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Byron Shire Rail Corridor

FINAL SUMMARY REPORT

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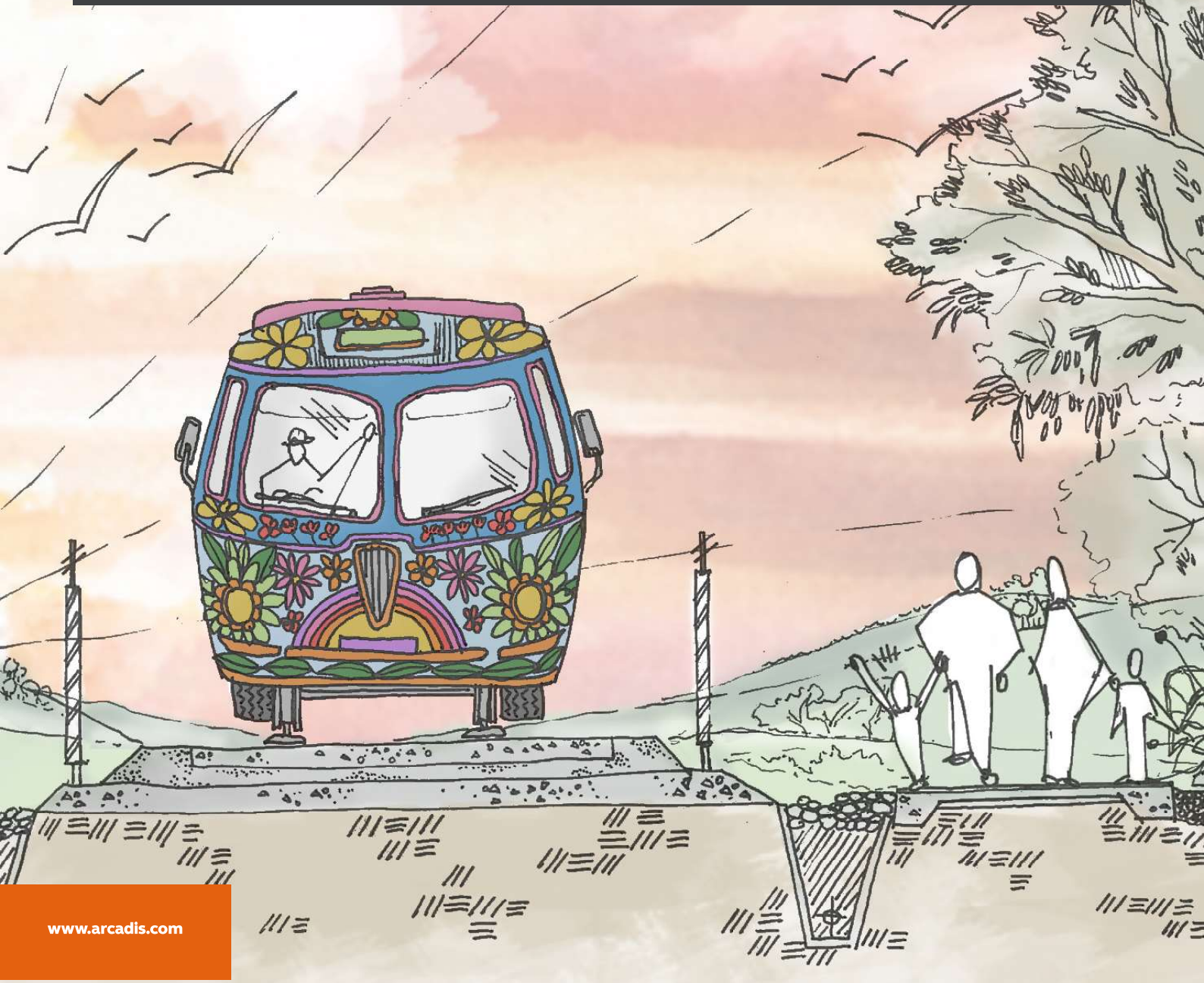

