000 passenger trips on the rapid transit system per day in 2031.**

No clear land use planning presently covers the 2051 forecasting horizon. It was assumed a great proportion of the new growth beyond 2031 would be a transit oriented style of living, served either by the new rapid transit system of frequent and direct buses. Through integrated land use and transport planning, there is an opportunity to reduce reliance on the private car by focussing redevelopment at key nodes and around major attractors along public transport corridors. Considering this, a scenario has been produced for 2051 which includes full development of Caloundra South and increased densities along Nicklin Way. This scenario increased the population for the zones in question from 12,295 to 29,360, and the employment from 1,821 to 4,011 compared to the 2031 scenario.

This 2051 scenario resulted in a potential overall public transport mode share for the entire Sunshine Coast of 7.10 per cent, for the south east urban area of 11.6 per cent, and for the Maroochydore to Caloundra corridor of 14.2 per cent. **This forecasting scenario suggests that by 2051, over 80,000 passengers per day would utilise the rapid transit system**.

15 Assessment of environmental factors

"A light rail system will secure the future of the region by allowing the transport system to be powered by electricity, with the option of responding to climate change targets by using renewable energy technologies to supply the power."

Emeritus Professor Ian Lowe, University of the Sunshine Coast; President, Australian Conservation Foundation and Light Rail Taskforce member.

This chapter provides a preliminary review of environmental factors and impacts. Further comprehensive assessment would form part of the more detailed next stage feasibility studies.

The key environmental issues considered at this stage include:

- Air quality;
- Energy and greenhouse;
- Noise and vibration;
- Visual amenity;
- Ecology; and
- Flooding and stormwater management.

15.1 Air quality

Car exhausts represent a large portion of contaminants in the South East Queensland atmosphere, and also contribute about 20 per cent of greenhouse gases including carbon dioxide. Although all vehicles are subject to improving emission standards, growth of motor vehicle travel will continue to impact on air quality. Any action which increases public transport use and reduces the proportion of trips made by private cars will have a positive effect on local and regional air quality.

On the Sunshine Coast, continued dominance of private vehicle ownership and use can be expected to continue to impact on air quality. Since it carries the greatest quantity of vehicles on the Sunshine Coast, the road network between Maroochydore and Caloundra is recognised as a major source of air pollution. Long term residences, child care facilities, schools, recreational facilities and medical facilities along this corridor are some of the most sensitive receivers.

15.1.1 Construction air quality (all technology options)

Each of the rapid transit technology options considered in this pre-feasibility report has the potential to generate dust during the construction phase. Construction vehicles and plant and equipment would also likely generate some localised emissions. The extent of construction works would vary considerably between each technology option, with construction works likely to be greatest for the Bus Rapid Transit and Light Rail Transit at-grade options as these would require the creation of a new corridor and large scale changes to the general traffic arrangements. Despite the differences, further detailed assessments would be able to quantify potential air quality impacts during construction and identify appropriate mitigation measures.

15.1.2 Operational air quality – base case

A base case scenario based on minimal intervention to increase public transport mode share would be expected to result in a continuing increase with projected population growth of fossil fuel usage, vehicle emission rates and resulting pollutant levels. Although technology improvements will see lower emissions per vehicle, the trend scenario will see motor vehicle trips will still grow by nearly 500,000 each day by 2031. This is an increase of 50 per cent on today's level. This could mean an increase in air pollution and carbon emissions from cars of at least 30-40 per cent over the next 20 years.

15.1.3 Operational air quality – bus options (CoastConnect and Bus Rapid Transit)

Bus operations based on low emission diesels produce localised emissions at much higher rates then cars. Of course they also carry more people, so emissions of pollutants and greenhouse gases would reduce overall if the use of bus based public transport increases. When compared to the base case scenario of higher private motor vehicle use, the emission rates of buses can be expected to improve air quality. Key factors influencing the emissions from buses include fuel type, combustion efficiency, the extent of bus movement priority over general traffic, and the patronage levels or equivalent number of private motor vehicle trips avoided.

The CoastConnect project has identified that emission rates and associated pollutant levels would be generally expected to reduce slightly or remain the same if the project were not to be implemented. Pollutant levels resulting from buses are also expected to improve over time as fuel composition and combustion technologies improve. There may also be benefits of a central running bus system over a kerbside bus lane as this option would generally increase the distance between the emission source and land uses directly adjoining the corridor.

15.1.4 Operational air quality – Light Rail Transit and Monorail Options

Light rail vehicles do not produce any localised emissions as they are electric powered. Light rail vehicles only emit very small quantities of brake dust at locations where they are required to slow or stop. There would be no or very minimal difference in air quality outcomes between at-grade and elevated LRT options.

The generation of electric power from power stations at a location remote from the light rail operations will result in emission of both air pollutants and greenhouse gases. Queensland's power stations rely on either black coal or natural gas for fuel. However the actual increase in emissions from the power stations attributable to a light rail or monorail system would be very small relative to the total amount of emissions created in generating the daily electricity needs of the region.

The introduction of a dedicated at-grade light rail corridor could have short term effects on vehicle traffic congestion at specific locations, and this would need to be accounted for in the design of the project to minimise any congestion affects for general motor traffic. Further assessments will need to consider how such induced congestion may impact on overall emission levels and sensitive receivers.

As the introduction of light rail would contribute to significantly less vehicle trips, a net positive benefit on roadside air quality can certainly be expected. This benefit is expected to be greater than for bus options. It is the extent of the mode shift away from private motor vehicle use that requires further assessment to determine overall emission reductions and resulting local air quality. This assessment would need to consider various mode share scenarios. Studies of the Gold Coast Rapid Transit

(GCRT) project have found that implementing light rail would decrease all pollution types of total emissions.

15.1.5 Further air quality studies

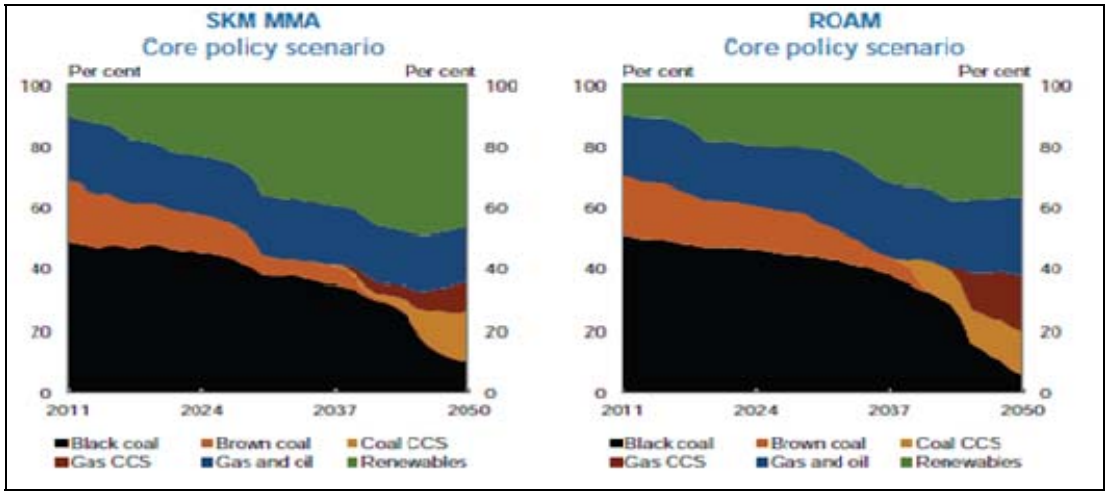
Air quality along the corridor is likely to change over time due to evolving fuel and engine technologies, and the types of fuel used. Such changes may also contribute to reduced pollutant levels. Due to the potential for on-going changes in both air quality and sensitive receptors along the route, further investigations will be required. The assessments would draw upon the guidelines and direction given by Queensland Transport (includes Main Roads & Rail) and the Queensland Department of Environment & Resource Management under the *Environmental Protection Act 1994* and *Environmental Protection Policies 2008 for air quality.*

15.2 Energy and greenhouse

The proposed technology options differ in their greenhouse gas emissions because they use a range of propulsion systems and fuels. The existing bus systems in Australia use internal combustion engines fuelled by diesel or natural gas, although there have been trials of alternative propulsion systems in Melbourne (hybrid diesel-electric), Adelaide (fully electric) and Perth (hydrogen/fuel cell). Light rail systems use electric motors which receive electricity via overhead catenaries (although some overseas systems use ground level power supplies).

Electricity is generated from a large range of energy sources in Australia (including black coal, brown coal, natural gas, and the renewables - hydro, wind and solar) and all feed into a national electricity grid. With the passing of the Clean Energy Future legislation it is expected that gas and renewable energy power stations would provide an increasing share of the energy mix out to 2050 as shown in Figure 15.1. Over time this will impact on the emissions generated from any transport system that uses electricity for propulsion, such as light rail. Further, the rate of change in the electrical energy mix in the scenarios provided by the Australian Government Treasury are claimed by Beyond Zero Emissions (2010) and Elliston, Diesendorf and MacGill (2011) to be conservative. They assert that a much more rapid change in electrical energy mix towards renewable energy sources is possible within this decade 2010-2020. This alternative scenario would substantially reduce the estimated emissions for a light rail project on the Sunshine Coast.

Figure 15.1: Two scenarios of electricity generation mix in Australia 2011-2050



Source: Australian Government Treasury, 2011, Strong Growth, Low Pollution: Modelling a carbon price, (online) Available at http://archive.treasury.gov.au/carbonpricemodelling/content/report.asp

15.2.1 Construction (all options)

Energy consumption during construction is likely to be based on the amount of concrete needed to implement the system and whether additional road way or electrical supply infrastructure would be required. A cursory estimation would suggest that:

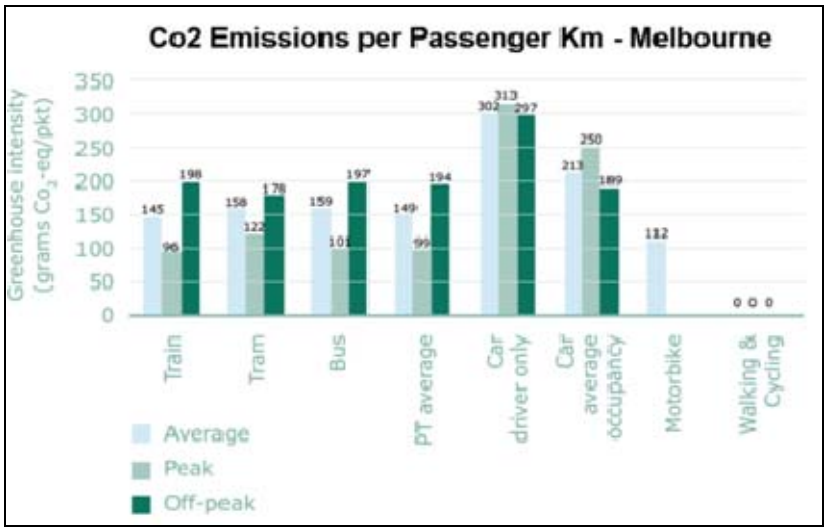
- LRT elevated and monorail would consume most energy in construction;
- Bus kerbside would consume the least energy in construction; and
- LRT and BRT at-grade would fall somewhere in between.

15.2.2 Operation (all options)

According to Currie (2009) a comparison of a range of transit options in Melbourne indicated that the carbon dioxide emissions from heavy rail, light rail trams and buses did not vary that much (see figure 15.2). However, as Victoria's electricity generation mix is currently highly dependent on brown coal this is likely to have inflated the emissions from their electric powered trams and trains. As the electricity generation mix in Victoria transitions away from the use of brown coal over the next decade it will reduce the emission intensity of the trams and trains in particular. In addition, trams and buses in Melbourne are not fully segregated from traffic and therefore any benefits that might accrue from full segregation are not shown.

The Gold Coast Rapid Transit Project considered the carbon emissions of Light Rail Transit compared to Bus Rapid Transit. The findings suggest that a light rail system would release 25 per cent more carbon dioxide into the atmosphere than a bus rapid system primarily because the carbon intensity of the electricity generation mix was high.

Figure 15.2: A comparison of CO_2 emissions from transport options in Melbourne



Available:http://www.infrastructureaustralia.gov.au/publications/
Source: Currie, G. 2009 Research perspectives on the merits of Light Rail vs. Bus, presentation given at the BITRE Colloquium, Canberra, 18–19 June 2009 (online)

Another growing risk to consider in addition to the impacts of energy use on the environment is energy security and oil scarcity. Transportation systems, such as cars and diesel powered buses that are dependent on oil are exposed and vulnerable to both diminishing and interrupted supply. The International Energy Agency indicated in its World Energy Outlook 2010 that conventional oil production peaked in 2006. The US Military's Joint Operations Environment report in 2010 indicated that "by 2012 surplus [global] oil production capacity could entirely disappear, and as early as 2015, the shortfall in output could reach nearly 10 million barrels per day".

The International Monetary Fund in its 2011 World Economic Outlook report recognises the growing oil scarcity issue and modelled potential impacts of growing scarcity into the future indicating that oil prices could rise by 100 per cent up to 800 per cent over the next 20 years depending on the severity of the scarcity experienced.

It certainly appears likely that any transport mode relying on fossil fuels, including the base case and bus-based options 1 and 2 of this pre-feasibility assessment, expose the region's public transport system to ongoing risks of shortages in supply or significant cost increases in the supply of fossil fuel over the life of the project. On the other hand, Queensland has vast resources of coal and gas, and its electricity future appears to be secure.

15.2.3 Further energy and greenhouse studies

Further studies will be required to assess the likely energy and greenhouse implications of the technology options. Considering the recognition of the risks of peak oil, rising prices and interrupted supply, it would also seem prudent to complete an oil vulnerability assessment to examine the exposure of each option.

15.3 Noise and vibration

Land uses sensitive to noise and vibration in the Maroochydore to Caloundra corridor include residences, schools, health facilities, community facilities and recreational areas. Industrial and commercial properties are not considered as sensitive.

Existing background noise in the primary corridor is variable and is influenced by proximity to roads. In some cases existing background noise levels can mask construction and operational noise. Noise and vibration levels will vary along the length of the corridor and at different distances from the corridor. Impacts are likely to be considerably different between each of the technology options of bus and light rail.

15.3.1 Construction noise and vibration (all technology options)

The extent of construction noise and vibration impact would depend on the sequence of construction, plant and equipment utilised and the distance from activities. Impacts are likely to be greatest for sensitive activities, such as hospitals or homes located close to the road corridor. However, in some areas buildings and structures located closest to the road corridor may provide a level of acoustic buffering. Significant construction noise impacts are expected to be intermittent and relatively short term. The areas of highest impact would most likely be around the bus / light rail stop sites and major intersections.

Construction noise and vibration is expected to vary between each of the technology options. The CoastConnect project, proposing bus services in kerbside bus lanes, may have potentially greater impact on sensitive land uses adjacent to the road corridor.

Central running BRT and LRT options, while being constructed furthest from adjoining land uses, would also result in considerable verge side construction activities at a number of locations due to the need to widen the carriageway, particularly around intersections.

An elevated LRT or monorail option would require the construction of two track viaduct above the roadway. With construction activities being located at ground level and also at elevated heights, there is limited opportunity for adjacent buildings and structures to

provide barrier effects and therefore possibility of noise emissions having a greater impact.

Noise control measures are likely to be required for all technology options where sensitive land uses are close to construction sites. Management strategies would likely include a combination of administrative and physical mitigation controls.

15.3.2 Operational noise and vibration – bus options (CoastConnect and Bus Rapid Transit)

Operational noise and vibration may be influenced by factors including: distance from emission source; vehicle type; surface type and geology; locations of vehicle acceleration and braking; and free flow ability of vehicles at intersections.

In the case of the high traffic volumes from Maroochydore to Caloundra, operational noise and vibration from either bus service will merge with general free flow traffic noise and vibration to an extent that the services will not cause a perceptible increase in the existing corridor noise and vibration levels. Conversely, while the introduction of either bus option is likely to result in a reduction of the projected growth of general traffic volumes in the long-term, this reduction may not be sufficient to achieve a perceptible noise and vibration decrease from the pre-existing levels for the free flow traffic case.

A perceptible noise (and in some specific cases vibration) increase can occur in the CoastConnect kerbside bus lane option where the frequent bus services and the associated stop, start or slowing of traffic flow at intersections, grade inclines and bus stops are in sufficiently close proximity to a sensitive premises. This increase would be attributable to a heavy bus in combination with the shorter distance to sensitive premises (e.g. the living room of a dwelling) due to the kerbside bus lane option. Subsequently, it is possible that this option may require specific noise attenuation and possibly vibration limiting measures where problematic localities are identified from environmental assessment.

When compared with the CoastConnect kerbside bus lane option, a central running dedicated BRT option with centrally aligned bus stops is potentially a less problematic option environmentally as a greater separation distance from sensitive receivers can minimise the operational noise and vibration impacts that arise from the heavy vehicle bus movements.

15.3.3 Operational noise and vibration – Light Rail options (at-grade and elevated)

Light rail vehicles will generate noise due to the motor operations, breaking and the friction of steel wheels on rails. The key parameters influencing the level of noise are light rail vehicle speed, rolling stock design including space between wheels on bogeys, track features including curve radius, elevated bridges and receiver distance. Other sources of noise may include warning horns or bells. These would be subject to assessment during the design phase to ensure compliance with recognised criteria.

The most significant concern is the potential for wheel squeal caused by the friction of flanged wheels on the rails on very tight curves. This can be avoided by ensuring a minimum desirable radius of at least 30 metres is used and the speed of the vehicles is limited when negotiating these tight curves. With the opportunity to design the light rail route in advance, higher radii of at least 50 metres can be utilised.

Factors that may result in ground-borne vibration from rail can generally be categorised as:

1. Vibration from the source: vehicle suspension, wheel condition, track surface and speed;
2. The vibration path: surface type, geology and separation from receiver; and
3. Vibration at the receiver: foundation type and vibration absorption.

As with the central running dedicated BRT option, a central running LRT option is potentially well located to minimise vibration impacts on sensitive areas because of the increased distance. In areas where services are likely to operate at higher speeds (i.e. 70 kilometres per hour) and result in higher vibration levels, the separation distance between central running LRT alignments and vibration receivers is greatest and therefore likely to minimise the potential for vibration impacts.

Gold Coast Rapid Transit project studies indicated that the introduction of BRT or LRT options would have a negligible impact on existing traffic noise levels at sensitive receptors. They also identified that the greatest potential to exceed desired levels was at adjacent medical uses. This highlights the need for assessment of the potentially sensitive Caloundra public and private hospitals and the future Sunshine Coast University Hospital. Light rail trackage is normally laid with an amount of vibration and noise dampening through rubber underlays. In the case of some sections of Sydney Light Rail, additional noise and vibration dampening was developed for extremely sensitive locations.

15.3.4 Operational noise and vibration – Monorail option (elevated)

Monorail technology generates noise from the motor, and the friction of the rubber tyres and guide wheels on the concrete track. Depending on the operating speed, the mode is quieter than steel rail modes, although because it elevated, noise will affect a larger area due to reduced attenuation. Of course if the monorail passes close to any first floor windows, the distance would be insufficient to attenuate the noise to acceptable levels. As with any mode, maintenance and age can play a factor. The Seattle monorail, constructed in 1962 for the World's Fair, is notoriously noisy.

15.3.5 Further noise and vibration studies

Noise and vibration impacts are likely from the construction and operation of each of the technology options. Any potentially significant noise and vibration impacts will require assessment to identify measures to mitigate adverse effects. Technology options will need to be considered individually and in conjunction with projected traffic noise levels, taking into account projected traffic volumes for each option.

Site specific noise and vibration mitigation strategies are likely to be required. Where construction activities are likely to impact on sensitive receivers such as residential or medical facilities, building-specific sensitivity investigations may be required. Further operational noise and vibration studies and assessment would need to include:

- Defining the existing noise environment;
- Confirming applicable noise and vibration criteria;
- Prediction of likely noise and vibration levels;
- An outline of mitigation strategies for further consideration during design development;
- Ambient noise monitoring; and
- Assessment of the key design parameters to mitigate predicted unacceptable air borne noise levels.