www.arcadis.com

CONTACT

Clara Tetther

Infrastructure Advisory Lead QLD

T +61 (7) 3337 0032
M 0439 738 051
E clara.tetther@arcadis.com

Arcadis
Level 5/120 Edward Street,
Brisbane QLD 4000

A joint report by

ARCADIS Design & Consultancy for natural and built assets

DeltaPearl Partners

Archr Design

BYRON SHIRE RAIL CORRIDOR

FINAL SUMMARY REPORT

Author	**Author Name**	Amy Kirkpatrick, Chris Moore, Elvira Lanham, Caroline Evans, DeltaPearl Partners, Amanda McGuane, Andrew Kim
Checker	**Checker Name**	Laurie Wilson / Clara Tetther / Amanda McGuane
Approver	**Approver Name**	Clara Tetther
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1.0	06/06/2019	Final Summary Report	Amanda McGuane/ Andrew Kim	Clara Tetther

CONTENTS

EXECUTIVE SUMMARY

Let's reimagine a space and take it from unloved and neglected and unlock it to become a beautiful environment……a meaningful space for environment, visitors and community alike….a space that connects and activates….a space for all of us.

Figure 1

(Source: Arcadis/Archr Design)

This report presents a summary of the engineering, economic and social assessment undertaken to investigate the feasibility of reactivation of the Bryon Shire rail corridor from Bangalow to Yelgun for multi use transport applications.

"Would create a dispersed economy that would share the tourism load throughout the region and lessen the impact on roads and parking."

The Byron Shire rail corridor is a vital piece of infrastructure which connects the main townships of Yelgun, Ocean Shores, Mullumbimby, Myocum, Tyagarah, Byron Bay and Bangalow. If reactivated effectively the corridor can provide a sustainable transport artery that connects the community and provides visitors with a seamless and efficient transport experience.

Both economic analysis and social consultation confirmed three levels of challenges as shown in Figure 2.

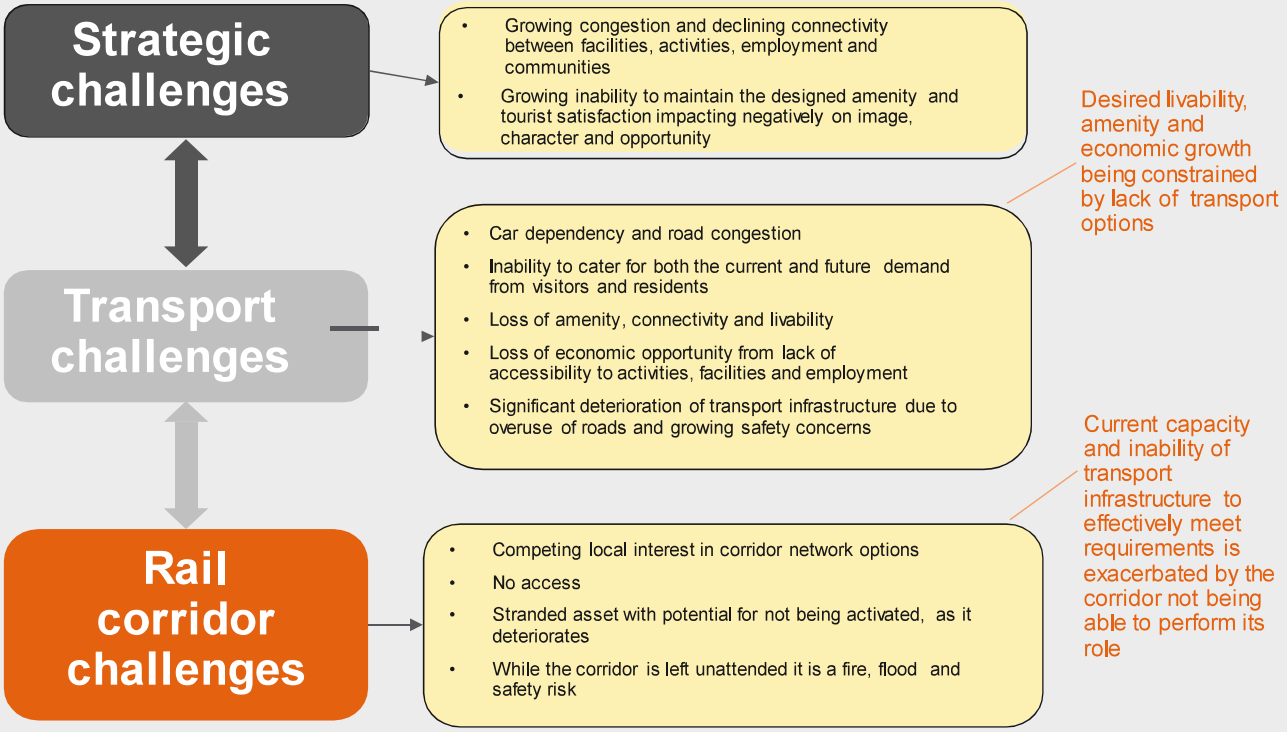


Figure 2

"It seems crazy that we have rail infrastructure there that is not being used"

Both the social and economic assessment clearly highlighted that there was a need to reactivate the Bryon Shire rail corridor to alleviate some of the challenges identified above.

Engineering inspections highlighted that the corridor is in reasonable condition and although the existing trackform, alignment and structures will not support high speed heavy rail without significant reparation, the engineering condition assessment concluded that it has the capacity to support very light rail vehicles at moderate speeds. A number of transport options were therefore considered with six options further developed to inform the economic analysis.

All of the public transport options (Figure 3) put forward in this report include active transport elements to increase health and wellbeing for visitors and residents alike, maximise energy efficient technologies and meet the equity and access needs of individuals, businesses and community. Two solutions utilise the current rail track thereby providing the Shire with considerable savings in capital investments in infrastructure and retaining the track for future generations.

"Rail with an adjacent walking/cycle track is of benefit to reducing carbon in the atmosphere and improving environmental health of the area. Failure to act will only result in seeing similar congestion on our roads as other major cities in the country"

Very Light Rail
Axle load below 10 tonnes combined with active transport modes (cycling, walking and motorized mobility aids).
Retains existing rail infrastructure.

Multi use active transport
Pavement width and design catering for cycling, walking, scooters and motorized mobility aids.
Requires removal of rail infrastructure.

Hi-Rail/Dual Mode Vehicles (DMV)
Hi-Rail or other light axle load dual mode vehicles, possibility to share with pedal cars and other novelty rolling stock (dining cars and the like) combined with active transport modes.
Retains existing rail infrastructure.

AV Vehicles/Self driving pods
Self driving autonomous vehicles with shared pathway for cycling, walking, scooters and motorized mobility aids.
Requires removal of rail infrastructure.

Cycling and walking
Basic concept, retains infrastructure for future use whilst providing a basic cycle way and walking pathway adjacent to the existing track.
Retains existing rail infrastructure.

Busway (guided)
Intrinsic busway (either guided or driver) combined with segregated pathway cycling, pedestrian and motorized mobility aids
Requires removal of rail infrastructure.

Figure 3

"Connecting the towns with this corridor would be incredible - especially during peak tourist times, getting cars off the road and providing an alternative - and actually usable - form of transport"

Multi-criteria analysis (MCA) undertaken highlighted that the following public transport options combined with active transport facilities (cycling and pedestrian path) provide flexibility and present cost effective and fit for purpose solutions for the corridor:

- Hi-Rail/Dual Mode Vehicles (Rail with Trail) – retains the current rail infrastructure
- AV Vehicles (e.g. driverless pods and shuttles) – removes the current rail infrastructure.