The assessments would be guided by the Queensland Transport (includes Main Roads & Rail) and the Queensland Department of Environment & Resource Management under the *Environmental Protection Act 1994* and *Environmental Protection Policies 2008 for noise and air quality.* Guidelines are provided for noise and vibration limits during construction and the operation of the chosen option.

15.4 Visual amenity

It is important to consider the impact on visual amenity when assessing options and designing the route and associated infrastructure, particularly the stops or stations. Residential dwellings neighbouring the corridor are most sensitive. Industrial and commercial properties are not considered to be as sensitive however in some cases may still be affected. There is also the overall impact on the “look and feel” of the places, which may be experienced by residents and visitors alike.

Some sections of the proposed route presently have a low level of visual amenity such as residences fronting onto Nicklin Way. For such areas, new public transport infrastructure and services may provide an opportunity to improve visual amenity through the redesign, revitalisation and development of large sections of the corridor including landscape and streetscape improvement works. Conversely, some sections of the proposed route currently have high levels of visual amenity. These include the iconic beachside precincts of Mooloolaba, Alexandra Headland and potentially Cotton Tree. In these areas the potential for visual impacts will need to be carefully considered in planning with a particular focus on the stop localities.

Visual amenity impacts will vary considerably between the different technology options. The introduction of a Light Rail Transit system would require the installation of an overhead power supply system. While this system of catenary supports and wiring may be considered to have a visual impact, the implementation of a light rail system will normally result in the diversion of existing power lines underground in some locations. There would also be the opportunity to integrate present street lighting with new lighting with overhead structures to minimise visual clutter. The careful positioning of new street trees could also mitigate visual impacts of catenary structures.

The major difference in visual appearance occurs between the options of at-grade or elevated services. Elevated options would require the construction of large concrete structures at the considerable height of at least 6 metres above existing roads. Structures would include a minimum 1.5 metre wide piling likely at approximately every 30 metres, and an elevated track approximately 8 metres wide. Monorail track is narrower, typically 600 mm to 1 metre, though with two tracks there would be a skyprint of at least 5 metres.

The requirement to elevate stations would also necessitate large structures overarching all or parts of the road at station locations. The scale of these structures can completely dominate a visual landscape, particularly in areas with a low to medium rise urban form. Aside from the visual appearance of elevated structures, there is potential for such infrastructure to result in a range of location-specific amenity and microclimatic impacts notably shading of sun which can result in barren areas of dirt.

Depending on the current state of the physical environment and point of view of the observer, the visual impact of elevated structures in attractive urban areas can be of such significance as to rule these options out. Since light rail and bus options at-grade are transport modes and are normally surrounded by other modes, their visual impact is noticeably lower.

15.4.1 Further visual amenity studies

The potential for visual and amenity impacts will require further consideration, especially for any sections of elevated running. Visual impacts would be assessed fully, and measures adopted to mitigate adverse effects. Further studies will need to include and identify:

- Construction and operational visual impacts at each stop locality;
- Urban design initiatives to minimise the visual impacts at each stop locality;
- Landscape design initiatives to minimise visual impacts at each stop;
- Design of access routes to stops to be clearly identifiable, while minimising visual impacts to sensitive visual receptors; and
- Visual impacts attributable to associated light rail infrastructure, other than stops.

15.5 Ecology

The ecological review study area is the land immediately adjacent to or within close proximity to the preliminary route. It is generally contained within the existing road network between Maroochydore and Caloundra, located within the most urbanised area of the Sunshine Coast. Analysis in Chapter 10 (Corridor selection) identified that approximately 91.6 per cent of land within Corridor 1 is located within the South East Queensland Regional Plan urban footprint. This area has been subject to ecological pressures associated with urbanisation over an extended period of time. Most original vegetation has been cleared for urban land uses and infrastructure.

Some ecological value remains, however these areas are highly fragmented having suffered impacts of the surrounding urban growth. Despite the area's highly urbanised character it is important to identify potential ecological impacts. Based on the preliminary route, ecological impacts are not expected to differ greatly between the technology options.

15.5.1 Potential issues

A desktop assessment of potential ecological impacts has identified that:

- The likelihood of impacts on matters of National Environmental Significance (NES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) is very low and therefore a referral to the Commonwealth Government under this act is unlikely to be required;
- It is not expected that the project would have any adverse impacts on any identified 'Important Wetlands of Australia';
- A number of threatened flora and fauna species listed under the Nature Conservation Regulation 2006 have previously been recorded within the study area;
- A number of Regional Ecosystems (REs) are located close to the project area;
- Mapped regional ecosystems close to the study area may function as 'essential habitat' for a number of flora and fauna species (including endangered Regional Ecosystem 12.3.1);
- The study area does not contain any identified koala habitat or protection areas;
- Some locally significant wetlands occur at Birtinya on the western side of Kawana Way and in Ben Bennett Park;

- A number of tidal waterway crossings in the study area contain aquatic and marine ecological values; and
- It is also likely there is high value regrowth within the proposed study area.

There is potential for some ecological impact around locations where bridge widening or replacement may be required. These construction activities could require the removal of small areas of vegetation at waterway crossings.

15.5.2 Further ecological studies

This preliminary desktop review of potential ecological impacts suggests ecological considerations will not require exhaustive investigation in future phases of project planning. More detailed ecological assessment may be required to protect ecological values through appropriate management and protection during construction and operation.

15.6 Flooding and stormwater management

The preliminary route between Maroochydore and Caloundra is located close to the coastline and traverses areas of low lying land subject to flooding, coastal hazards and drainage deficiency. During extreme weather events these hazards impact on the existing transport network and adjoining land uses.

Due to the amount of existing investment in these areas, substantial efforts are likely to be required over time to mitigate the impacts of extreme weather events and adapt to changes in the coastal zone. It is acknowledged that, as with many road corridors and transport modes, there will be times when the occurrence of an extreme weather event may require a temporary closure of public transport services. However, the implementation of a large scale public transport project provides the opportunity to ensure the greatest possible mitigation of potential impacts and in some cases the improvement of existing conditions i.e. through the retrofitting of improved drainage infrastructure.

The following section outlines the key issues in relation to flooding, coastal hazards and stormwater management. It identifies matters that will require further investigations as part of feasibility studies.

15.6.1 Flood risk management

The preliminary route crosses catchments of the Maroochy River, Mooloolah River, Currimundi Creek and some beachside areas that discharge directly to the ocean. The occurrence of flooding in the corridor can generally be considered as either:

- Catchment or river flooding; or
- Stormwater network flooding.

Catchment or river flooding occurs when rainfall over a catchment results in runoff volumes that exceed the capacity of the waterways. This flooding typically occurs as a result of larger regional weather events and can result in flooding for longer periods of time. Stormwater network flooding occurs when stormwater runoff volumes are greater than the capacity of the stormwater network of an area. This flooding typically occurs as a result of short duration, localised weather events that produce high intensity rainfall. This flooding can occur separately from larger freshwater or storm tide flooding events.

Further detailed investigations are required to assess the extent of possible stormwater network flooding along of the proposed route. Further studies are also required to

determine the desired standard of service of future public transport services with regard to the level of flood immunity. Given the brownfield location of the proposed route, this will be influenced largely by characteristics of the existing urban environment.

Flooding of the proposed corridor by either type of flood event will have varying implications for each of the public transport options being considered. Options operating at-grade are likely to be the most vulnerable to flooding and storm tide impacts associated with major storm events, while the elevated options may avoid such impacts.

The level of flood immunity would most likely be least for the kerbside bus lane (CoastConnect) option as the kerbside lane would in most areas be the first lane to become inundated during an extreme weather event. This situation would result in reduced operational efficiency of the service as vehicles would need to use general traffic lanes where possible.

For median running Bus Rapid Transit and Light Rail Transit options, a slightly higher level of flood immunity would be likely due to the corridor profile, with vertical alignment of these options being located higher than general traffic lanes. However, pedestrian access to median running services may be compromised during events where kerbside areas become inundated. Where an extreme weather event results in the inundation of part of the route, this would most likely require a temporary period of closure of services. Such closures are not uncommon for public transport systems in a sub-tropical climate.

For the elevated options, whilst services may be able to continue to operate during an extreme weather event, the use of services could be restricted by reduced pedestrian accessibility to station entry/exit points. Major weather events may also result in power outages which would halt the service irrespective of flood impacts.

While consideration will need to be given to the impacts of flooding on the operation of public transport services, the implementation of any option would need to maintain non-worsening of flood impacts on upstream and downstream properties. This would likely be the maintenance of immunity to a 1 per cent Annual Exceedance Probability (AEP) flood.

15.6.2 Stormwater management (construction)

Due to the scale of construction, the potential for water quality impacts is an important factor to be carefully considered. The main potential impact could come from soil and sediment disturbance or removal during earthworks adjacent to water course crossings. Disturbance of soil and sediment is likely through activities such as bridge pile construction, removal of vegetation and earthworks. Transporting and depositing soil and sediment could have potential impact both on and off-site. There is also the potential for disturbing contaminants (chemical or toxic) during construction or earthworks. Another potential source of water contamination during construction is from chemical or fuel spills draining directly to waterways or through runoff during high rainfall.

Acid Sulphate Soils (ASS) found throughout areas of the proposed corridor could also be disturbed during construction. Further investigations will need to identify and quantify the extent of ASS and the level of mitigation required.

Comprehensive construction management and erosion and sediment control plans will be needed to manage and protect water quality regardless of the technology option selected.

15.6.3 Stormwater management (operation)

The implementation of a major public transport project has a range of potential impacts and benefits on stormwater drainage and water quality within the vicinity of the proposed corridor. The implementation of any technology option would result in large scale changes and retrofitting of existing road infrastructure and drainage systems, particularly for the BRT and LRT at-grade options. This could provide the opportunity to rectify drainage issues and increase the overall flood immunity of the areas.
For all technology options, the extent of works would require widening of existing carriageways at various sections of the corridor. This has the potential to result in increased areas of impervious surfaces. Potential impacts may include:

- Increases in peak run-off rates;
- Reduction in existing drainage capacities;
- Increases in surface water run-off containing gross pollutants, suspended solids, nutrients, heavy metals and hydrocarbons; and
- Conflict between alignment of underground services and drainage infrastructure.

While there may be a range of potential impacts, delivering a major public transport corridor is an opportunity to improve existing drainage infrastructure and achieve benefits across the length of the corridor including:

- Improved drainage capacities that may reduce impacts on the road network during rainfall events; and
- Large scale implementation of Water Sensitive Urban Design (WSUD) measures to improve the water quality of surface runoff.

The potential and scale of impacts and benefits will require detailed consideration as part of further studies and design of the relevant technology option.

15.6.4 Climate change vulnerability and coastal hazard management

Predicted rising global sea levels and changes in the frequency and intensity of major rainfall events could result in:

- Higher flooding and storm tide levels;
- Reduced capacity of stormwater drainage systems and resulting impacts on stormwater network flood levels;
- Impacts on the treatment of stormwater quality;
- Impacts on the structural integrity of pavement and other infrastructure;
- Potential impacts of salt water intrusion on infrastructure or construction materials; and
- More frequent road closures and reduced flood immunity for public transport.

The Queensland Government has produced the Queensland Coastal Plan. The plan identifies areas of the Queensland coast that are subject to coastal hazards including:

- Erosion risk due to storm impact and long term trends of sediment loss and channel migration;
- Permanent inundation of land due to sea level rise; and
- Storm tide inundation.

The identification of these coastal hazards is based on the impact of climate change to 2100 including a sea level rise of 0.8 metres from levels in the year 2000. This is a relatively conservative estimate that is currently used as a basis for coastal planning in Queensland. The actual changes could be higher or lower. Moreover, the life of the project, and the new buildings pIanned in its vicinity, may extend well beyond 2100.

The potential occurrence and extent of these hazards will require detailed assessment as part of further feasibility studies to determine the most appropriate mitigation strategies.

The implementation of a major public transport project has a range of potential benefits for coastal hazard reduction. The implementation of any technology option would result in large scale changes and retrofitting of existing road infrastructure and drainage systems, particularly for the BRT and LRT at-grade options. This could provide the opportunity to reduce exposure of the local area to coastal hazards.

15.6.5 Further coastal hazard, flooding and stormwater management studies

Further investigations will be required to manage the potential impact and extent of flooding and climate change on the proposed alignment and the design and operation of the relevant technology option. Further studies need to take account of:

- Combined impact of flooding and storm surge under climate change scenarios;
- Stormwater capacities of known drainage deficiency areas;
- Inform route alignment options and design parameters;
- Potential long term erosion risk and extent of inundation due to sea level rise; and
- Meeting a suitable level of flood immunity design standard for public transport.

16 Rapid Economic Appraisal – determining value and costs

> *"We need to think about what sort of coast we are and what we want to be. How our diverse communities connect now and will connect in the future and how the whole region benefits socially, environmentally and economically."*
>
> **Sandy Zubrinich, Chair Sunshine Coast Business Council and Light Rail Taskforce member**

Earlier chapters of this pre-feasibility report have identified key matters including: the need and objectives for a rapid transit project on the Sunshine Coast; what would be the possible options; where it could go; what it could cost; and who might use it. The final phase in a decision process would centre on a "business case" to allow decision makers to decide if the benefits of the project outweigh the costs to provide it, what the best option is, and how the project could best be delivered and funded. A full business case would consider a more limited range of options and may include the risks of doing nothing.

Chapter 11 cost estimates suggest it will cost in excess of $ 2 billion to fully construct a major rapid transit project. This pre-feasibility report does not examine the full detail necessary for an important "go or no go" decision on a project of that scale. Rather, it provides an understanding of whether the project has a reasonable chance of success, and whether the expenditure necessary to complete a full business case is justified given the broad assessment of the likely level of benefits expected from an option/s. To satisfy that requirement, a rapid economic appraisal was completed and included three assessments:

- Cost Benefit Assessment (CBA);
- Economic Impact Assessment (EIA); and
- Social Impact Assessment (SIA).

These assessments all provide relevant information on the expected project benefits and costs/impacts. It is important to view the results together when deciding the best option for the Sunshine Coast community.

The process used for the rapid economic appraisal is fully in line with the early phases of the Queensland Government's Project Assurance Framework (PAF). All major projects that wish to qualify for State Government investment must be assessed with regard to the PAF. The Commonwealth has its own evaluation framework for major projects, determined under its *Reform and Investment Guidelines*. If completed with Commonwealth input on its study requirements, an assessment in line with the PAF is capable of meeting these Commonwealth guidelines.

16.1 Cost Benefit Assessment - CBA

CBA is a tool used by decision makers to determine how benefits to a community can be maximised given scarce resources. It compares a number of options aimed at achieving a particular goal. The technique quantifies as many costs and benefits as possible for each option in monetary terms. By doing so, the options are directly comparable with one another. Costs and benefits are valued by their impact on the community, rather than the costs or benefits to any particular entity. As far as the assessment of benefits and costs to broader society are concerned:

- The benefits considered relate to those that can be quantified in monetary terms. Broader economic impacts, such as jobs and impact on the economy are not directly included in this CBA, but are considered in the Economic Impact Assessment later in this chapter.
- Benefits that cannot be quantified in monetary terms are termed 'intangibles' and need to be considered in line with CBA outcomes. For example, many of the social benefits associated with the options are intangible. The intangibles for the project options are discussed in the Social Impact Assessment later in this chapter.

There are a number of basic concepts that are important to understanding cost benefit assessment. These include:

- Opportunity Cost – costs and benefits are priced at their value in their best alternative use, which may be above or below the actual cost of the item.
- Willingness to pay – if opportunity costs cannot be determined, costs and benefits are valued at what the last consumer in a competitive market is willing to pay for them.
- Reasonable timeframe – to ensure all costs and benefits are adequately accounted for a time period needs to be considered in a CBA. For the Sunshine Coast project a notional time period of 100 years from 2011 is reasonable considering the economic life and the sustained impact of the benefits from these types of major projects. This time period included a breakdown of detailed analysis for the first 40 year period, and then the input of a 'residual' value for each option for the remaining 60 years. The residual value shows that remaining value of the option until the notional end of the economic life of the infrastructure.
- Discounted cash flow techniques – CBA assesses costs and benefits at the time they are expected to occur, which is known as a "stream" of costs or benefits. A 'discount rate' is then used to return the stream of costs or benefits to a single value in today's dollars (termed the 'present value'). The initial discount rate normally used is the government bond rate, because that is the highest return at the lowest risk that could be otherwise applied to an investment of a given amount. A discount rate is applied because, given the choice, people will logically choose benefits now rather than in the future, when their own circumstances may have changed. Therefore, costs or benefits in an earlier timeframe are considered to be 'more valuable' than those later in a period[10]. An example of the impact of a discount rate can be seen with the costs of the Light Rail at-grade option. Although in nominal terms the cost of this option is $2.01 billion, given that construction is not expected to commence until 2020, discounting this back to a present value at a discount rate of 6 per cent results in the option costing $1.1 billion. In other words, if we invested $1.1 billion today at a rate of 6 per cent, in 2020 it would be worth $2.01 billion.

Two key measures have been evaluated for each option:

- **The Benefit Cost Ratio (BCR**) – this is simply the 'present value' of the benefits divided by the 'present value' of the costs. When the **BCR is well over 1 the project is worthwhile** as this indicates that more benefits accrue to the community than costs when implementing the option. **A BCR of 2 or more is considered highly desirable**, as this is indicating that the option is likely to return twice (or more than twice) the benefits when compared to the costs involved.

[10] This is known as the 'time value of money'

- **Net Present Value** – the net present value subtracts the 'present value' of costs from the 'present value' of benefits. The result shows the 'net' gain (a positive value) or 'net' loss (a negative value) expected with implementation of the option.

Sensitivity testing was also completed on the options using different discount rates. The current 5 year government bond rate is around 6 per cent, and as such, this has been used as the 'base' discount rate. However to test the effect of a higher discount rate, scenarios using higher discount rates of 8 per cent and 10 per cent were also assessed.

When a project has a BCR over 1 for the variety of discount rates tested, the project is considered robust under a number of economic circumstances.

The costs and benefits considered in the CBA assessment are shown in the table below.

Table 16.1: CBA – costs and benefits

Costs	Benefits
System Costs	**Transport Benefits**
• Capital Costs • Operating Costs	• Travel Time Savings for Car Users • Travel Time Savings for existing Public Transport Users • Car Operating Savings
	Avoided Infrastructure Costs
	Avoided Current System Costs
	Productivity Benefits to the Economy
	• Productivity benefit effects • Industry connectivity effects • Social connectivity benefits
	Tourism Benefits
	• Induced tourism • Savings for tourists from increased public transport
	Social Benefits
	• Reduced cost of accident
	Environmental Benefits
	• Reduced greenhouse gases
	Residual Value of The System at Year 40

16.1.1 Estimating the costs

The capital and operating costs were compiled using the capital cost estimates in Chapters 12 and 13, and relying on key inputs including the *National Guidelines for Transport system Management in Australia*[11] escalated to 2012 dollars. The costs are shown in Table 16.2. This table includes both nominal costs and also the 'present value' for the capital costs under a 6 per cent discount rate. Present values are parenthesised. Operating costs are nominal costs.

[11] Australian Transport Council. 2006. National Guidelines for Transport system Management in Australia. Volume 4. Urban Transport.