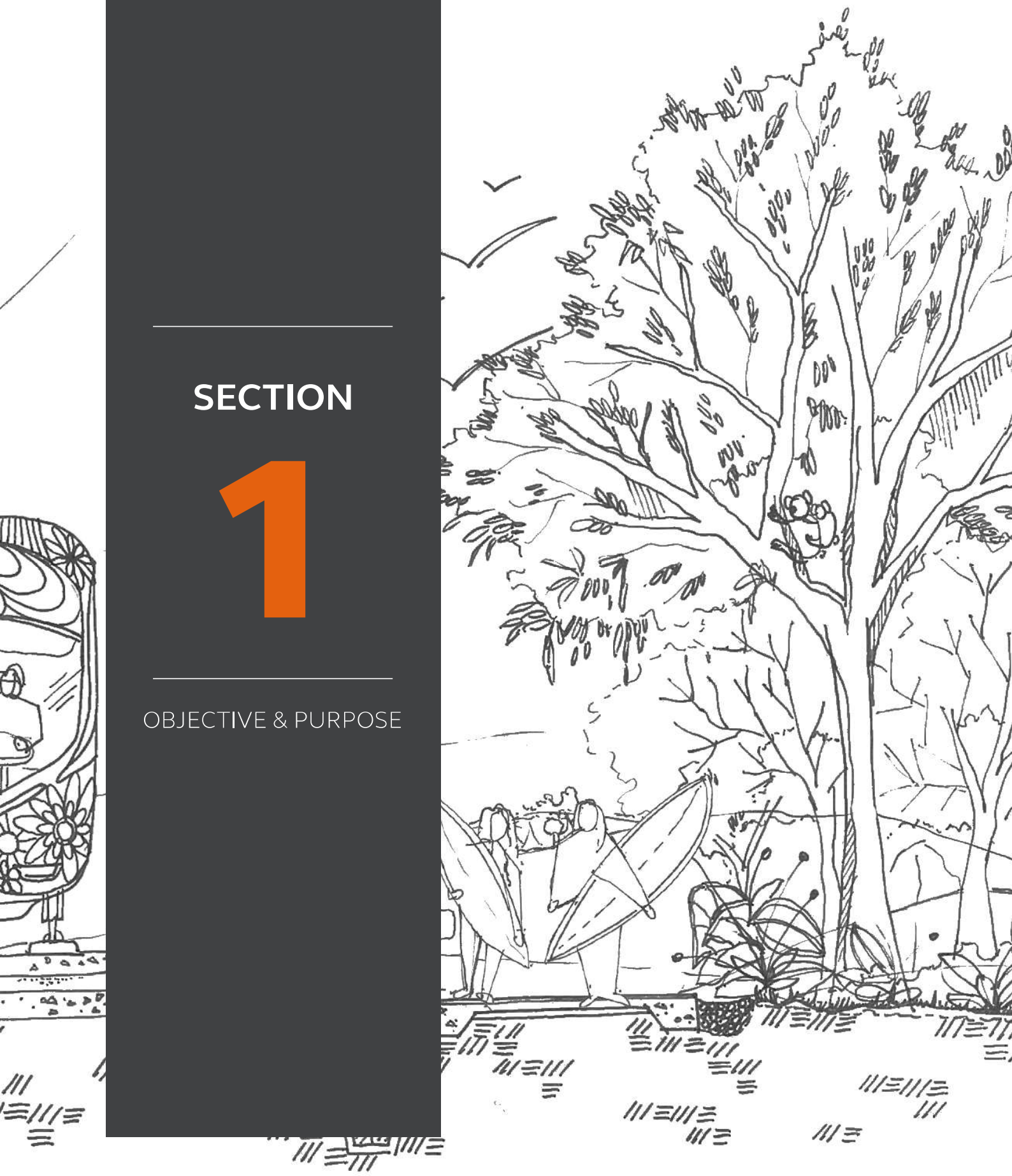
However, the later requires costly and invasive removal of existing infrastructure, which may have significant impacts on future capacity and sustainability of the corridor. The economic assessment indicated that for the multi use Hi-Rail/Dual Mode Vehicle (DMV) option, there is a potential benefit-cost ratio (BRC) ranging from 1 (breakeven) to 1.5 depending on demand assumptions and implementation of travel change behaviour incentives such as increases in car parking fees in Bryon Bay township. That is, for every $1 spent, the investment provides near to or up to $1.50 in return showing that usage of the existing rail infrastructure combined with active transport is not only socially beneficial, environmentally recycling and a healthy option but also, is economically viable.

Options that only include active transport (rail trail) and rubber tyred vehicle solutions which involved removing and replacing existing infrastructure and replacing with alternative road pavement were estimated to have a potential benefit-cost ratio of less than 1, that is , for every $1 spent there is less than $1.00 return of investment.

"Multi use train, track, and biking/walking tracks is my hope"

SECTION 1

OBJECTIVE & PURPOSE



1. OBJECTIVE & PURPOSE

1.1 Introduction

As a part of the broader Casino to Murwillumbah rail corridor, the Byron Shire Rail Corridor has been identified within the Byron Bay Town Centre Masterplan as a key space, crucial to the master plan, and a potential catalyst site for supporting sustainable future growth and maintaining connectivity and inclusion within Byron Shire to its key population centers, regional areas and heritage sites, scenic hinterland and coastal beauty.

Cities around the world have, in addition to traditional forms of passive and active transport options, a plethora of new technologies related to transport to choose from. Considering the innovation and rapid growth of these technologies, the way these new or traditional transit technologies are introduced and implemented in the future, will have a direct functioning impact on a city, affecting quality of life, accessibility, commuting time, and the level of urban regeneration that can be unlocked by effective, clean and efficient transport networks.

Unhindered by legacy transit systems, Byron Shire Council and the community have a choice and opportunity to either reactivate the corridor through traditional transit multi use options or 'leap frog' the currently adopted transport technologies in an optimum way that will strengthen their economic development whilst providing an inclusive, safe, resilient and sustainable solution to the reactivation of the unused rail corridor.

"Thanks for involving the public. I hope you will hear our voice."

This project seeks to understand the many social and economic transport issues faced by Byron Shire and determine the optimum feasible multi use transport solutions to overcome these issues as well maintaining Byron's uniqueness and commitment to make Byron Shire an even better place to live, aligning with the social and economic goals outlined in the Community Strategy Plan 2028.

Background to this study

The Casino to Murwillumbah Byron Shire Rail Corridor is a 130 kilometre rail corridor that was opened in 1894. The train was a main transport option for travel from Murwillumbah, through Byron Bay, Bangalow and Lismore, and continued to Sydney from 1990 as an express passenger train (XPT) service. The last train service was in April 2004, and despite community voicing disappointment, no rail services have since used this rail corridor.

"It's such an amazing asset – the rail corridor – and should be utilised for multiple uses ASAP.... what a difference it would make and what a great thing for our tourist visitors.....fewer cars."

Figure 4 The last train to use Lismore Railway station in 2004. (Source The Northern Star Archives - https://www.northernstar.com.au/news/watch-special-report-by-hamish-broome-on-the-last-/3178149/)

In September 2004, PriceWaterhouseCoopers (PwC) completed a feasibility study for passenger and/or commuter services on the Murwillumbah to Casino branch line. The study investigated five options for developing and operating the railway, however, all of the options had an estimated net present value (NPV) cash deficit of between $43.7 million and $55.3 million over a 20-year period.

In 2008, Byron Shire Council made a submission to Infrastructure Australia (IA) proposing the refurbishment of the Casino to Murwillumbah rail corridor and an extension to the Gold Coast Airport . A 2012 'Condition Assessment' was completed for Transport for New South Wales (TfNSW) by ARUP and in the following year TfNSW (April 2013) published the Casino to Murwillumbah Transport Study in favour of improving bus services between Casino and Murwillumbah in place of the railway option that was estimated to cost some $900 million. In addition, the TfNSW report recommended a safety review of three bridges on the line that, in 2014-15 resulted in the removal of two rail bridges west of Bangalow in Byron Shire.

The TfNSW study assessed operations for a 120 kph class two standard track, thereby raising concerns that the scope and standard of the railway used for the cost-benefit analysis in the report was excessive, leading to a higher than needed cost. However, the study did indicate that with some additional works to improve the railway and adding additional passing loops, the corridor gradient and alignment could support rail shuttle services.

"If ripped up/sold off, rail will cost a fortune to reinstate when highways are clogged, think Sydney trams?"