Table 16.2: Estimated capital and operating costs – all options

Option Code	Description of Costs	Source	Overall Cost Nominal (PV: 6% discount rate)
Base case Diesel buses	Under the base case it is expected that the MMTC would be implemented, plus a number of car parks	Council information	Costs of the base case are included where appropriate as 'Avoided Costs' under the Options under review.
1. CoastConnect. Diesel or hybrid buses	Upgrades to roads, intersections and improved bus infrastructure associated with an improved semi-rapid bus system.	CoastConnect CDIMP, 2010/11 Council Information National Guidelines for Transport Systems in Australia	Capital Costs: $370 million Timing: 2014 – 2019 Operating Costs: $3.7 million per year (PV cap & op costs: $390 million)
2. Bus Rapid Transit (BRT)	Construction of separated corridor for bus, upgrades to intersections and improved bus infrastructure	Council Information National Guidelines for Transport Systems in Australia	Capital Costs: Stage 1: $1,030 million Stage 2: $540 million Total: $1,570 million (Timing: 2020 – 2025 Stage 1 Operating Costs: $4 million per year (PV cap & op costs : $920 million)
3. Light RailTransit (LRT) at-grade.Overhead electric power	Property acquisition, civil and related costs, rail systems, stations, service relocations, rollingstock, Depot, Owners costs and contingencies	Ranbury Working Paper National Guidelines for Transport Systems in Australia	Capital Costs Stage 1: $1.3 billion Stage 2: $710 million Total: $2.10 billion Timing: 2020 – 2025 Stage 1 Operating Costs $3.9 million per year (PV cap & op costs: $1.1 billion)
4. Elevated Light Rail	Light rail with elevated and /or tunnel running	Ranbury Working Paper National Guidelines for Transport Systems in Australia	Capital Costs Stage 1: $2.3 billion Stage 2: $1.3 billion Total: $3.6 billion Timing: 2020 – 2025 Stage 1 Operating Costs $3.7 million per year (PV cap & op costs: $2.0 billion)
5. Monorail fully grade-separated	Monorail with elevated and /or tunnel running	Ranbury Working Paper National Guidelines for Transport Systems in Australia	Capital Costs Stage 1: $2.0 billion Stage 2: $1.1 billion Total: $3.1 billion Timing: 2020 – 2025 Stage 1 Operating Costs $3.7 million per year (PV cap & op costs : $1.8 billion)
6. Hybrid at-grade segregated light rail, overhead power	Light rail with some sections at-grade with some sections segregated to improve travel speeds	Council Information National Guidelines for Transport Systems in Australia	Capital Costs Stage 1: $1.8 billion Stage 2: $820 million Total: $2.6 billion Timing: 2020 – 2025 Stage 1 Operating Costs $3.8 million per year (PV cap & op costs: $1.5 billion)

16.1.2 Estimating the benefits

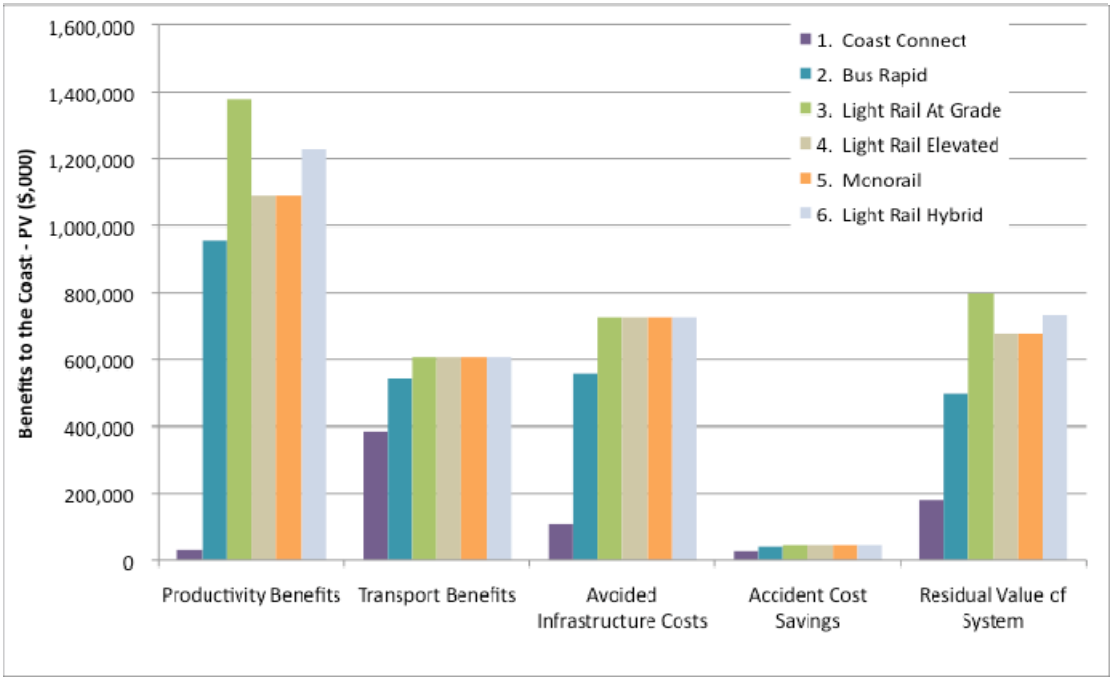
The objectives of an improved public transport system for the Sunshine Coast were based on ensuring Council's overall objectives of productivity, sustainability and liveability could be assisted. As this report demonstrates, an improved public transport system can form part of an important catalyst in realising Council's desired social, economic and environmental outcomes. Figure 16.1 shows how the options under assessment are expected to benefit the region.

Benefits were grouped by:

- Productivity: how the economy, business interactions and production and unemployment might be assisted through implementation of the option. This group also included expected benefits from induced tourism;
- Transport: the benefits expected with decreased private vehicle usage such as saved travel time and saved car operating expenses. In addition, the expected travel time savings for existing public transport users was included here;
- Avoided infrastructure costs: those projects / costs no longer needed if the options were implemented. For the assessments completed, the benefits included savings from major road projects (such as components of the MMTC) that would not be needed with improved public transport, and also savings to car parking;
- Accident cost savings benefits: the savings associated with expected decrease in accidents due to less kilometres travelled by car; and
- The residual value of the system at the end of the assessment period: even though an assessment period of 40 years has been considered, the economic life of much of the infrastructure in the options assessed extends beyond that timeframe. The system will still return substantial value to the community post 40 years and the residual value shows what the value of this is to the community.

As noted earlier, many of the likely social benefits are intangible and cannot be considered in a CBA. As such, results should be read in conjunction with the Social Impact Assessment.

Figure 16.1: Estimated benefits – all options



The benefits associated with Light Rail at-grade are either higher or equal to the other options.

Productivity benefits are expected to be around $1.4 billion under a Light Rail at-grade (at a discount rate of 6 per cent), compared to CoastConnect at $32 million. Bus Rapid is expected to assist productivity by around $955 million. Avoided costs are also significantly higher under all light rail options compared to CoastConnect. Light rail avoided costs would total around $730 million, compared to bus options where much of the road projects would still be required and avoided costs would be much smaller (around $110 million). Avoided costs for Bus Rapid are expected to be in the vicinity of $560 million. The residual value of the system is also much higher under light rail, and particularly the 'at-grade' option, at around $800 million as compared to around $180 million for the CoastConnect option. Bus Rapid's residual value is around $500 million. Largely due to higher productivity benefits and higher residual value, future benefits of light rail options are expected to continue to far exceed those of the bus options.

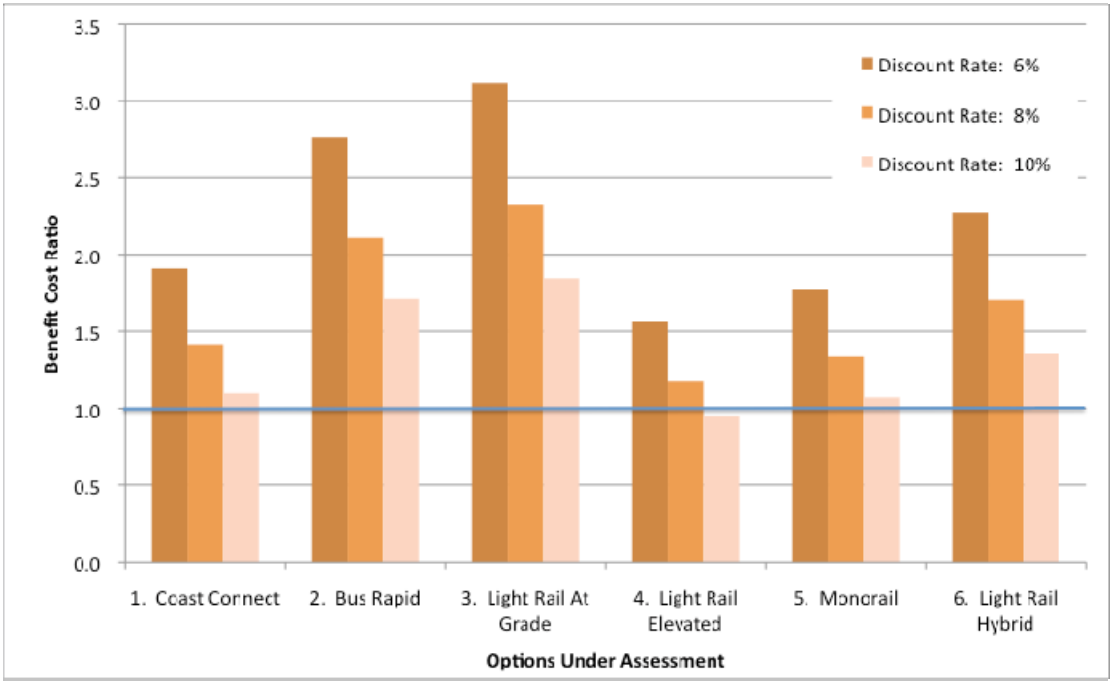
16.1.3 The Benefit Cost Ratio results – staying above the Line

The option with the highest BCR under a variety of discount rate assumptions is Option 3, Light Rail at-grade. With a 6 per cent discount rate, the BCR for Option 3 is expected to be around 3.1. This means that there are 3 times as many benefits expected than the costs involved in implementing the option. Even at a discount rate of 10 per cent the Light Rail a-grade option is expected to return benefits in excess of 1.8 times the expected cost of the implementing the option.

The two other options that are expected to provide significant benefits to the community are Option 2, Bus Rapid and Option 6, Light Rail Hybrid, partially elevated and partially at-grade. Bus Rapid has BCRs between 2.8 (under a 6 per cent discount rate) and 1.7 (under a 10 per cent discount rate). Light Rail Hybrid is expected to return BCRs between 2.3 (under a 6 per cent discount) to 1.4 (under a 10 per cent discount).

Light Rail Elevated, Monorail and CoastConnect all return BCRs above 1 for the 6 per cent and 8 per cent discount rate scenarios. However, the benefits of these options are marginal under a discount rate of 10 per cent (with Light Rail elevated falling below 1 to 0.9, Monorail slightly above 1 at 1.07 and Coast Connect just above 1 at 1.1).

Figure 16.2: Benefit Cost Ratio – all options



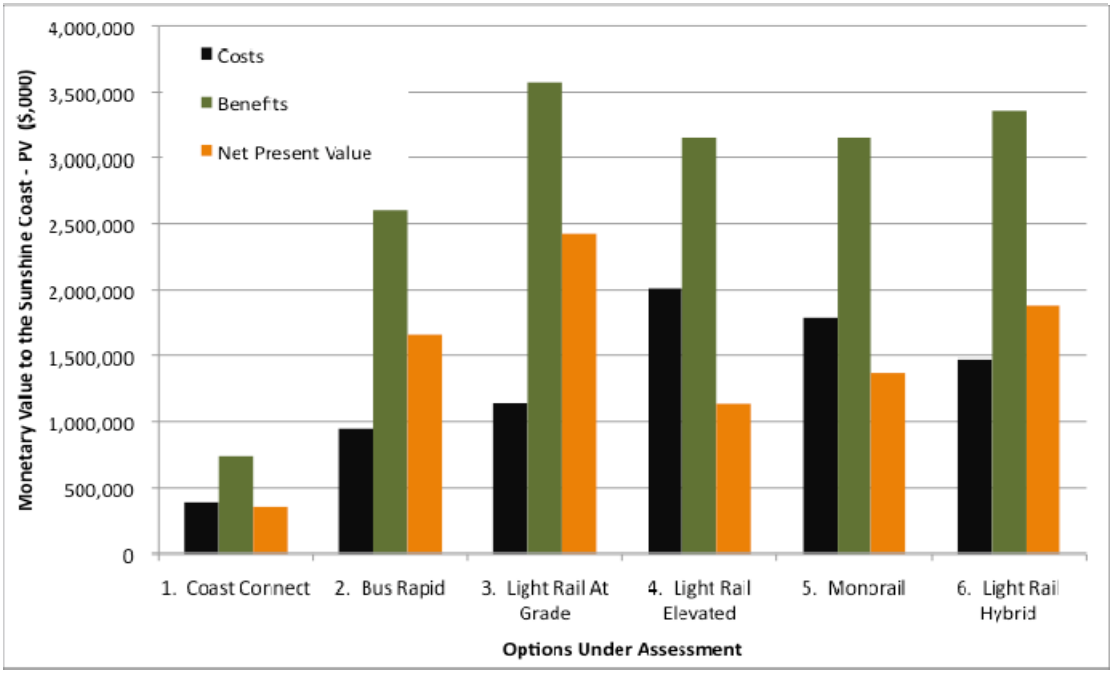
Light rail at-grade has the highest BCR under all interest rates tested. It offers the Sunshine Coast the most cost-effective benefits. Light rail hybrid is also a strong performer as is Bus Rapid. However, as noted in the Social Impact Assessment, Bus Rapid is not expected to bring significant 'intangible' benefits to the Coast when compared to the Light Rail Options. The actual physical ability of a bus rapid transit solution to meet long term patronage needs in excess of 80,000 passengers per day in the key corridors will also need to be closely evaluated in future investigations should this option be taken forward to full business case.

16.1.4 Net Present Value – what the project options are worth

The net present value (NPV) shows the overall benefits (or costs) associated with implementing an option in today's values. Figure 16.3 shows that the NPV is positive for all options, with significant gains expected from Light Rail at-grade, Light Rail Hybrid and Bus Rapid. Coast Connect, Light Rail Elevated, and Monorail are expected to deliver the least benefits.

The overall benefit expected for the Sunshine Coast community from implementing the Light Rail at-grade is around $3.6 billion (present value at a discounted rate of 6 per cent). When taking into account the cost involved in implementing the option (around $1.1 billion present value at a discount rate of 6 per cent), the net benefit to the community is around $2.4 billion (present value).

Figure 16.3: Net present value to the Sunshine Coast



Light rail option 3 is expected to benefit the Sunshine Coast community by around $3.6 billion – taking into account implementation costs, the net benefit would be around $2.4 billion

16.1.5 Overall CBA results

Overall, Option 3, Light Rail at-grade ranks the best option on the CBA results. This option has:

- The highest BCR at every discount rate tested;
- A substantially higher net present value over the assessment period;
- Considerable productivity, transport and avoided costs benefits to Council, the State and the Region; and
- Is expected to continue to provide significant benefits well beyond the assessment period.

Bus Rapid ranks the second best option under the CBA and Light Rail Hybrid, a combination of at-grade and elevated, ranks the third. However as noted earlier the actual ability of Bus Rapid to meet the desired long term passenger tasks in key corridors needs to be better understood before it can tested as a realistic option.

As the BCR is below or close to 1 (meaning the benefits either do not exceed the costs or are only marginally better) for the Light Rail Elevated, Monorail and the CoastConnect option at a 10 per cent discount rate, these options do not appear to be competitive.

16.2 Economic Impact Assessment

The aim of an economic impact assessment is to examine how a project is likely to affect the 'local', 'regional' and 'State' economies through its various links with all industry sectors. In this assessment, the 'local' economy is the Sunshine Coast Region's economy, the 'regional' economy is South East Queensland's economy and the 'State' economy is the economy of Queensland.

The economic impact is the sum of the 'direct' contribution (often termed the 'economic stimulus' and/or the 'initial effect') of the option plus the 'indirect' contribution (often termed the 'flow on effect'). The Taskforce has reviewed information from Council's economic impact model and used multipliers supplied by SGS Economics and Planning Pty Ltd[12].

Three indicators are used together to provide an overall view of the project's economic impact on the study area. The three indicators include:

- Output: (or total turnover) which refers to the value of total expenditure in the economy;
- Value added: the equivalent of total turnover less the amount spent on non-labour inputs and imported inputs – put simply, it's the value added expected by the economy being assessed; and
- Employment: this refers to the number of full time equivalent (FTE) jobs supported by the option[13].

The total impact or contribution is comprised of "direct effects" (also known as the "initial effect") and "indirect effects" (also known as the "flow-on effects"). The direct effect measures the level of output, employment or value added directly generated through the project. For this project both the construction and operational phases have been analysed.

The direct effect in the construction phase would be the total construction, planning and management costs outlined in Table 16.3 and the direct effect in the operational phase is the expected operating costs to run the system. For ease of understanding, the assumed costs of each of the options are noted in the table below.

Table 16.3: Estimated construction and operating costs

Options						
	1 CoastConnect	**2 Bus Rapid**	**3 Light Rail at-grade**	**4 Light Rail Elevated**	**5 Monorail**	**6 Light Rail Hybrid**
Nominal Costs	*$,000*	*$,000*	*$,000*	*$,000*	*$,000*	*$,000*
Capital Costs (Stages 1+2)	$370,000	$1,570,000	$2,010,000	$3,600,000	$3,100,000	$2,600,000
Operating Costs Per Annum	$3,700	$4,000	$3,900	$3,700	$3,700	$3,800

The 'in-direct contribution' to the economy exists because during construction and operation there would be purchases made from companies who would in turn spend those dollars on their inputs, and so on through the industry sectors. In addition, there is a consumption effect as employees will spend their wages creating additional demand for goods and services in the economy. The in-direct contribution traces the flow of money spent in the Sunshine Coast, SEQ and Queensland economies and is the measure of the

[12] The following data, with interpretation by SGS Economics and Planning Pty Ltd, was used to derive the multipliers: 5220.0 - Australian National Accounts: State Accounts, 2010-11; 5209.0.55.001 - Australian National Accounts: Input-Output Tables - Electronic Publication, Final release 2006-07 tables; ABS 2006 Census of Population and Housing.
[13] It is noted that direct employment has been determined through applying similar $/employee ratios as determined in the Gold Coast's Light Rail project for the rapid assessment. Should the Council decide to complete a full Business Case for options, a detailed employment analysis would be undertaken.

additional value generated. Calculation of the total in-direct contribution is based on all quantifiable expenditures.

These in-direct contributions have been measured in terms of:

- The dollars of spending (or output);
- The value added to economy; and
- Additional jobs generated in other sectors of the economy.

16.2.1 Results of the Economic Impact Assessments

Figures 16.4 and 16.5 show the results of the economic impact assessments for the construction phase of the options assessed. The Light Rail Elevated option has the most impact on the economy, followed by Monorail. This is to be expected given that the direct impact on the economy is the capital cost of the option. These options returns around twice the value added to the economy as the Light Rail at-grade. However, these benefits should be viewed in light of the fact that the Light Rail Elevated and the Monorail option only returned a marginal BCR at a 10 per cent discount in the preceding CBA (and therefore not considered competitive options for Council).

Light Rail at-grade and Light Rail Hybrid (combination of at-grade and elevated) would have a significant impact on the Sunshine Coast economy, with total impacts estimated at:

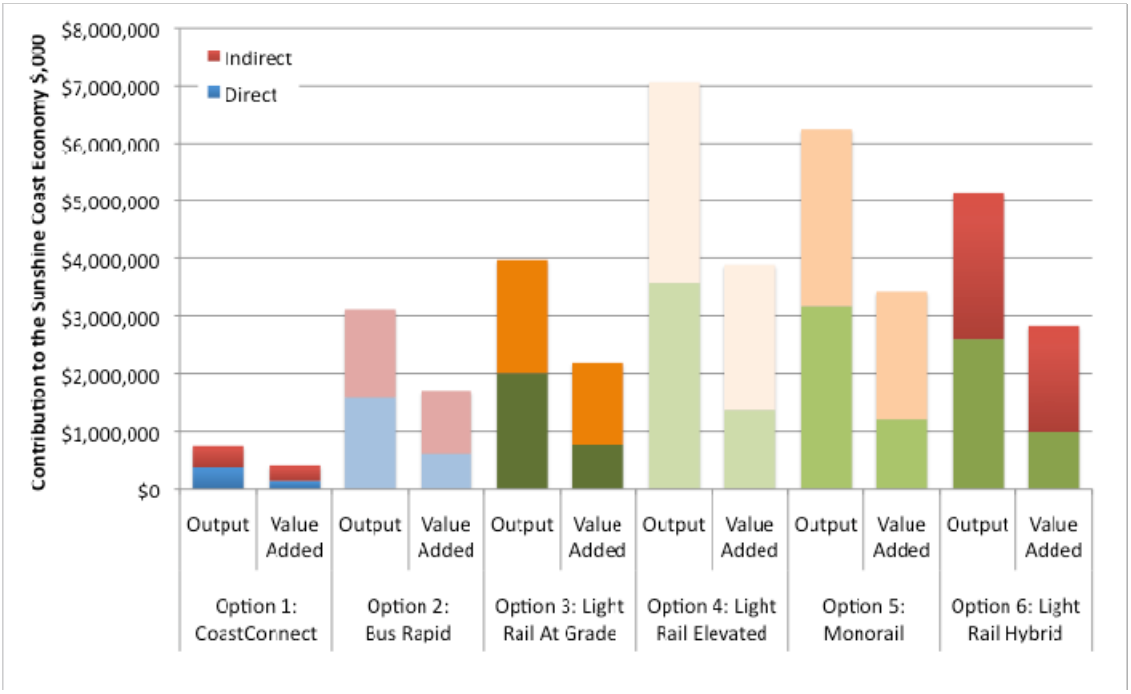
Table 16.4: Economic impacts – construction and operation Light Rail options

Type of Impact to Sunshine Coast economy	Light Rail (at-grade & hybrid) Construction Impacts (approx.)	Light Rail (at-grade & hybrid) Operational Impacts (approx.)
Output: Additional total expenditure expected in the economy	• $4.0 - $5.2 billion	• $6 M per annum
Value Added: Output, less the amount spent on non-labour inputs and imported inputs	• $2.1 - $2.8	• $5 M per annum
Employment: The number of full time equivalent (FTE) jobs supported by the option	• 8,600 - 9,800	• 200 per annum

Light Rail at-grade and Hybrid (combination of at-grade and elevated), stimulate significant contributions to the output and value added components of the Sunshine Coast Economy. This outcome, coupled with the positive outcomes from the CBA and the social impact assessment (see next section) indicate that these are the favoured options. Although Light Rail Elevated and Monorail exhibits even larger contributions to output and value added to the Sunshine Coast economy, it has been seen that under a 10 per cent discount rate in the CBA, the benefits associated with these options are marginal, and thus the options are not considered competitive.

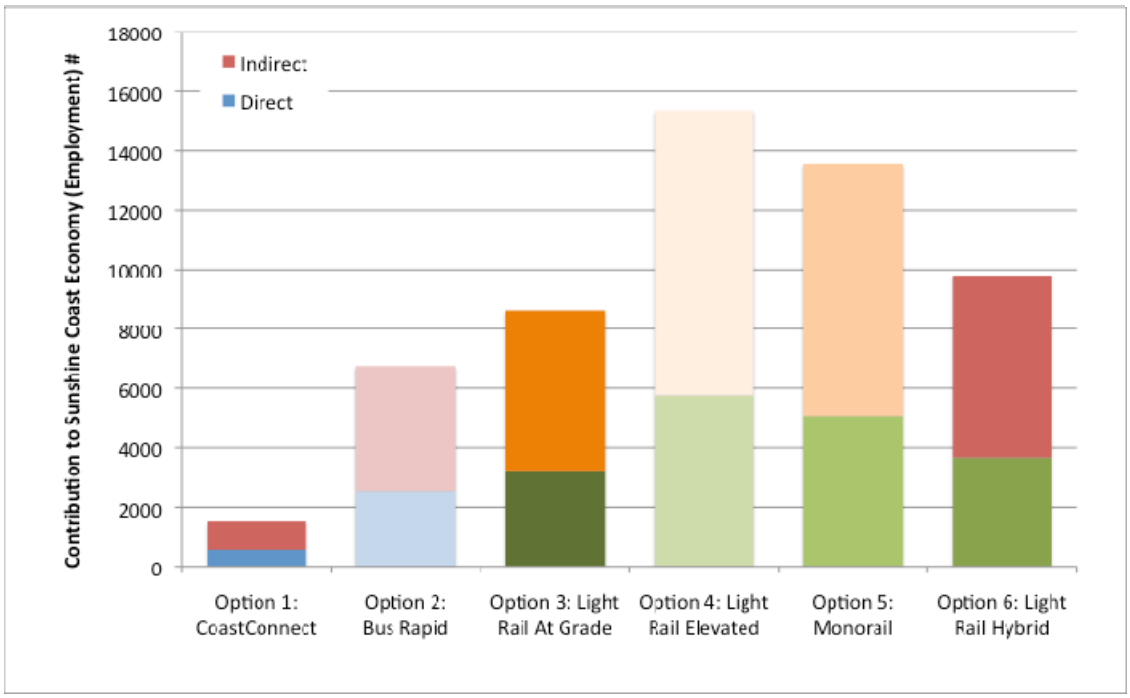
By comparison, the CoastConnect option has direct and indirect output impacts of around $730 million at the construction phase, of which approximately $400 million can be categorised as value added to the Sunshine Coast economy. This option is expected to create an additional 1,500 direct and indirect jobs through the construction phase. Ongoing jobs supported by the option would be around 250 per year.

Figure 16.4: Sunshine Coast economy: output, value added: construction only



Light Rail at-grade and Hybrid (combination of at-grade and elevated), stimulate significant contributions to the output and value added components of the Sunshine Coast Economy. This outcome, coupled with the positive outcomes from the CBA and the social impact assessment (see next section) indicate that these are the favoured options. Although Light Rail Elevated and Monorail exhibits even larger contributions to output and value added to the Sunshine Coast economy, it has been seen that under a 10 per cent discount rate in the CBA, the benefits associated with these options are marginal, and thus the options are not considered competitive.

Figure 16.5: Sunshine Coast economy: employment impacts: construction only



Although not included in the graphs, the impacts on the State of Queensland are even larger than those noted above. For the Light Rail at-grade and Light Rail Hybrid (combination of at-grade and elevated) total impacts for the Queensland economy are estimated as shown below.

Table 16.5: Impact to Queensland economy

Type of impact to *Queensland* economy	Light Rail (at-grade & hybrid) Construction Impacts (approximately)	Light Rail (at-grade & hybrid) Operational Impacts (approximately)
Output: Additional total expenditure expected in the economy	• $5.4 - $7.0 billion	• $8.6 million per annum
Value Added: Output, less the amount spent on non-labour inputs and imported inputs	• $2.6 - $3.4 billion	• $4.6 million per annum
Employment: The number of full time equivalent (FTE) jobs supported by the option under review	• 9,800 – 11,000	• 250 per annum

16.3 Social Impact Assessment

A social impact assessment is used to describe the likely social impacts (positive and negative) of all the project options.

There are many impacts that cannot easily be converted to a monetary value. If an impact cannot be converted to a monetary value then it cannot be included in a CBA or an economic assessment. Social impact assessments can be used to complement the CBA by ensuring that all social impacts are adequately considered. The assessments conducted here concentrate on the 'intangible' social benefits associated with the options under review. As such, the social impact assessment is considered an integral component when determining the most beneficial option for the Sunshine Coast community.

16.3.1 Social benefits – significant potential to assist council's liveability, productivity and sustainability objectives

Much research has been dedicated to determining the benefits and costs associated with public transport corridors. The extent of benefits or costs a community experiences is influenced by many things, including the transport mode, the amenity of the locations along the corridor and also the perceived and real safety of the immediate environment.

In addition to the benefits already quantified through the CBA, additional social benefits expected from improved public transport include[14] are summarised in the following table.

[14] For references, please refer to Bibliography

Table 16.6: Social benefits from improved public transport

Social Benefits from Improved Public Transport	
 Place making & urban intensification	• Improved access to service and facilities for a number of people from a range of socio-economic groups • Increased opportunities for walking and cycling • Avoided costs for infrastructure no longer required given consolidation outcomes • Connected region – unique villages and precincts linked
 Productivity improvements	• Social Connectivity - benefits to individual from increasing employment opportunities • Skills and training opportunities • Additional tourism benefits
 Social advantage	• Wellbeing benefits – people closer to key economic, social, natural and cultural attractions • Benefits to the economy from decreased unemployment • Savings on travel costs in accessing key services and facilities by public transport
 Community health, safety and wellbeing	• Increased physical activity, reduced respiratory illness and pollution • Cost savings - reduced travel times for public transport users, therefore ability to spend additional money on other items / services • Improvements in safety (real and perceived) around stations due to passive/active surveillance
 Property prices and housing affordability	• Property price uplifts - improved amenity and access to services and facilities around key nodes on the transport route • Benefits of diverse housing stock and potential for a range of affordable housing • Ability for Local Governments to request or provide affordable housing outcomes in regenerating / intensifying areas
 Social inclusion and connectivity	• Greater access to work, social networks and services • Encourages social inclusion and more community interaction - creates safer spaces, and further social infrastructure • Potential for higher level of service and facilities through an activated urban area
 Environmental outcomes	• Protection of environmental assets through consolidation of urban footprints • Positive impact on climate change through less emissions
 User benefits	• More comfortable travel for those travelling on the new public transport mode • Private vehicle operating cost savings

16.4 User benefits

A well planned and delivered public transport system offers many benefits. The type of transport can influence the level of benefit and there is literature to support the view that Light Rail (particularly at-grade) can impact many of these issues more positively than buses given that, among other things:

- Consolidation around key nodes is expected to be more intense with a Light Rail system when compared to a bus system, and therefore the benefits associated with liveability and sustainability better assisted;
- Place making opportunities are expected to return higher benefits under a Light Rail system (particularly 'at-grade'), because activation of the street frontage can be better assisted; and
- Consumer confidence (and particularly tourism confidence) associated with using public transport is expected to be higher with a 'fixed' track Light Rail system rather than a bus system.

16.4.1 How the options impact the community socially

The following table lists the performance of each option under social impact assessment. **The results suggest Option 3 Light Rail at-grade is likely to produce the greatest social benefits**. The assessment shows both the negative and positive social impacts assessed for all options. As supported in the literature, it is based on the assumption that Light Rail is likely to generate higher levels of intensification than any bus option. It was also assumed that intensification would occur in the most appropriate way for the Sunshine Coast community with a focus on place making. The following assessments were conducted based on this premise. The number of ticks or crosses (up to 3), indicate the potential extent the option has to make a positive impact socially, a '-' indicates little or no impact. If the project proceeds to Phase 2, social impacts will be thoroughly investigated through consultation with key stakeholder groups.

Table 16.7: Social Impact Assessment

	Option 1: Coast Connect	Option 2: Bus Rapid	Option 3: Light Rail At-grade	Option 4: Light Rail Elevated	Option 5: Monorail	Option 6: Light Rail Hybrid	Overall Comments
Demographic and Population Impacts	-	✓	✓✓✓	✓✓	✓✓	***	All Light Rail options are assumed to be associated with higher levels of intensification when compared to bus options. As such, Light Rail options will create positive and diverse environments, which are assumed to assist in retaining youth on the Sunshine Coast. Given the ease of mobility, simplicity, reliability and linear nature of the Light Rail system, these options are expected to positively impact older people. Light Rail at-grade expected to have more positive social impacts than Elevated / Monorail, as Elevated / Monorail option may result in less activation at street level, impacting on perceived (or real) safety and not acting as strong a magnet to retain youth or population. Given the expectation of increased intensification associated with Light Rail systems, families may experience cost savings foregoing the need for a second (or third) car. Bus Rapid expected to have marginal benefits. CoastConnect not likely to make an impact.
Accommodation and Housing	-	✓	✓✓✓	✓✓	✓✓	***	All Light Rail options assumed to be associated with higher levels of intensification compared to bus, and therefore create more diverse housing. More affordable options likely from Light Rail systems compared to bus as options for master planning areas are more likely. Amenity of housing likely to be improved under Light Rail - level of regeneration expected. Potential for noise impacts from the system for all options - need to be mitigated. Light Rail may require acquisition of more road space and/or properties than the bus options. Bus Rapid expected to have marginal benefits. CoastConnect not likely to make an impact.
Mobility and Access	✓	✓	✓✓✓	✓	✓	***	Light Rail modes expected to bring the most benefits in terms of aiding movement within and around areas, both due to the benefits with the mode itself and also due to intensification (which would increase access and walk-ability to key services and facilities for many people). The At-grade option considered the best in terms of universal access (i.e. access for patrons with all levels of ability) (as patrons would not need to reach above ground platforms). Light Rail carriages have universal access. Surfers likely to have more comfortable trips under the Light Rail compared to bus. All systems would be connected to regional networks via bus feeder systems.
Social Infrastructure	✓	✓	✓✓✓	✓✓	✓✓	***	Light Rail options expected to significantly improve access to services and facilities for a high number of people. . Bus Rapid and

	Option 1: Coast Connect	Option 2: Bus Rapid	Option 3: Light Rail At-grade	Option 4: Light Rail Elevated	Option 5: Monorail	Option 6: Light Rail Hybrid	Overall Comments
							CoastConnect expected to return marginal benefits. Given the assumed catalytic effects, the provision of further social infrastructure (spaces and facilities) is very likely. Light Rail Elevated / Monorail options are not expected to be as beneficial as At-grade as activation of the street level is likely to be less than At-grade (given Elevated / Monorail stations).
Cultural Values and Beliefs	-	-	✓✓✓	✓	✓	***	Feedback from the Sunshine Coast Consultation Hub as well as several Council policies suggests that cultural values and beliefs on the Sunshine Coast centre on sustainability, productivity and liveability. Light rail has the ability to have a very positive influence and effect on these values through consolidation / intensification. Intensification - brings many benefits that protect and enhance the positive attributes of the coast, as well as assist in attracting/retaining high value adding industry sectors. Liveability would be improved through intensification around nodes and therefore diversification of housing, employment and social facilities and services, as well as generally adding a positive and forward looking atmosphere to the Coast. For these reasons Light Rail options scored better than bus.
Community Identity, Amenity and Cohesion	-	-	✓✓✓	✓	✓	***	Light Rail options are likely to have more positive impacts on social interaction, inclusiveness, community identity and harmony on the Coast given the expected levels of patronage and likely levels of street activation. Light Rail At-grade expected to improve physical connections within communities better than other options, as the mode will activate street frontage, rather than act as a barrier (as it can with bus options). Higher levels of patronage associated with the light rail options- ensure more equitable mobility for a range of people. Bus systems not expected to contribute to community identity or amenity.
Health and Well Being	-	-	✓✓✓	✓	✓	***	Literature on light rail suggests more benefits regarding health and well-being than bus. Walking and cycling activities are assisted, particularly At-grade light rail, both because stations are close to high levels of populations and because more intense development means it is often easier to access services and facilities. The light rail stations can be created as a focal point, and where they are on street level can activate a street - which is likely to increase people's ability to enjoy areas. The nodes/stations can become community focal points, and provide areas where civic participation is increased. Accidents are likely to decrease on roads given

	Option 1: Coast Connect	Option 2: Bus Rapid	Option 3: Light Rail At-grade	Option 4: Light Rail Elevated	Option 5: Monorail	Option 6: Light Rail Hybrid	Overall Comments
							switch to PT – the extent of which has been quantified in the CBA.
Crime and Public Safety	✘	✘	✓✓✓	✘	✘	***	Bus systems can create physical boundaries rather than creating more community cohesion. This can decrease the level of safety for pedestrians. Literature suggests that light Rail systems are likely to be better utilised by women and youth as they are perceived to be safer. Light Rail Elevated / Monorail systems can create crime spots and be targets for graffiti given the elevated structures. They can also be magnets for accidents, for example, with youth swinging on structures.
Employment and Local Economic Development Opportunities	✓	✓✓	✓✓✓	✓✓✓	✓✓✓	***	Significant potential for job creation both direct and indirect from all options, Light Rail options have the best outcomes and improved bus systems are expected to have positive benefits also. Given the intensification likely with Light Rail, these options are most likely to assist attracting/retaining knowledge workers. Bus systems are not expected to significantly attract knowledge workers. Economic development will be assisted given expected flow on effects in region. Training opportunities likely in many areas of the economy. Less infrastructure (road projects, new infrastructure in greenfield areas), is required under the Light Rail options, which means more savings for community. Intensification can also produce more savings for infrastructure given less Greenfield areas required to support growth.
Tourism	-	-	✓✓	✓✓	✓✓	***	Literature suggests that tourism is likely to be better facilitated (and induced) with Light Rail systems as they are 'fixed' track. Hence tourists more confident in using them. Buses are not expected to have an impact on tourism. There is a better 'branding' option of the Coast with an identifiable public transport system such as Light Rail. Tourists can save on hiring cars and/or taxis due to the ease of use with Light Rail.
Natural Environment	-	-	✓✓✓	✓✓	✓✓	***	Light Rail can assist the protection of environmental assets more as less Greenfield areas are expected to be required given intensification. Higher patronage on public transport means better impact on climate change through fewer emissions. Light Rail systems are expected to have higher patronage than buses.
OVERALL ASSESSMENT	-	✓	✓✓✓	✓✓	✓✓	✓✓	

*** *Mix of Option 3 and 4, depending where at-grade and elevation occurs*

16.5 Overall Rapid Economic Appraisal – the results

Light Rail At-grade and the Light Rail Hybrid are considered to be the projects potentially worth pursuing based on the overall results of the economic assessments given that they both:

- Provide a robust BCR under all discount rates assessed and a high Net Present Value;
- Are likely to produce significant economic impacts with regard to output, value added and employment; and
- Deliver considerable social benefits for all elements assessed.

CoastConnect Light Rail Elevated and Monorail deliver positive outcomes under a limited number of discount rates assessed but are not competitive when compared to the other options. In addition, CoastConnect and Bus Rapid only deliver limited social benefits, and Bus Rapid Transit may not be able to satisfy the requirements to move very high numbers of passengers in the future.

Table 16.8: Results of Rapid Economic Appraisal

		Options					
		1. Coast Connect	2. Bus Rapid	3. Light Rail At Grade	4. Light Rail Elevated	5. Monorail	6.Light Rail Hybrid
CBA - Discount Rate 6%							
Total Costs	PV ($ million) 6% DR	$390	$940	$1,100	$2,000	$1,800	$1,500
Total Benefits	PV ($ million) 6% DR	$740	$2,600	$3,600	$3,200	$3,200	$3,400
Net Present Value	PV ($ million) 6% DR	$350	$1,700	$2,400	$1,100	$1,400	$1,900
Benefit Cost Ratio	(10% DR - 6% DR)	1.1 to 1.9	1.7 to 2.8	1.8 to 3.1	0.9 to 1.6	1.1 to 1.8	1.4 to 2.3
Economic Impact Assessment							
Construction Impacts							
Total Output - Sunshine Coast	($ million)	$730	$3,100	$4,000	$7,100	$6,200	$5,100
Total Value Added - Sunshine Coast	($ million)	$400	$1,700	$2,200	$3,900	$3,400	$2,800
Total Employment - Sunshine Coast	(jobs)	1,500	6,800	8,600	15,400	13,600	9,800
Operational Impacts							
Total Output - Sunshine Coast	($ million, pa)	$5	$6	$6	$6	$6	$6
Total Value Added - Sunshine Coast	($ million, pa)	$4	$5	$5	$4	$4	$5
Total Employment - Sunshine Coast	(jobs)	250	250	210	200	200	210
Social Impact Assessment							
Overall Social Assessment		-	✓	✓✓✓	✓✓	✓✓	✓✓
OVERALL RAPID ECONOMIC ASSESSMENT		×	✓ (?)	✓✓✓	×	×	✓✓

* PV = Present Value
* DR= Discount Rate

Options worth pursuing given assessment

Potential option worth pursuing given assessment

PART III – Implementing the Rapid Transit project

17 How the project would work

The analysis of options in Part II has demonstrated the benefits of a new rapid transit system, based on light rail, in achieving sustainable mobility on the Sunshine Coast as it continues to develop. These benefits extend well beyond the movement of people, to cover supporting greater economic development, providing a range of new lifestyle choices, and making the region a better place to live and visit.