Importantly, the study also indicated the corridor had many of the attributes that support a successful rail trail project including being close to large population centres, having heritage infrastructure, enabling a unique experience and accomodating a variety of trail lengths. In May 2013, a Northern Rivers group, The Sourdough Group, provided a report proposing a Northern Rivers Rail Trail be built on the line and specifically recommending the NSW Government do a feasibility study of the walking/cycle trail. In May 2014, the completed NSW Department of Premier and Cabinet (DPC) study indicated a potential BCR of between 1 (breakeven) and 2.54 depending on the demand assumptions for a proposed rail trail. The financial capital cost of the project was estimated as $75.5

[1] *Byron Shire Council, 14 Oct 2008, Refurbishment of the Casino to Murwillumbah Rail Corridor and its Extension to the Gold Coast Airport, Submission to Infrastructure Australia, Viewed 19 Sept 2017, http://infrastructureaustralia.gov.au/policypublications/submissions/published/files/188_byronshirecouncil_SUB2.pdf*

million, partly driven by the need for more than 160 bridges along the route, with annual operating maintenance costs between $6800 and $8900 per kilometre. The assumed base case suggested the project would be financially viable with a payback period of four to five years.

Following the feasibility study, the NSW Government budgeted for $100 million under the Restart NSW – Regional Tourism Infrastructure Fund: Rail Trails over 2014-15, however, this funding did not materialise. The lack of funding and general community agreement on what to do with the corridor has led to suggestions from Regional Development Australia (RDA) that the land could be sold off section by section if not used for a community purpose.

"We live close by in Grafton and have a beach house at Hastings Point and can't wait to ride the Rail Trail"

Community voiced concerns in relation to losing a vital piece of transport infrastructure has prompted Byron Shire Council and community groups to act. The Mayor of Byron Shire had The Byron Line report produced in June 2016 to bring the community together in developing the agreed vision; communicate the issues and views; and to assist with planning and management. The Byron Line report envisages a central governance body (Trust) establishing and managing a combined railway shuttle service and rail-trail walk/cycleway from Billinudgel and Bangalow within the Byron Shire. The first step recommended is securing a social license by establishing a community group the "Friends of the Byron Line". This community includes stakeholders such as Byron Shire Council, Northern Rivers Regional Organisation of Councils (NOROC), RDA and local, State and Federal Members of Parliament.

The Byron Line report has addressed several of the difficult issues of the previous reports considering the corridor, including reducing the scope of the project to only include Byron Shire and use light rail not high-speed rail; expand the benefits to accessing attractions close to the line, suggesting adjoining land-owners starting new businesses to service the users of the line; and allowing the line to be used for commercial activity. The cost estimate used is approximately $300,000 per kilometre for 30 kilometres or $9 million capital cost. The revenue estimated in the report uses the full Country Rail Contracts division of the TfNSW budget of $750 000 and private funding through usage fees, sponsorship and event payments. The operating model suggested is that ownership stays with TfNSW and a Trust is established by the TfNSW Minister to manage the development and operations.

Multi use Byron Shire rail corridor overview

"Our rail corridor is such a wasted resource. It is exactly that, a corridor that connects…or at least should"

In view of the history of the project, community concern and a push to optimise existing infrastructure and opportunity for re-use and sustainable future growth in the future, Byron Shire Council resolved to support multiple and integrated commuter, tourism and active transport uses of the rail corridor.

As a part of defining the most sustainable and acceptable long-term solutions for the multi use re-activation of the corridor, the Council have instigated the Multi Use Byron Shire Rail Corridor study which consists of a State of the Use of Corridor Report (Engineering Report, Appendix A) an Economic Feasibility Study (Appendix B) and Social Impact Assessment to assess the potential project impacts related to both environmental and social aspects and standards (Appendix C).