This chapter ties together all the previous analysis and describes how the recommended project options could work.

17.1 Technology

The rapid transit system would operate mostly at-grade (street level) in its own right of way. It would share intersections with other road users but would benefits from traffic signal priority, where the signals are programmed to anticipate the arrival of the vehicle and minimise its delay through the intersections. Because the vehicles would be arriving at a steady and reliable frequency due to their own right-of-way, signals would be phased so as not to cause any intermittent disruptions to other traffic.

Under option 6, parts of the track would be elevated above street level to avoid intersections and improve running speed. This would considerably reduce travel times but would convey the likelihood of more noticeable visual impacts. Elevated track would not be likely to be considered in areas of high visual amenity such as the beachfront zones, or in accessing major centres like Maroochydore.

The vehicles would be either:

- modern fully-low-floor modular electrically powered light rail vehicles about 30 to 40 metres long; or
- 14.5 metre long rigid or 18.5 metre diesel or hybrid diesel-electric articulated buses if a Bus Rapid Transit option 2 demonstrates it can meet the longer term passenger demands. These would be semi-low-floor.

Vehicles would operate at a maximum speed of 80 km/h.

The light rail options would have overhead power at low voltage 750 v DC, and many of the existing higher voltage overhead power lines would be put underground, resulting in less clutter overall. Bus options would be diesel powered though cleaner technology may become practicable in the future.

There would be specially designed stations spaced about one kilometre apart, with a platform height of 300 mm. The vehicles would stop close to the platform at the exact grade with minimal gap and would meet disability standards. For Light Rail this would include a very small gap under 40 mm, whereas Bus Rapid Transit may not achieve this on a guaranteed basis.

Passengers would benefit from integrated TransLink fares using *go card* fare collection or they may be able to pre-purchase other ticket types approved by TransLink. They would not interact with the driver and would possibly validate their cards/tickets before boarding. Revenue protection would be undertaken by TransLink patrols.

17.2 The routes

The corridor from Maroochydore to Caloundra is the recommended core system. Staging would be required to provide scale economies while spreading the call for funding over a longer period. The first stage would most likely be Maroochydore to the Kawana Hospital precinct. This stage is just over the length of stage one of the Gold Coast project. Construction time for this stage would be about 2 years from establishing the works.

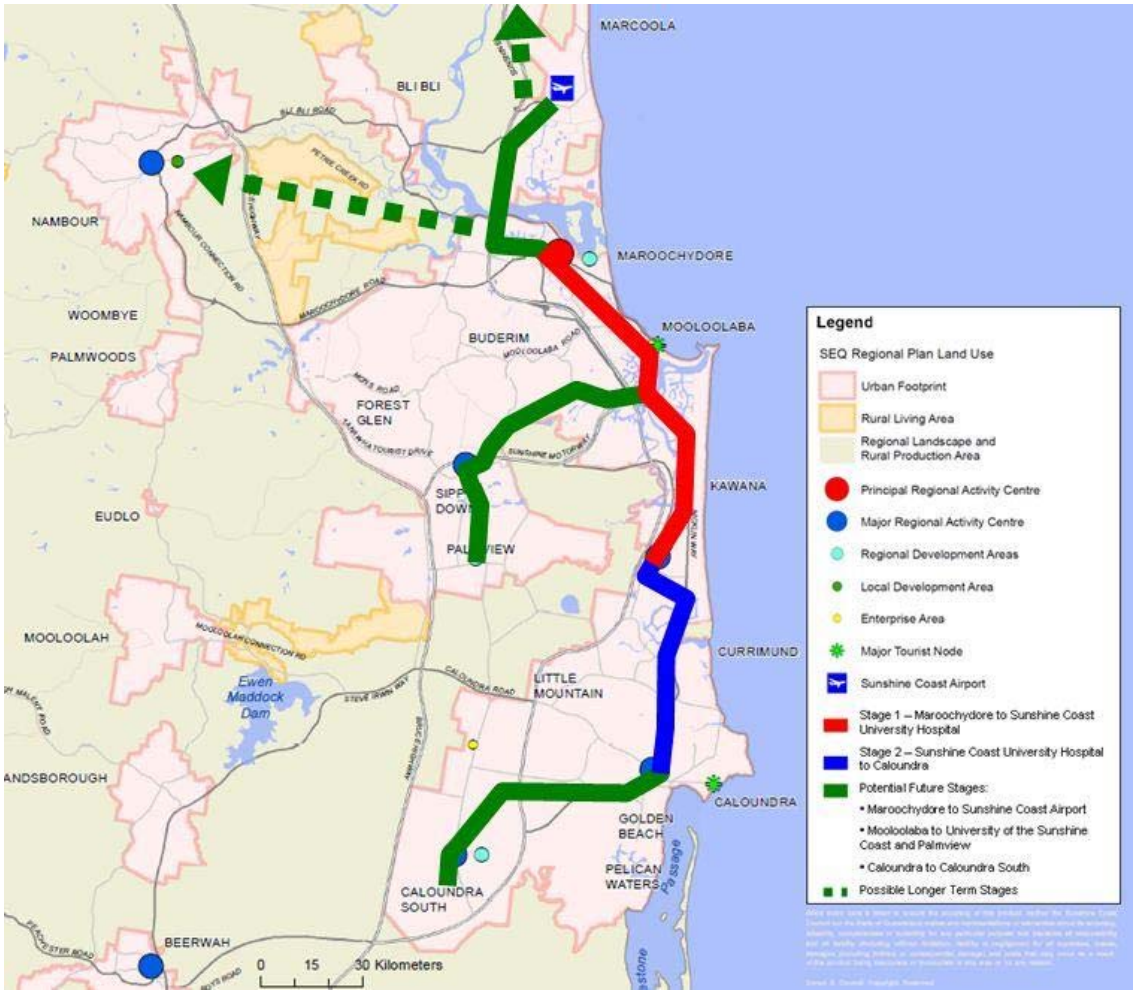
Other extensions could be considered in the future. The most obvious candidates would be:

- Mooloolaba to Sippy Downs and Palmview to serve the University and schools and ongoing development in that corridor;
- Maroochydore to Sunshine Coast Airport; and
- Caloundra to Caloundra South if the Maroochydore regional rail line is not constructed.

Other longer term corridor options could include:

- Maroochydore to Nambour; and
- Sunshine Coast Airport to Noosa.

Figure 17.1: Possible staging of ultimate LRT system



18 Redesigning the future public transport system

'Light rail is about vision and long term growth for the Sunshine Coast as a whole - the right connections within and beyond our region would provide broader dimensions of potential for new and revitalised growth. It's about creating a successful system that provides for 3D sustainability, connecting contextually for future economic and social well-being, as well as alleviating future road transport demands".
Tony Vella, UDIA representative and Light Rail Taskforce member

As noted in Chapter 6, a fundamental premise of the Sunshine Coast Light Rail project is its development in tandem with an improved bus network, and connections to the regional rail system.

TransLink's integrated contracting regime that applies on the Sunshine Coast is one of the most advanced in the world, providing integrated fares and ticketing with no transfer penalty across the entire south east Queensland region. It also allows TransLink to specify where and when bus, light trail and rail services operate, so there is no duplication of resources. This will allow TransLink to redesign the bus network around the new rapid transit system and ensure it forms part of an efficient integrated system in the Sunshine Coast region.

This chapter provides a high level guide to how that redesign could be achieved.

18.1 Roles and responsibilities in public transport in the region

Providing public transport in Australia is primarily a state government function, and the Queensland Government provides the majority of funding for planning and investment in public transport on the Sunshine Coast. The Department of Transport and Main Roads provides strategic planning and route design, and TransLink provides network design, funds services and manages the system.

The major service providers on the Sunshine Coast are Queensland Rail who provides rail services, Transit Australia Group (Sunbus) who provide scheduled route bus services, and Buslink, who provide school buses. There is also a taxi system operated by Suncoast Cabs which plays a strong role across the region.

The Sunbus contract is part of TransLink's contracting system and is based on a "gross cost" funding arrangement where TransLink owns all the revenue to ensure integrated tickets and fares are offered between service providers across South East Queensland. This means most decisions to alter routes or service levels are determined by TransLink. Operators are paid to run agreed services to a certain standard, and act as revenue agents for TransLink. There is currently no formal incentive for operators to increase patronage.

Sunshine Coast Council plays an important supporting role in public transport, and views itself as a strong partner to TransLink and the Department of Transport and Main Roads. As Council is the main agency for urban planning and development approvals, it can play a lead role in determining and shaping future needs such as trunk public transport systems to support new communities and urban regeneration.

Other Council functions include improving road use management to help buses avoid congestion, providing funding assistance for road based and kerbside bus infrastructure and funding some services which would not otherwise be offered by TransLink. During key holiday periods Council has used its Public Transport Levy, to negotiate with

TransLink to take over funding for services so passengers travel for free for a limited time.

18.2 The critical future role of public transport on the Sunshine Coast

To meet the Queensland Government's Connecting SEQ 2031 public transport target of 10 per cent for all Sunshine Coast trips by 2031 for an estimated population of around 500,000, the number of daily trips will need to rise to about 175,000 across the region from about 40,000 trips per day now.

That's an increase of more than 300 per cent on today's levels of patronage.

18.3 Best practice public transport system design principles

As the region's public transport system will need to perform a much larger task than at present, we need to have a clear plan on how to develop it. Rather than just more of the same, expansion of the network should encapsulate best practice design principles. The Department of Transport and Main Roads and TransLink have been developing best practice design principles for urban public transport networks in south east Queensland[15]. Their recommended approach includes emphasis on two core ideas:

- Develop a ***branded hierarchy*** of services incorporating:
  - A "trunk" network of direct, high frequency services on the strategic routes across the service area; this can be frequent bus, light rail or regional rail;
  - Local buses that extend service coverage from the trunk routes to areas not immediately accessible by walking to trunk services; and
- Develop a connective network which:
  - Services the full range of destinations within the urban area;
  - Is designed to allow for transfers at key points to provide more journey destinations; and
  - Concentrates vehicle resources to improve frequencies on trunk routes.

These two core ideas are supported by other best practice design features to make public transport more viable as an alternative to car transport, including:

- Attractive interchange points and hubs at strategic locations;
- Faster and more reliable services, such as maximising pre-paid boarding to reduce times spent at stops, and priority for buses on roads where there is frequent congestion;
- Safe and effective access for people walking and cycling to public transport to extend the sustainable transport option right to the front door;
- Park and ride at the edge of the system to attract passengers using car transport beyond the public transport service area; and
- The introduction of real time information through variable message signs at major stops and hubs and through smart phone applications.

18.4 Best practice design of a future network for the Sunshine Coast

To apply these best practice principles including the two "core ideas" of a branded hierarchy and connective network of services to the Sunshine Coast requires specific actions.

---

[15] See Connecting SEQ 2031, pp 51 – 56.

18.4.1 Service branding

The travelling public are well used to road hierarchies, where there are fast motorways for long distance travel, and local feeder roads and connectors for slower local trips. This makes it easy for motorists to understand the network, and plan their trip accordingly. If the trip is longer, the motorist will seek to use a motorway to achieve a higher travel speed and more direct journey. A local trip would be confined to the local street system and made at slower speed.

Many bus systems lack a similar hierarchy. The history of bus planning in Australia has led to systems where one bus looks much like another, differentiated only by route number. As a result the travelling public, especially first time or occasional users, cannot easily recognise one service or route from another and the system becomes less easy to understand and use.

A branded hierarchy of services provides different types of services for different trips, with branding distinctions so the different service types are more easily identified.

Like roads, public transport services have a natural hierarchy. This includes:

- Fast, direct trunk services, often making fewer stops with an accelerated service pattern;
- Slower services making more stops with a local service pattern; and
- Specialised services for discrete markets or areas of weak demand, such as night link services.

Most importantly, a clear service hierarchy allows for the establishment of high frequency trunk service routes that can be mapped and communicated as a higher order network. If a passenger can get to the trunk network, they can easily get to the major destinations across the city. For buses in particular this improves the visibility and recognition of the system to first time users, and can mimic the benefits of fixed track rail services[16].

18.4.2 A connective network

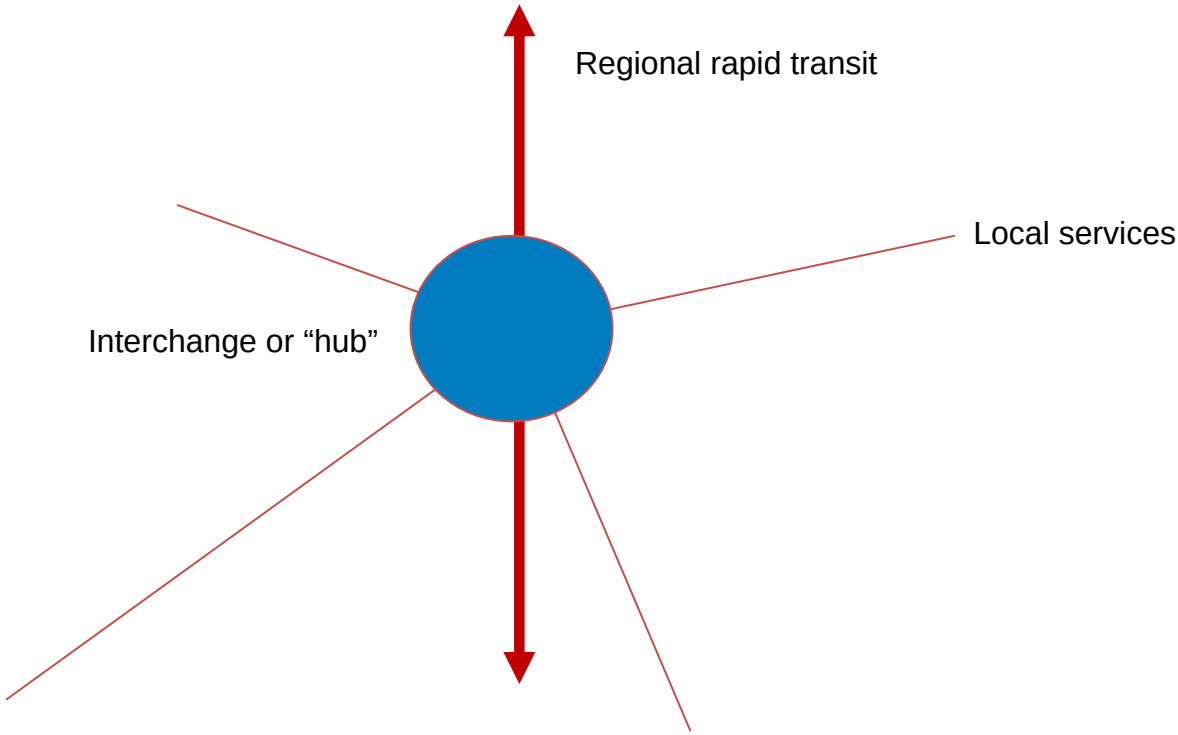
The Sunshine coast bus network has evolved around a traditional network design, “many to one” or single-seat journey planning. This is based on getting a little bit of service to everyone, with a view to getting people to and from one or two major destinations such as a town centre.

Modern cities and lifestyles have requirements for travel to many points across the region. The concept is based on meeting diverse demands for travel to many destinations in a major region. Passengers have the ability to access central and non-central destinations through either a direct route, or by transferring between services. The match of origin and destinations is termed “many-to-many” reflecting the numerous choices offered.

In a lower density urban area, such as the coastal precincts of the Sunshine Coast, a connective network can be achieved via a **trunk and feeder** network where a high frequency trunk service is met by a lower frequency feeder service or a basket of feeder services at a suitable transfer location such as a local centre or major facility, see Figure 18.1.

[16] This is best conveyed through the European catch phrase “think train, use bus”

Figure 18.1: Example of a trunk and feeder network



Some trunk and feeder networks also include timed transfer points where a range of local services are “pulsed” to arrive around the same time, allowing passengers to board or alight from a trunk service, and then depart at about the same time.

As well as offering a much larger range of potential destinations, a connective network avoids wasteful duplication of services, particularly towards the network centre where many routes converge. However to ensure success, the connective network must achieve smooth transfers, and must be supported by long-term investment in improved interchange facilities and include reliable travel information. There must also be a clear trade-off benefit for the passenger needing to transfer, relating to an improved level of service and more destinations offered for passengers. Transfers forced to achieve operating efficiencies alone will not be accepted by the travelling public.

Since it lacks a single CBD as a focus for activity and public transport services, the Sunshine Coast region is best suited to a trunk and feeder based on a very strong trunk route through the proposed light rail corridors.

18.5 The roles played by each type of public transport on the Sunshine Coast

18.5.1 Regional rail

Operated by Queensland Rail, the regional rail system is a fast inter-regional service that connects the Sunshine Coast to Brisbane. Current services on the North Coast line between Nambour and Caboolture are low in frequency. The line north of Beerburrum is poorly aligned and relies on a single railroad, limiting both operating speed and frequency. There is also a mix of train types and operating characteristics e.g. length, speed and frequency, which complicates service planning. A corridor and alignment of the North Coast line as far north as Nambour has been preserved. However there is no

actual timing of the works currently listed by the Queensland Government and in the current economic climate this could be decades away.

If the Queensland Government's proposed Maroochydore Line is constructed in the future it would extend from the North Coast Line at Beerwah to connect Caloundra South, Kawana and Maroochydore. It would provide a high speed intra-regional connection between these key coastal centres and also connect to the key destination of Brisbane, with its government and cultural services, much broader employment market and major international airport. This would offer huge potential for public transport providing an alternative to the congested Bruce Highway.

18.5.2 The future rapid transit system

The future rapid transit system will provide the primary focus for the high frequency trunk network in the coastal precincts of the Sunshine Coast. It will be a local urban mass transit system connecting the major centres of Caloundra, Kawana, Mooloolaba and Maroochydore. Future extensions could link to the airport and possibly the University of the Sunshine Coast and the Palmview growth centre. There will also be opportunities for nodes of higher intensity urban infill at suitable locations along the corridor.

The light rail or similar service could meet the regional rail at stations in Kawana town centre and Maroochydore. Passengers needing to travel between centres served by the regional rail (Maroochydore, Kawana and Caloundra South) would use the faster regional rail system, whereas passengers from local areas and centres not served by the regional rail would use the light rail. The two rail systems are generally complimentary to each other and fill different market needs.

However there are a number of other potential options for connection between the regional rail and light rail projects. Section 11.3 reviews these options at a high level. The objective was to optimise the combination of investments between regional rail and light rail that provides the best overall mix for the Sunshine Coast. The Taskforce did not conclude on the best option, as decisions on such matters are beyond its terms of reference. However it did note that the options of constructing the regional rail spur line as far north as the new Caloundra South town centre, and connecting light rail to that from Caloundra, or constructing a regional rail spur to Caloundra, and connecting the light rail to it there, could achieve both a regional and light rail system and avoid duplication of investment.

18.5.3 Bus network

Buses will continue to provide a major role in public transport on the Sunshine Coast. Public transport trips are predicted to increase from an estimated 40,000 per day in 2011 to 175,000 per day in 2031. It is estimated that at least 90,000 of those trips will be on a bus for at least one leg of the journey. The remaining trips will be primarily on the regional rail and the rapid transit, with taxi accounting for around 4,000 trips per day.

18.6 Planning a supporting bus network for the light rail and regional rail

Buses offer specific opportunities and challenges that are not characteristic to fixed track services, including inherent flexibility and the ability to operate on shorter frequencies. However if bus is to compete with car transport, it needs to incorporate a high frequency trunk network operating on direct routes with reliable running times, supported by local feeder type services.

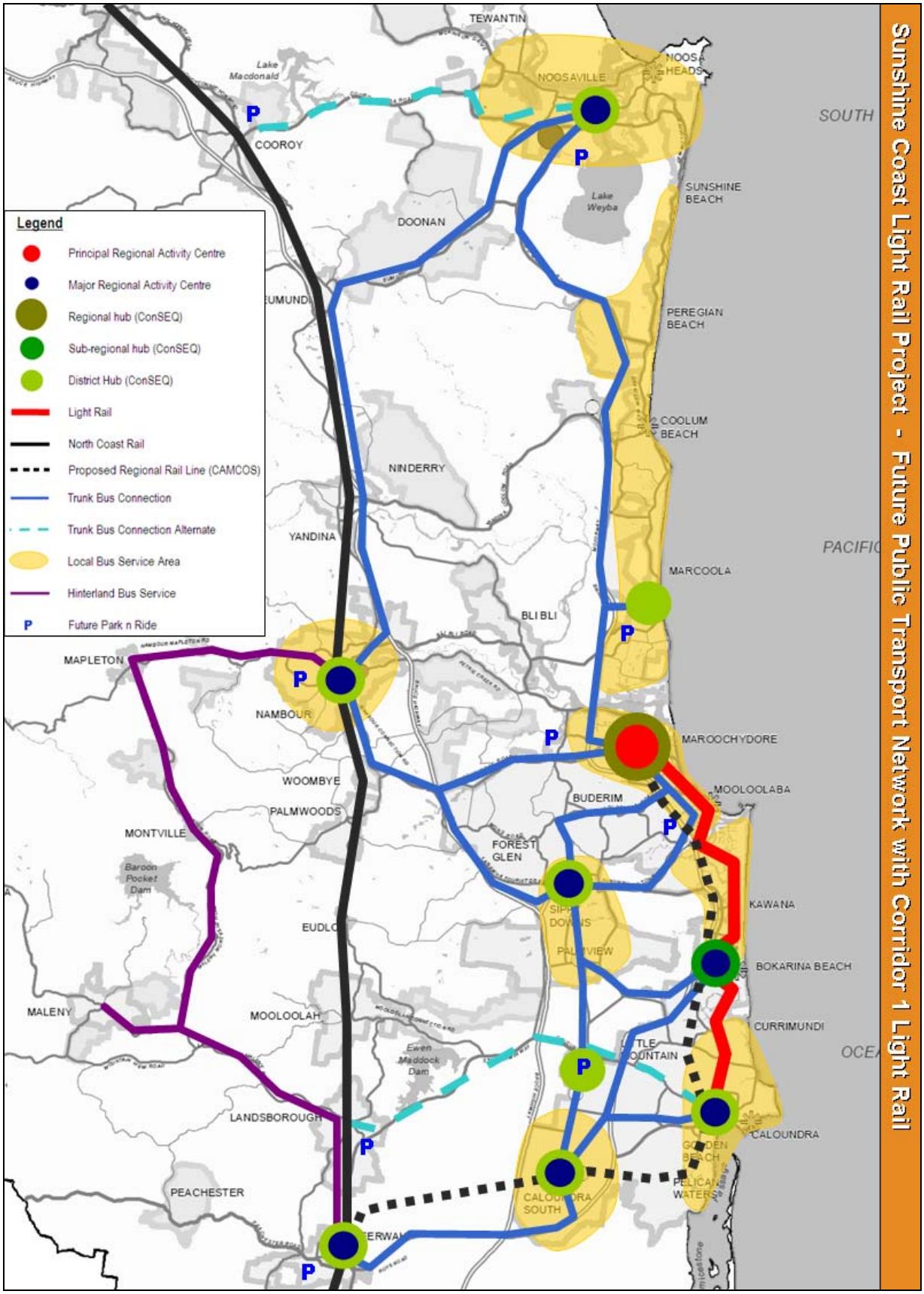
As the region grows, light rail and regional rail will need to be supported by an improved bus system that provides a direct and reliable high frequency bus network across the major movement corridors of the region.

As part of the light rail project work, a preferred network design for buses and light rail has been identified and is shown on the map figure 18.2. Each corridor has a longer term mode up until 2031, and an interim mode, pre 2020, depending on the likely demands assessed in Chapter 10, corridor assessment. For the purposes of this analysis, it has been assumed the construction of the rapid transit system precedes the regional rail line from Beerwah to Maroochydore through Caloundra South, which on current planning seems unlikely to be in place before 2031.

Table 18.1: Major movement corridors and their proposed treatments

No.	Corridor	Longer Term Mode	Interim Mode	Comment
M1	Maroochydore - Caloundra	Light rail/BRT	Trunk bus with priority	Proposed Stage 1 and Stage 2
M2	Maroochydore to Airport	Light rail/BRT	Trunk bus with priority	Possible future stage
M3	Maroochydore to Palmview via USC	Light rail/BRT	Trunk bus with priority	Possible future stage
C1	Caloundra to Caloundra South	Possible light rail/BRT	Trunk bus with priority	Possible future stage
M4	Maroochydore to Nambour	Trunk bus with priority	Route bus	Lower demand
P1	Palmview to Nambour	Trunk bus with priority	Route bus	Lower demand
N1	Airport to Noosa	Trunk bus with priority	Trunk bus with priority	Long running/lower demand
P2	Palmview to Kawana town	Trunk bus with priority	Route bus	Lower demand
P3	Palmview to Caloundra South	Trunk bus with priority	Route bus	Lower demand
CS1	Caloundra South to Beerwah	Trunk bus with priority	N/A	Sunshine Coast Rail will eliminate need
CS2	Caloundra South to Kawana	Trunk bus with priority	Route bus	Sunshine Coast Rail will eliminate need

Figure 18.2: Future Public Transport Network with Corridor 1 Light Rail



18.7 Key transfer locations in the network

As part of developing a connected, accessible public transport network to a maximum range of destinations, it is necessary to identify the preferred transfer points that services can “hub” to, and that can be provided with suitable transport interchanges and bus layover facilities.

Connecting SEQ 2031 has identified a “centres access hierarchy” which shows where the proposed transit hubs should be all around south east Queensland. There are three levels of hub in the hierarchy:

- ***Regional hubs*** form strategic transfer points and will act as the terminus for most regional trunk services. Maroochydore is the regional hub for the Sunshine Coast. It will be a major station in the light rail project, and also be a focus for trunk buses and some local route buses. It will eventually become the regional rail terminus for the Sunshine Coast Line.
- ***Sub-regional hubs*** serve as a focus for services in a major part of the region and are connected to the regional hub by trunk services. Kawana town centre, with its light rail stations and the planned regional rail station, will be the sub-regional hub. As Noosa grows its role as a public transport hub, it may also become a sub-regional hub.
- ***District hubs*** serve areas of local employment activity and are linked to the sub-regional hub or to the regional hub. They may also have a light rail station or a planned regional rail station. The district hubs for the Sunshine Coast are Noosa, Nambour, USC Sippy Downs, Caloundra, Caloundra South, and Beerwah. The Sunshine Coast Airport may become a district hub if the rapid transit links it to trunk buses from Noosa and Nambour and local route buses. There is also a possible *interceptor* or remote district hub at the Caloundra road exit to the Sunshine Coast Regional business park, which is on the major new proposed link road between Caloundra South and Palmview. This could be provided at the junction of planned high frequency trunk bus routes and could also include a park and ride.

18.8 Park and ride

Current best practice principles include park and ride as a way to access public transport from areas of weak passenger demand that may be unable to be served by effective trunk or route buses. Park and ride should therefore generally be provided at the edge of the system to capture and attract passengers using car transport coming from outside the public transport service area. Park and ride also requires good access to the strategic road network, and may be best located near a major motorway interchange or planned arterial road intersection where existing or planned high frequency trunk public transport services will be able to stop.

Providing park and ride at inner urban locations can encourage motorists to drive into the congested road network, leaving their car for only the “last mile” of the journey to avoid paying for parking. This type of park and ride is expensive and not generally supported due to higher land costs, and it also reduces traffic and pollution benefits of using public transport. It can also overload public transport services as they approach critical sections of the network where many passengers are wishing to access public transport by walking from local transit oriented developments.

Potential locations for park and ride have been identified on the map of the future public transport network, figure 18.2. They are all likely to be served by high frequency buses rather the first stages of the rapid transit system as these are located in areas unsuitable for park and ride. Detailed study will be required to establish the best sites, available land and suitable access.

Park and ride is a very important element of the future public transport system and new sites for bus-based park and ride should be identified and secured irrespective of whether the Sunshine Coast Light Rail project proceeds.

19 Project delivery options

19.1 The Potential for innovative funding sources

The expected benefits of implementing an improved public transport system such as Light Rail are far greater than the capital and ongoing costs expected to be required to implement them. Nonetheless, the initial upfront investment required to implement an improved public transport system such as Light Rail is no small undertaking. With this in mind, part of Phase 1 included assessments associated with the ability for the Sunshine Coast Light Rail Project (SCLRP) to be a Private Public Partnership (PPP).

There is great potential for a system such as the SCLRP to be developed through a PPP. Building on the franchising model developed for the Gold Coast, the Sunshine Coast project is expected to be designed specifically to ensure that private sector investors' risks are minimised in a way that can be controlled by Government. This will allow the expected call on public funds to be minimised while ensuring that the attraction to private sector interests is maximised.

In addition to PPPs, other potential funding streams were investigated in Phase 1, including:

- Connectivity Gain/Land Uplift Capture (LUC);
- Development Gain;
- Advertising revenue;
- Tax increment financing;
- Ticketing revenue streams and mobility management services;
- Parking Charge/Levy;
- Congestion Charging/Tolling/Road Pricing;
- Public Transport Levy/Other Levies; and
- Visitor/Tourist Levy.

The funding streams vary and some are more likely than others to attract community concern or negative response. The potential funding opportunities considered to have the most potential and be most suited to the Sunshine Coast at this early stage can be broadly categorised into three areas:

- Land Uplift Capture (LUC);
- Public transport levy; and
- Advertising.

Land Uplift Capture: The Land Uplift Capture (LUC) methodology uses the increased potential value in land adjacent to the proposed light rail corridor to provide funding mechanisms for the project. The rationale is that public transport infrastructure projects usually result in substantial increases in land values surrounding stops and stations and development opportunities which are traditionally capitalised on by land owners. Under LUC a proportion of this value is captured by the public authority and used towards project funding.

LUC is considered a viable opportunity to capture potentially significant project funding. Conservative estimates indicate this mechanism could raise around $230 million, although it may have some requirements for seed funding. If the project moves to the

next phase, the opportunity to realise land value capture gains and allocate them to the project will need to be investigated further.

Taxes and levies: A parking levy or visitor tourist tax in the form of a “bed tax” would not generate the necessary funds needed for such a substantive project and should only be considered a potential complementary source of income. The most likely levy option is to continue the Public Transport Levy and accrue capital savings a part of future Council contribution to the project, as has been done by Gold Coast City Council.

Advertising: Outdoor advertising also presents a considerable opportunity that is highly suitable to the SCLRP. Conservatively it was estimated that around $4 million per annum could be raised through this mechanism. It is noted that the implementation would depend on ownership arrangements and agreements with third parties that would provide the required vehicle to generate advertising revenue.

19.2 Making the project attractive to investors

Government and the private sector have different roles in delivering a major mass transit project. The Government is responsible for planning and controlling the project and the private sector is responsible for building project elements, operating and maintaining the system.

A PPP project is the best way to ensure the call on taxpayer funds is minimised.

An important feature of a successful PPP is to ensure risks to private sector investors are minimised and limited to those they can fully control. The Taskforce recommends the government delivery agencies, both Commonwealth and State, take all possible steps to minimise and mitigate risks to the private sector as part of the future delivery model.

20 Risks and Issues

"Talking to politicians, getting them on board we need to be very clear about our message and priorities. Where does light rail fit within the bigger picture?"

Stephen Dittmann, Chair, Sunshine Coast Chambers of Commerce Alliance; member of the Sunshine Coast Economic Development Advisory Board and Light Rail Taskforce member

20.1 Project Risk Overview

Risk assessment and allocation is a vital element of project planning. It enables design elements to be included in the project to reduce risk, and risk allocation to be made to the party most able to manage it. In the case of innovative financing models involving private sector investment, this risk allocation provides the opportunity to make the project an attractive investment.

A preliminary project risk assessment has covered the planning, procurement, design and construction, and operating phases. Table 20.1 provides details of this initial assessment, including some suggested mitigating actions. The current experience from the Gold Coast Rapid Transit Project and the input from the Taskforce have also been included in this assessment.

The risk review covers major risk areas and anticipated mitigation strategies. At this stage it does not include a formal quantification of likelihood and consequences with or without the mitigating strategies. The risk assessment relies on a qualitative assessment of risk following implementation of possible mitigation measures.

The major risks associated with a rapid transit project on the Sunshine Coast include:

- Funding risk; the potential that the absolute amount of funding required cannot be secured from government and the private sector;
- Climate change; the risk that impacts including sea level rise may cause the project to fail;
- Community understanding and support; the extent to which the need for a public transport project of this nature is appreciated by the community;
- Corridor selection and managing any property acquisition and construction impacts on adjoining properties;
- Engineering risks including those associated with river and canal crossings, and in locations subject to infiltration, subsidence or inundation;
- Constrained construction site, with major potential impacts on road users, adjoining residential and commercial properties, including worker and public safety, and congestion and other construction impacts (e.g. noise, blocked accesses); and
- Managing public utility relocations, including service disruptions, and dealing with any non-planned utilities disturbed by construction activities.

Broader risks beyond the direct high risks have also been identified. They include:

- Integration risk; the concern that other modes of public transport may not support the new rapid transit system;
- Competition risk; the possibility that other providers might set up in competition with the rapid transit system;
- Failure of a partnership between Local, State and Federal Governments ; and
- Environmental risk; the need to protect and preserve the local environment.

All of the risks associated with the project are considered normal for a project of this scale. Perhaps two risks that need to be highlighted in the next phase, the business case, would be:

- Funding risk, given the current issues surrounding budget development by governments in Australia; this means the strongest possible efforts must be made to structure the project so as to capture land value gain, and to make it attractive to private sector investors; and
- Climate change risk; if predictions of possible sea level rises prove correct, some parts of the route may need to be provided with bunds or revetments or other measures to maintain freeboard.

More comprehensive risk assessment will form part of the business case and subsequent detailed planning and design phases, should the project proceed. This will include the measures necessary to mitigate high risks.

Table 20.1: Preliminary risk register

Phase	Risk Driver/Cause	Impact	Treatment Action	Residual Risk Rating
Planning	Suitability of preferred route	Project viability & and community support	Comprehensive pre-feasibility phase	Low
	Forecast patronage too low	Project viability	Conservative planning assumptions	Medium
	Adequacy of scoping	Project viability	Lessons learnt from other projects (e.g. GCRT)	Medium
	Adequacy of capital estimates	Project viability	Engagement of experience consultants	Medium
	Planning approvals -land impacts	Cost increases/delays	Establishment of competent, resourced Owner's team	Low
	Planning approvals- environmental impacts	Cost increases/delays	Early engagement with key stakeholders	Low
	Suitability of site for depot	Increased cost and greater land use impacts	Provision of appropriate contingency (budget, schedule)	Medium
	Achieving desired trip time (road user priority measures, intersection and SCLR road crossings) not approved.	Competitive journey time not achieved -reduced likely patronage		Medium
	Loss of on-street parking (where required to fit SCLR)	Adverse publicity from land owners/businesses affected		Medium
	Design of terminus stations and major interchanges not acceptable to public, local businesses	Possible cost increases and loss of functionality		Low
Procurement	Suitability of procurement model adopted	Level of market interest and pricing competition	Lessons learnt from other projects (e.g. GCRT)	Medium
	Suitability of Risk allocation model	Level of market interest and pricing competition	Engagement with likely contractors	Medium
	Inadequate client management of procurement process	Increased costs/delays	Establishment of competent, resourced Owner's team	Medium
	inadequacy of specification of requirements (quality, reliability,	Inadequate performance, poor publicity, possibly extra costs/delays	Specifying proven products, designs	Low
	Funding availability and certainty	Delays, poor publicity, potential extra costs		High
Construction	Poor management of impacts on adjoining properties (access, parking, construction noise, safety, services disruptions)	Increased costs/delays/poor publicity	Rigorous selection process of contractor and team (experience, skills, adequate resourcing)	Medium
	Poor management of road traffic impacts -site constraints	Increased costs/delays/poor publicity	Properly resourced contractor's and owner's teams	Medium
	Poor management of road traffic impacts -construction vehicles	Safety, poor publicity	Effective project/design/construction management, controls, reporting	Medium
	PUP impacts (planned & unplanned)	Increased costs/delays/poor	Design/construction solutions to ensure fit for purpose, no	Medium

		publicity	surprises, effective management of impacts (traffic, property)	
	Adverse geotechnical latent conditions (bridge crossings and soft ground conditions)	Increased costs/delays	Adequate engineering investigations at feasibility stage	Medium
	Dealing with acid sulphate soils	Increased costs/delays	Engagement with key stakeholders (including service authorities, TTA, property owners likely impacted)	Low
	Inadequacy of bridge design solutions (scope definition)	Increased costs/delays	Provide adequate contingency (budget/schedule)	Low
	Excessive wet weather	Increased costs/delays		Medium
	Construction safety with constrained worksite	Injuries, delays, extra costs, poor publicity		High
	Client initiated scope creep	Increased costs/delays		Medium
	Inadequacy of Contractor performance (management, quality, financial, resource availability)	Delays, poor publicity, possible extra costs		Medium
	Adverse impacts on operation of existing CoastConnect bus services during construction	Delays to bus services, reduced patronage, increased road congestion.		Medium
	Inadequacy of commissioning activities	Delays and potential increased costs		Low
	Loss of key staff (contractor's and owner's)	Increased costs/delays		Medium
Operation	Safety with road interfaces	Injuries, impacts on services, poor publicity, impacts on future patronage	Adequacy of design/signage, maintenance and public awareness campaigns.	Medium
	Public and passenger safety	Injuries, impacts on services, poor publicity, impacts on future patronage	Rigorous selection process for O & M contractor	Medium
	Inadequate operating establishment, with inadequate training	Impacts on services, poor publicity, impact on future patronage, potential safety risks	Effective contract management of O & M contract (by Owner and Contractor)	Low
	Inadequate recruitment plan and inability to retain skilled workforce	Impacts on services, reliability	Utilise proven equipment, design solutions	Low
	Inadequate maintenance practices	Impacts on services, poor publicity, impact on future patronage, potential safety risks		Low
	Poor timetable reliability	Poor publicity, impact on future patronage		Medium
	Vandalism damage	Poor publicity, impact on future patronage, extra cost to repair		Medium
	Patronage less than planned	Poor publicity, impact on who is taking patronage/farebox risk		High
	Patronage greater than available capacity - overcrowding	Adverse publicity. Delay to acquire extra capacity		Low
	Commuter parking around major light rail stations	Adverse local community complaints		Medium
	Inadequate management of the O & M contract by Owner	Likely extra costs, poor publicity, reduction in quality of services		Low

Risks and issues have been identified in a preliminary way in line with the Queensland Government's Project Assurance Framework. Should the project proceed to full feasibility, these risks and issues will be reviewed and actions included, to mitigate potential negative impacts.


Sunshine Coast
Council
lightrail
2020

PART IV – The way forward

21 The Taskforce Conclusions

"The service delivery potential of a Sunshine Coast light rail is a stark contrast to the consumptive, resource depleting nature of car travel."
Natasha Hart, Light Rail Taskforce community representative

21.1 Deciding whether to proceed

For such a major public transport improvement project to succeed on the Sunshine Coast there should be a reasonable prospect that all three spheres of government are interested in contributing to its planning. Council has demonstrated its ongoing commitment to the rapid transit project, and has now received approval from the Commonwealth Government for $500,000 funding under the Liveable Cities Program to help complete feasibility and business case studies planned for 2012-2014.

The Queensland Government is presently reviewing its position on major transport investments in south east Queensland. Council will continue to work with the Queensland Government to enable a jointly funded feasibility and business case process. The Taskforce believes it will be possible to demonstrate a need for a business case to the Queensland Government in the near future. Since the Council and the Commonwealth have the resources to proceed with at least the major elements of the business case, the Taskforce believes the business case could be commenced in 2012 with further discussion to continue with the State regarding their level of support.

A comprehensive business case will need to be established before the project can meet the stringent approval requirements of the Queensland and Commonwealth Governments. This should be developed over the next two years. The business case would need to demonstrate conclusively that the project:

- Meets national, state and local goals for a strong economy, a sustainable environment and an improved quality of life;
- Establishes clear service requirements and represents the best option for achieving them;
- Is soundly based and can be feasibly constructed; and
- Represents excellent value for money.

This pre-feasibility report has established there is a very strong possibility all these requirements can be satisfied by a light rail based rapid transit project on the Sunshine Coast. However a strong business case will not be enough. As the 21st century unfolds, all spheres of government are finding it increasingly hard to provide expected levels of service in the face of increasing costs, and an unwillingness on the part of the community to debate increased levels of taxation. In a highly competitive funding environment, the project will also need to demonstrate a maximum level of local community support, and a willingness of the private sector to engage with the project, either through direct contributions, or through supportive activities and contributions in-kind.

21.2 Summary of findings from the pre-feasibility phase

The Taskforce has found that the two light rail options, **Option 3 Light Rail At-grade and Option 6 Light Rail Hybrid** are considered to be the projects worth pursuing on the Sunshine Coast based on the overall results of the economic assessments, and the expected benefits to the community, the economy and the environment. Both these options:

- Provide a robust BCR under all discount rates assessed;
- Are likely to produce significant economic impacts with regard to output, value added and employment; and
- Deliver positively on all social elements included.

The partially elevated **Option 6** will need careful consideration as to where elevated track on structure may be provided. There will need to be trade-offs between faster running times and visual impact, and of course construction costs which are higher for elevated systems.

Option 2, Bus Rapid Transit also has many potential benefits, though it runs the risk of having insufficient capacity as a long-term option. A Bus Rapid Transit option that could begin to match the benefits of light rail, though slightly cheaper would still be expensive. Its ability to meet the required transport task should be carefully considered.

The **other options** (Coast Connect, Monorail and Light Rail Elevated) deliver positive outcomes under a limited number of discount rates assessed. However they have significant drawbacks, and cannot meet the full range of project objectives. Options 1, 4 and 5 are therefore not recommended for further investigation.

A low cost bus based option based on CoastConnect could deliver interim benefits and might be a forerunner to light rail or Bus Rapid Transit however it is unable to meet fundamental project objectives relating to a swing to sustainable transport and transit oriented lifestyles. It would not be a “game changer”.

21.3 The Taskforce recommendations

The Taskforce recommends Council draw a “line in the sand”, and promote a major rapid transit project above the many significant and expensive proposals for new freeway style roads. Large new road projects will ensure the need to massively increase car parking and perpetuate the present “car city” mentality that applies across developing Australian communities. The Taskforce believes the Sunshine Coast is uniquely placed to demonstrate how an emerging city in Australia can act before the undesirable trend towards car dependence is fully entrenched.

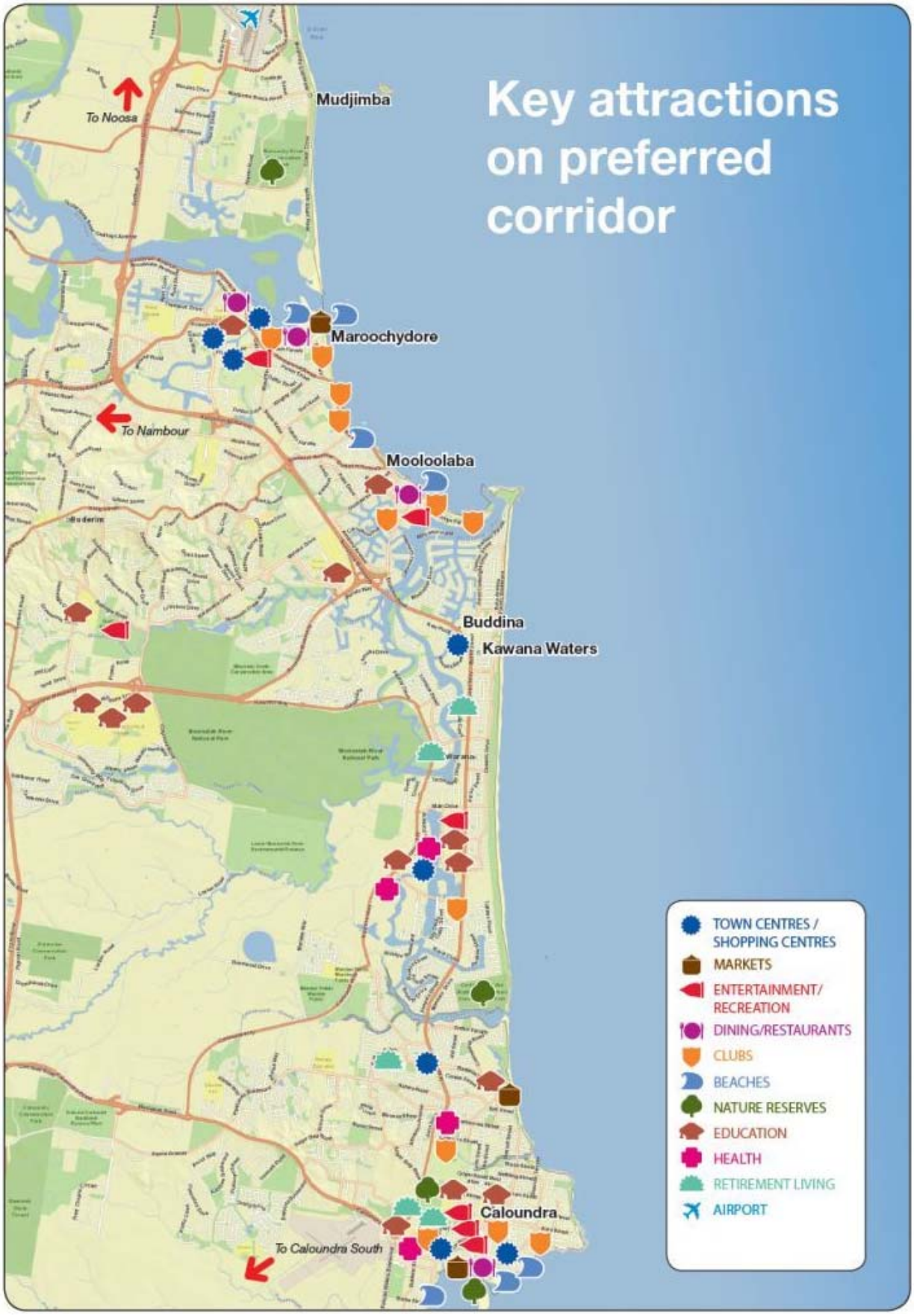
The Taskforce has noted the very considerable efforts made by the Gold Coast over the past 15 years to turn the trend away from more and more roads and more and more car parking. Its light rail project is a model for all medium sized Australian cities. The Taskforce believes the Sunshine Coast can achieve even greater benefits than the Gold Coast because it is acting at an earlier stage in the development of the region.

The Taskforce therefore recommends Council endorse the next step toward the Sunshine Coast Light Rail vision by proceeding to feasibility and full business case.

The preferred corridor would link Maroochydore with Caloundra. This is the primary activity corridor in the region and contains many of the key attractions to potential public transport users. There would be a connection to the Kawana Town Centre and health precinct. It could be developed in two major stages based on an initial connection between Maroochydore and the new hospital precinct at Kawana.

Other routes should be anticipated and could be separately investigated. It is clear key destinations like the Sunshine Coast Airport and the University of the Sunshine Coast and the Palmview growth corridor would be potential attractors for future routes. Longer term connections to Caloundra South, Noosa and Nambour could also be anticipated.

Figure 21.1: Key attractions on preferred corridor



The corridor from Maroochydore to Caloundra includes many of the region's key attractions.

The technology options considered should include:

1. The reference case; light rail at-grade;
2. A hybrid option for light rail with some sections elevated to improve running speeds; and
3. Possibly a Bus Rapid Transit option if it can be demonstrated the BRT has the potential to meet the longer term requirements for public transport patronage.

Caution should be exercised in adopting a cheaper long-term solution based on an upgraded bus system running in conjunction with general traffic or partially in kerbside bus lanes as proposed by CoastConnect. While these options give the comfort of saving money and providing a basic service, this form of bus transport does not have the ability to attract passengers out of cars, nor the pulling power to encourage a range of lifestyle opportunities along its corridor.

The Taskforce believes a project based on low key bus options will not be a “game changer”. The CoastConnect project could however be a practical forerunner to light rail or Bus Rapid Transit while demand builds and funding for a major rapid transit scheme is sought. Planning for the ultimate rapid transit system should however not be delayed by such an approach.

22 Moving to full feasibility and business case

The Project Assurance Framework (PAF) is the Queensland Government's framework for determining which projects are to receive public funding. The PAF has specific requirements when undertaking a full business case. These can broadly be described as follows:

- Determine whether the project should be progressed through traditional delivery mechanisms or as a potential PPP project;
- Establish project organisation and governance arrangements for leading and managing the project;
- Develop a detailed plan & budget;
- Review the objectives from Phase 1 and confirm the outcome sought for the project;
- Evaluate the project technology options ;
- Confirm/review the project organisation and governance arrangements;
- Conduct a detailed evaluation of the costs, risks and benefits associated with the identified project options;
- Recommend a preferred option;
- Consider delivery options;
- Develop a project implementation plan for the preferred option; and
- Seek approval from the State to proceed.

The economic assessments undertaken in the rapid appraisal have provided a comprehensive basis for moving forward to full business case. The framework utilised will be maintained and the inputs reviewed. To ensure the most comprehensive outcomes of the full business case a number of data/information will be required. This will include:

- Sophisticated transport modelling outputs from a multi-modal transport model;
- Review / updating of all assumptions made for the CBA, economic impact assessment and social impact assessment, including the utilisation of the 2011 census data upon its release; and
- Detailed costings of the preferred options to be taken forward.

23 Communications strategy

Community support is essential for a successful migration to public transport as a serious part of transport on the Sunshine Coast. The best way to enlist community support is to have ongoing dialogue about the consequences of a car dependant future, and the potential benefits of a major rapid transit system to lifestyles, the look and feel of the region, and the potential to reduce our exposure to key risks such as those posed by oil depletion and climate change. This chapter outlines efforts to date to have dialogue with the region's community. Chapter 24 sets out the potential role of communications activity in the future.

What will not change behaviour is more of the same.

23.1 Communications so far

The communications objectives for local residents and visitors to the Sunshine Coast have been identified as:

- Create and build awareness;
- Create and grow community and stakeholder support;
- Inform and educate community (expectations, timing, impact); and
- Foster an informed media.

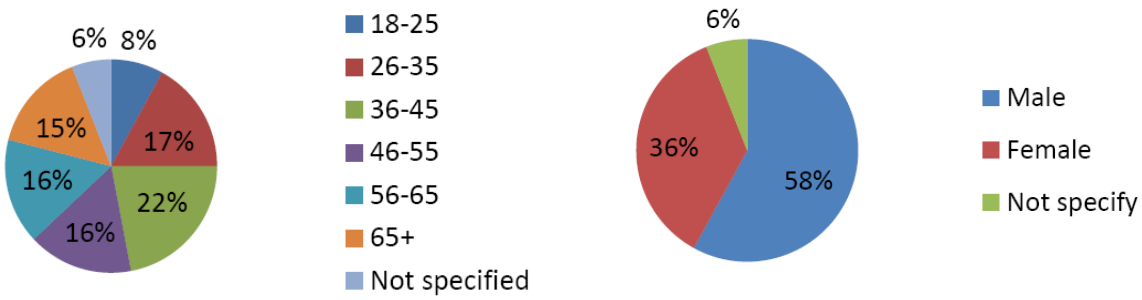
The key messages have centred on the role of a major new rapid transit system on the Sunshine Coast as a **game changer**. As a world class, new, modern service, it represents a 'one off' opportunity and a unique platform to leverage the benefits of sustainable transport on the Sunshine Coast and its relevance to the economy, the quality of its places and much valued lifestyle.

23.2 The communications strategy – making it relevant and real

The consultation hub, www.sunshinecoastlightrail2020.com.au was an online community engagement portal launched in January 2012 to encourage community participation and debate, monitor concerns and opinions and educate via forums and survey polls.

People from all areas of the Sunshine Coast have joined in the conversation, with strong participation from both the coastal and inland towns. As at 2 August 2012, more than 2,936 people have visited the site, with 329 downloading further information, 228 taking polls and 184 registering for ongoing communications. The demographic data collected from the registered participants showed all age groups were well represented, the highest being 36 to 45 year olds at 22 per cent, followed by 26-35 year olds at 17 per cent. Many visitors joined in forum discussions and posted informed comments and questions.

Figure 23.1: Age and gender breakdown



23.3 What are the key themes being discussed?

Key comments, queries and themes posted on the consultation hub so have covered a broad range of topics including:

- Need for and timing of the project;
- Possible routes;
- The importance of frequency and reliability;
- Technology options other than light rail;
- The importance of supporting buses and the need for the service to benefit the entire region;
- The importance of speed relative to the car;
- Connections and the importance of regional rail;
- Need for affordable fares;
- Improvement to interim public transport before light rail;
- Long-term planning;
- Environment protection;
- Climate change and peak oil;
- Transit oriented development and relationship between managed density and sustainable patronage;
- Costs and funding options;
- Airport and key connections;
- Increased population and future demand; and;
- Importance of protecting lifestyle.

23.4 Was there debate on the forum?

Open forums on the consultation hub encourage discussion and debate. Of all the comments registered, 90 per cent were favourable and constructive. The minority of comments that expressed some negativity tended to focus on broader issues and skepticism that improvements would occur to public transport on the coast within the next two decades.

These comments from the hub represent the views of many who have registered their support for light rail:

"I believe a light rail system would help prevent urban sprawl and boost our economy. The biggest single challenge is funding. Innovative solutions are needed. The coast needs big thinkers and the will to make this happen…"

“If light rail is not operating by 2025, the Sunshine Motorway, Nicklin Way and other major areas will be "gridlocked"

“The question isn't 'if', but 'when'. Oil production has already peaked. Light rail should have been introduced to the coast a decade ago.”

“Light rail is the fastest and most comfortable medium, and would attract many travellers away from cars…”

“Transport is the crux of any successful town or city. A rapidly growing destination needs to have the support of an innovative council and community in order to sustain and profit from that growth. The potential positive impact the light rail will have on local tourism is enormous.”

The light rail is the environmentally responsible answer to our transport woes while protecting the ecology of the coast. The light rail will bring more students to the region and importantly will be the reason why we retain those students once they graduate where at the moment we are losing many of our most talented graduates to the cities because of lack of infrastructure”.

“The Sunshine coast desperately needs a good rail system, and it needs it now. The traffic continues to worsen as the population continues to increase. For too long it appears that road widening is considered the answer to congestion...Light rail would be a great improvement…”

Some comments from the hub represent the views of those with concern for example:

“Busways can provide all the advantages of light rail at a fraction of the cost if they have their own rights of way. Unfortunately, the Brisbane Busways have been built to standards that are more appropriate for heavy rail and are thus extremely expensive. The only noticeable advantage that light rail has over Busways is image, so important to politicians.”

“There hasn’t been any discussion about a business model [especially in light of the history for BOOT and PPP’s projects] which needs to form part of the strategy development phase.”

“Light rail becomes viable once the population reaches 500,000.Our population is expected to reach 500,000 in 2031. That's 20 years! Until then, we need to improve the bus network - fast, convenient, regular.”

“I live in Tewantin. There's no mention of the light rail including the northern end of the Sunshine coast which is a shame. I would have liked to have seen it cover this area right down to Caloundra. Just to get to Brisbane via rail is a pain as I have to drive to Nambour if I want a return trip. So a light rail does not have any benefits for us up here.”

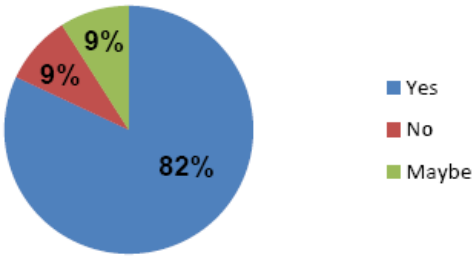
“I do not understand the logic of creating yet another transport route (light rail) when the existing ones do NOT work. A rail trip from the Sunny Coast to Brisbane is over two hours, expensive and no guarantee of a seat. Why extend a system that desperately needs an overhaul?”

23.5 Does the Sunshine Coast community support light rail?

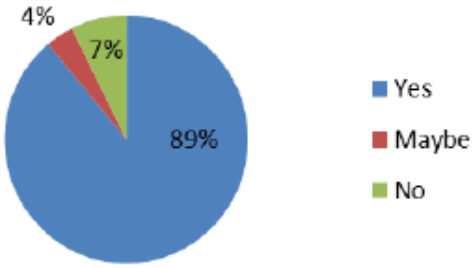
Based on the ongoing forum discussions and the results of on-line polls, at this early stage of consultation it appears the community supports the introduction of light rail on the Sunshine Coast. The consultation hub provides reporting and analysis data including demographic information which has delivered a preliminary picture of resident attitudes. This support is outlined in the graphs below. It should be the noted sample sizes vary between polls. As they include a cross section of ages, residential locations and gender they are useful to draw preliminary conclusions however further community consultation is recommended.

Figure 23.2: Consultation hub survey results

Do you support the introduction of light rail on the Sunshine Coast?
(Survey sample size 100)



Would you consider using light rail instead of your car for some trips?
(Survey sample size 30)



Preliminary communications activity indicates the Sunshine Coast community supports the introduction of light rail and will embrace an improved public transport alternative to the car if given reason and motivation to do so. More effort will be needed to ensure further community dialogue in the future phases.

24 An action plan to proceed to full feasibility and business case

The Taskforce has recommended the development of the next phase of project planning, with consideration of how and when the project should be developed. To guide the next phase, an action plan is suggested.

24.1 A transition plan

Development of any major transport project requires a transition plan that can progress the major elements in stages, to allow the community to plan and adjust to the change. While action should begin as soon as possible to take advantage of the rapid changes in urban settlement and community travel culture, the development of a major new transit system on the Sunshine Coast must be achieved over a realistic timeline. This will allow for allocation of government funding, maximisation of private sector investment, and community dialogue and consideration of a full range of options.

The following major steps have been identified as part of a transition plan:

- Adoption by Council of a preferred scheme for a major rapid transit project, with light rail at-grade remaining the reference case, consistent with its agreed long-term agenda for major projects;
- Drawing a “line in the sand” when it comes to choosing between major high speed motorway or arterial roads, and investments in public transport. Future planning for transport on the Sunshine Coast must consider the light rail reference scheme as part of “future proofing” the transport system and evaluating transport system scenarios that deliver moderated traffic capacity increases;
- Adoption of preferred urban infill nodes within the planned corridors for light rail. Through ongoing review of its new draft Planning Scheme, Council should promote better land use and transport integration along the transit corridors and discourage major new development anywhere else;
- Preservation of future corridors for light rail, which requires direct paths and expanded curve radii to eliminate the possibility of wheel squeal;
- Development of high frequency trunk bus routes either as forerunners to light rail where it is planned, or as the ultimate mode in high frequency bus corridors;
- Reviewing town planning regulations to implement a switch from requiring developers to provide a minimum amount of car parking supply in major centres, to a regulatory regime which reduces parking requirements in return for support for the light rail, through capital, contribution of land, and development of transit supportive buildings;
- Undertaking further planning for the future public transport network in co-operation with TransLink, including in particular identifying:
    - Possible bus and rail station sites;
    - Key network transfer points and hubs; and
    - Park and ride sites.

    This planning would allow Council to leverage support from within other government and private sector planning processes to ensure these critical transfer and park and ride sites are secured and can be developed as funding permits.

24.2 Governance

A major catalytic project such as the Sunshine Coast Light Rail cannot be provided by a single authority acting alone. It will require a partnership between the relevant levels of government and strong support from the community. Council will need to make this partnership a priority, in particular enlisting the support of the Queensland Government. This can include the establishment of an inter-governmental steering committee to guide Phase 2.

24.3 Undertaking full feasibility

A full feasibility investigation will allow more detailed study of the proposed project solution, and testing of the performance of a discrete range of options. This will include comprehensive modelling of future land use impacts and potential demand for public transport across the Sunshine Coast.

The feasibility will also establish whether the project can be delivered within an established timeframe, and provide a detailed budget estimate. There will be a need for field-based engineering investigations, and robust cost estimation based on actual construction requirements.

Possible staging and alignment options will also need to be reviewed, and a preferred alignment established. Community consultation will address all these issues and any potential impacts on current properties along the preferred corridor.

24.4 Completing the business case

Business case requirements will include:

- The project meets national, state and local goals for a strong economy, a sustainable environment and an improved quality of life;
- The service requirements for the project are clearly established and the project represents the best option for achieving them;
- The project is soundly based and can be feasibly constructed;
- The project represents excellent value for money; and
- Identifying the optimum project scope and staging, and the delivery option likely to provide best value for money.

24.5 Assessing environmental and social impacts

The project will need to meet Queensland Government and Commonwealth Government environmental impact assessment requirements. Given the nature of the environment proposed for the initial stages, it appears unlikely the environmental component will provide onerous investigation and exhaustive field study needs.

A preliminary assessment has been made of environmental and social impacts of a potential rapid transit project in the preferred corridor from Maroochydore to Caloundra. There do not appear to be any “show stopper” issues in either of these two areas.

Environmental investigation will be required in future more detailed stages of project planning to consider impacts and determine management measures in a number of areas including:

- Noise and vibration;
- Ecology in key parts of the route;

- Flooding and storm tide inundation on some sections of the route;
- Visual amenity impact of elevated track in option 6; and
- Air quality for bus options in option 2.

24.6 A funding and revenue strategy

The project will have very substantial costs, and will need to compete for funding in an environment where funding for capital infrastructure is increasingly scarce. As part of the Phase 2 investigations, a comprehensive funding and revenue strategy will need to be developed that leverages maximum benefits off local developments, maximises opportunities for innovation and private venture capital, and considers the amount and source of public funding that will be required.

An important facet of this work will be to prioritise local infrastructure needs, particularly with regard to those facilities which encourage car travel to major centres, compared to the needs for public transport infrastructure and services. By taking a strong stand on what type of transport facilities it wants to see, and clearly articulating when and where they are supported, the Sunshine Coast community can take control to position itself as a real influencer of the future.

A useful comparison for a likely funding model might be drawn from the Gold Coast, although it must be noted world financial markets and government budget positions do seem to have deteriorated since that project was approved in 2009.

The Gold Coast Rapid Transit project is presently under construction and the 13 km stage one will open in 2014. The costs of that project have been shared by all three spheres of government and are spread over some 8 years of project planning and construction.

The breakdown of funding has been advised as:

- Gold Coast City Council $ 120 m
- Commonwealth government $ 365 m
- Queensland Government $ 464 m

It should also be noted:

- Construction risk (the potential for building cost over runs) is shared between the Queensland Government and the private sector consortium; and
- Patronage risk, the risk that insufficient patrons use the system and it does not generate expected fares revenue, is taken by the Queensland Government.

Notwithstanding the concerns expressed by some local citizens, the Gold Coast Rapid Transit project can never provide unforeseen impacts on the City Council budget because its contribution is limited to a capped stream of capital payments. It is not exposed to patronage risk.

The Gold Coast City Council adopted a transport levy in 1999 to help it bank money to cover its share of the capital. As Sunshine Coast Council already has a multi-purpose public transport levy, this seems a legitimate and worthwhile option for Council to consider.

The Gold Coast project includes an element of private sector financing that is subject to commercial-in-confidence arrangements. It is generally understood this franchise

includes the private sector providing an amount of funding, perhaps around $50 M in return for a revenue stream of availability payments from the Queensland Government.

It should be recognised that private sector venture capital is difficult to attract to public transport projects due to the loss making nature of public transport ventures. Whereas a toll road may in some cases expect to operate at a long-term profit, thereby generating a return on private sector venture capital, no such opportunity usually exists for public transport projects.

The need for the Sunshine Coast project to operate within an integrated fares structure further complicates this. The private sector *Airtrain* in Brisbane was developed prior to TransLink and has much higher fares than the TransLink system. This enables the *Airtrain* to seek a return on investment of private sector venture capital.

Private sector contributions may be obtained from development opportunities that are increased by the rapid transit project. In theory these can be leveraged by clever project structuring and ideally, pre-purchase by the government of developable land in the corridor. In practice this has not been achieved as yet in Queensland for a public transport project. It needs to be an integral part of the project design and could be further developed in the full business case process.

24.7 Future communications and engagement strategy

Bringing the community and its key influencers and stakeholders on the light rail journey is integral to project success and a fundamental part of the behavioural change process. Communication, education and engagement has begun and is recommended to continue for the life of the project to create a unified Sunshine Coast approach and solid partnerships across all sectors of business, education and the community. The proposed approach is outlined in the model below.

The communications strategy for Phase 2 needs to be implemented alongside the technical and business case studies. The dialogue already established with the community should be built upon so the debate centres on matters relevant to the need to improve public transport, the role of roads and traffic in the future, and the consequences of not acting.

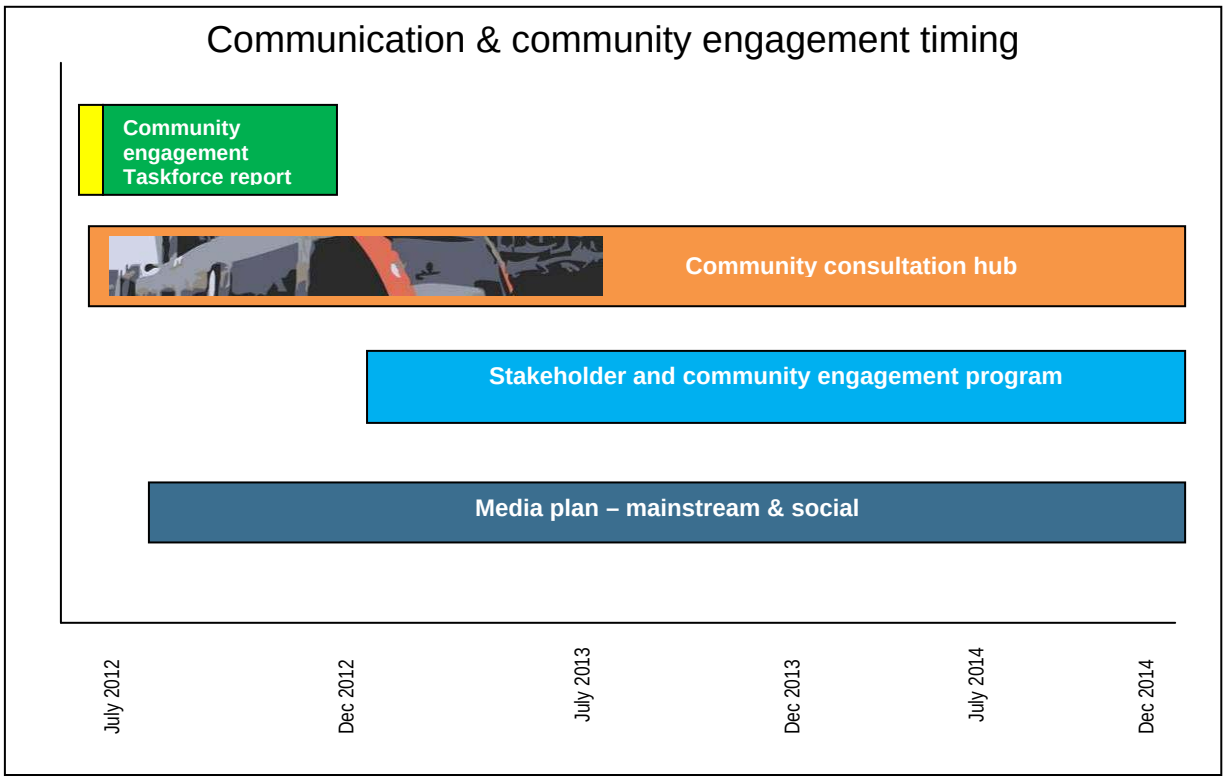
Most importantly, we should recognise that there will be many steps to be followed, and many decisions to be taken, before a major project can be implemented. While there will always be people opposed to anything new, we must not let debate centre on short-term thinking, or to focus on negative issues such as any new revenue measures that may need to be considered.

We must focus on whether we want to proceed, and if so, how we can do it.

Figure 24.1: Communications and engagement strategy

Proposed timing is outlined in Figure 24.2 below:

Figure 24.2: Communication and community engagement timing



.

Glossary of terms

ABS	Australian Bureau of Statistics
Accessibility	The ability to reach desired goods, services, activities and destinations. Access is the ultimate goal of most transportation.
Avoidable congestion	Avoidable congestion is described as situations where the benefits to drivers of travel in congested conditions are less than the costs imposed on other members of the community and consists of business time costs, private time costs, extra vehicle operating costs and extra air pollution costs.
Busway	A separate carriage way for buses.
CoastConnect	Quality proposed public transport bus infrastructure between Maroochydore and Caloundra.
Connecting SEQ 31	Current integrated regional transport plan for South East Queensland.
Headway	The time difference between individual services.
Level of Service	Level of service (LOS) is a measure used by traffic engineers to determine the effectiveness of elements of transportation infrastructure.
Mobility	Physical movement. Mobility can be provided by walking, cycling, public transport, carpooling, taxis, private vehicles, trucks and other motorised modes.
Mode share	Mode share describes the percentage of travellers using a particular type of transportation.
Piers	Structural support.
Pocket Track	Small section of track used for storing vehicles out of service.
Revetment	A wall to protect land or retain fill.
SEQ	South East Queensland
Skyprint	The physical space above street level taken up by an object or facility.
Sustainability	Meeting the needs of the present without compromising the ability of future generations to meet their own needs.
TMR	The Queensland Department of Transport and Main Roads
Trackage	Railway tracks.
TOD	Transit oriented development.
Trip	For the purpose of setting mode share targets, a trip is defined as travel by each person from an origin to a destination for a single purpose. Several changes of travel mode may be part of a single trip however a single mode is assigned to each trip e.g. a trip may include a walk leg before and/or after a public transport leg however the mode assigned is public transport. Two people travelling in a private vehicle from the same origin to the same destination are considered to be two trips.
Trunk	Central line connecting branches
TTA	Translink Transit Authority

Bibliography

- Australian Bureau of Statistics. 2001, 2006. Census of Population and Housing, CDATA
- Beer, A. Kearins, B. and Peters, H. 2007. Housing affordability and planning in Australia: the challenge of policy under neo-liberalism. Housing studies. Vol 22 No 1
- Bernsteink, S., Makarewicz, C. and McCarty, K. 2005. Driven to Spend: Pumping dollars out of our households and communities. Centre for Neighbourhood Technology, Surface Transportation Policy Project.
- Bierbaum, R and Friedman, R.M. 2006. The Road to Reduced Carbon Emissions. P. 62.
- Buchanan, N. Evans, R. and Dodson, J. 2005. Transport disadvantage and social status: a Gold Coast Pilot Project. Griffith University Urban Research Program Research Monograph 8
- Bunker, R., Gleeson, B., Holloway, D. and Randolph, B. 2002. The local impacts of urban consolidation in Sydney, Urban Policy and Research Vol 20, pp. 143–167
- Burton, E. 2000. The compact city: just or just compact? A preliminary analysis, Urban Studies, Vol 37 No 11, pp. 1969-2001
- Casello, J. 2010. The Economic Impact of Transit Investment: A National Survey. pp. 22-26.
- Craig, B., 1989. Health Costs and benefits of urban consolidation versus suburban expansion in Adelaide: A literature review. Southern Community Health Services Research Unit
- Curtis, C. 2006. Network city: retrofitting the Perth metropolitan region to facilitate sustainable travel. Urban policy and research. Vol 24, no 2, pp. 159-180
- Curtis, C. and James, B. 2004. An institutional model for land use and transport integration. Urban policy and research. Vol 22 No 3, pp. 277-297
- Davis, J.S. and Seskin, S. 1996. Effects of Urban Density on Rail Transit. Lincoln Institute of Land Density, Vol. 8, No. 3.
- Department of Transport, Energy & Infrastructure, SA: Coast to Coast Light Rail City West to Adelaide Entertainment Centre, 2009, pp. 2-8.
- Department of Transportation, USA. 2009. Rail Safety Statistics Report. pp. 15-17.
- Development Contributions Review Steering Committee, 2002. 'Funding Infrastructure under the Planning and Environment Act, Final Recommendations' State Government of Victoria
- Dodson, J. and Sipe, N. 2006. Shocking the suburbs: urban location, housing debt and oil vulnerability in the Australian city. Griffith University Urban Research Program
- Dodson, J. Buchanan, N. Gleeson, B. and Sipe, N. 2006. Investigating the social dimensions of transport disadvantage: I. Towards new concepts and methods. Urban policy and research, Vol 24 No 4, pp. 433-453
- Edwards, M. and Haines, A. 2007. Evaluating smart growth: implications for small communities. Journal of Planning Education and Research, Vol 27, pp. 49-64
- Ellison, G., Glaeser, E.L. and Kerr, W.R., 2010. What Causes Industry Agglomeration? Evidence from Co-agglomeration Patterns, American Economic Review 100: pp. 1195-1213
- Evergreen Line Rapid Transit Project, 2010. Socio-Community and Socio-Economic Assessments, Fact Sheet.
- Friedman, A. 2007. Sustainable Residential Development: Planning and Design for Green Neighbourhoods. p. 53.
- Friedman, A. 2011. The Cambie Corridor – Building Complete Communities. Case Studies, pp. 51-52.
- Golam, R. and Smith-Heimer, J. 2010. Relationship between the streetcar and the built environment, TCRP Systhesis 86. pp. 13-14.
- Healey, K. (ed.) 1996. City Squeeze - Urban Sprawl Population Pressures on Cities, Cars and Public Transport and the Urban Sprawl: Issues for the Nineties Spinning Press Vol 61, pp.36-37

- Helsley, Robert W. and Strange, William C., 1990. Matching and Agglomeration Economies in a System of Cities, Regional Science and Urban Economics 20 (1990), pp. 189-212.
- Honolulu High-Capacity Transit Corridor Project, EIS. 2010. Ch. 7: Evaluation of the Project. p. 7-3.
- Huang , H. 1996. The land use impacts of urban rail transit systems. Journal of Planning Literature, Vol 11, No. 1, pp. 17-30
- Industry Commission. 1993. "Taxation and Financial Policy Impacts on Urban Settlement." The Industry Commission. Vol. 1, No. 30, April.
- Institute for Human Centred Design, Case Study Collection: CCT384: Transportation.
- International Association for Impact Assessment. 2003. International Principles for Impact Assessment
- Knapp, G. Ding, C. and Hopkins, L. 2001. Do plans matter? The effects of light rail plans on land values in station areas. Journal of Planning Education and Research, Vol 21, pp. 32-39
- Konsult Charged Access (web site). Light Rail Systems. Evidence on performance - Case Study 2. Sheffield Super Tram.
- Litman, T. 2012. Evaluation Criticism of Smart Growth. Victoria Transport Policy Institute.
- Loukaitou-Sideris, A., Liggett, R., Iseki, H. 2002. The geography of transit crime: documentation and evaluation of crime incidence on and around the Green Line stations in Los Angeles. Journal of Planning Education and Research, Vol 22, pp. 135–151
- Lucas, K. 2006. Providing transport for social inclusion within a framework for environmental justice in the UK. Transportation research, Vol 40, pp. 801-809
- Metro Transport (Sydney) web site, Light Rail to Barangaroo. 2011.
- Ministry of Transportation and Infrastructure, Government of Canada, TransLink Communique. 2012.
- Newman, P. and Scheurer, J. 2010. The Knowledge Arc Light Rail: A concept for delivering the next phase of public transport in Perth. pp. 1-173.
- Newman, P., Bachels, M. & Scheurer, J. 2010. The Knowledge Arc Light Rail: Sections F & G – Delivering TODs. p. 15.
- Prescott, Tony. 2008. A practical scheme for light rail extensions in inner Sydney. First published *Transit Australia*, vol. 63, no. 11 (November 2008), pages 323-330; vol. 63, no. 12 (December 2008), pages 355-360. and vol. 64, no. 1 (January 2009), pages 4-6.
- Priemus, H. and Konings, J.W. 2001. Public Transport in Urbanised Regions: The Missing Link in the Pursuit of the Economic Vitality of Cities. Planning Practice & Research vol 15, no 3 (2000).
- Railway-technology.com. Projects - Montpellier Light Rail Network, France.
- Randolph, B. and Holloway, D. 2005. Social disadvantage, tenure and location: an analysis of Sydney and Melbourne, Urban Policy and Research, Vol 23 No 2, pp. 173–201
- Report of the House of Representatives Standing Committee for Long Term Strategies. 1992. "Patterns of Urban Settlement: Consolidating the Future?" Australian Parliament.
- Rodrigue, J-P, C. Comtois and B. Slack (2009). The Geography of Transport Systems, Second Edition, New York: Routledge. Ch 7, Application 3: International Tourism and Transport.
- Russell, Professor Bill. 2008. The Doncaster Railway – A Strategic Imperative. Address to Forum on Transit Options for the Doncaster Corridor. pp. 1-8.
- Ryan, S. 1999. Property Values and Transportation Facilities: Finding the Transportation-Land Use Connection. Journal of Planning Literature, Vol. 13, No. 4, 412-427
- Stokes, R. MacDonald, J. and Ridgeway, G. 2007. Estimating the effects of light rail transit on health care costs. Health and Place vol 14 pp. 45-58
- The Smith Institute. 2011. Investing in better places – international perspectives. pp. 64 - 66.
- Thomas, L. 2010. Correcting the mistakes of the past – The resurgence of Light Rail in Strasbourg – A detailed case study. pp. 2-4.

- Transportation Research Board, National Research Council, Washington DC. Extract from TCRP Report 35: Economic Impact Analysis of Transit Investments: Guidebook for Practitioners, 1998. pp. 9-29.
- TriMet. 2007. Community Building Sourcebook – land use and transportation initiatives in Portland, Oregon.
- Troy, P., 1996. Perils of Urban Consolidation: A Discussion of Australian Housing and Urban Development Policies. Federation Press p50-76
- Ulfarsson, K. and Hennessy, T. 2007. Analysis of light rail rider travel behaviour: Impacts of individual, built environment, and crime characteristics on transit access. Transportation Research Part A, Vol 41, pp.511–522
- Village Well, 2006. Train Stations as Places for Community Wellbeing, pp. 1-6.
- Weisbrod, Glen 2009. Economic Impact of Public Transportation Investment, TCRP J-11 Task 7, p. 18.