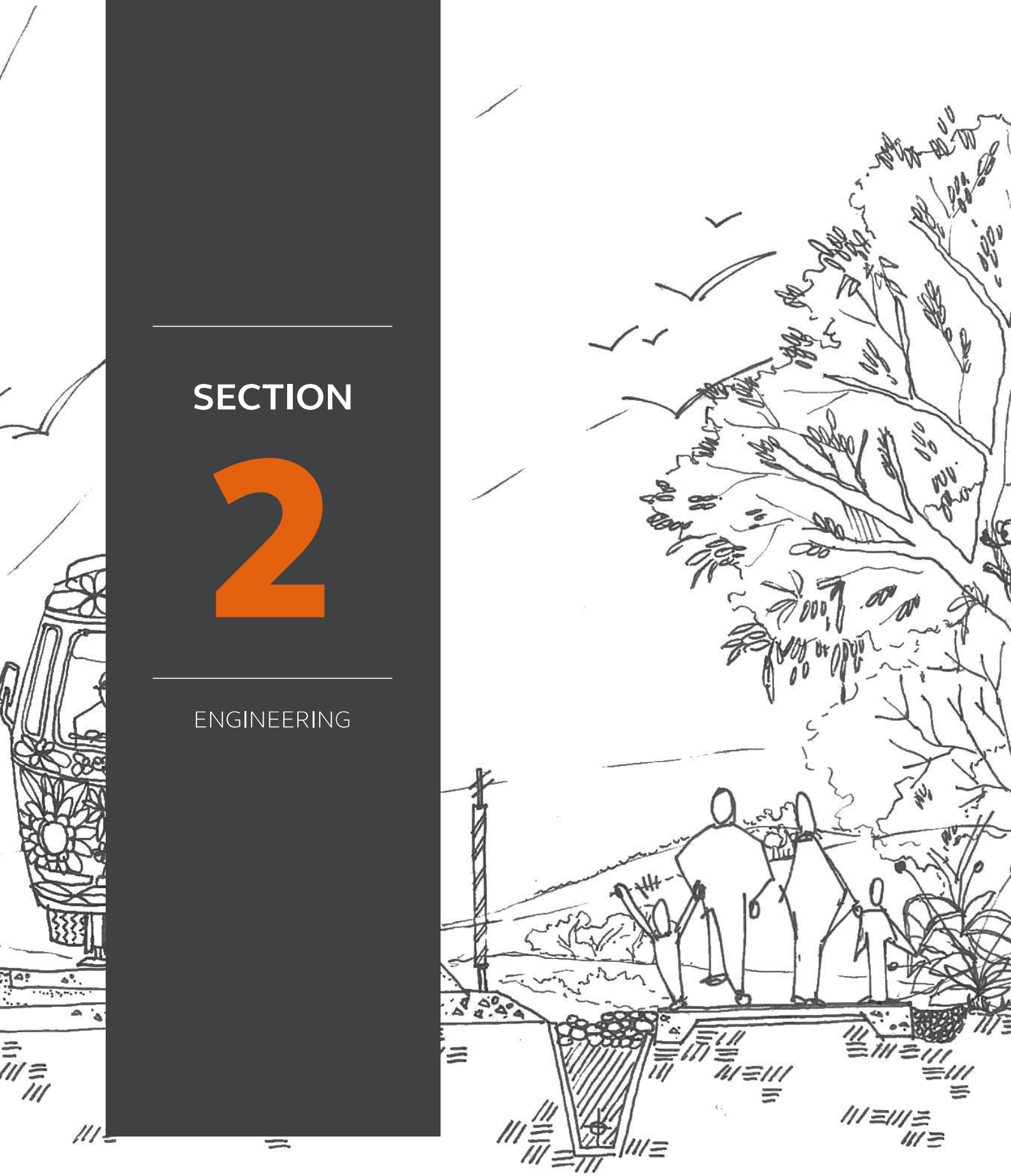
This report forms a summary of all the above reports. Further details on any specific area can be found in the Appendices of this report. The study is developed on the basis that not only is Byron Shire very unique in its advantageous position in the tourism market, but that it also has its own culture, social setting and context.

"This multi use concept would be a major catalyst for the growth of community focused businesses along the route and would provide positive commercial, recreational and sustainable tourism opportunities"

[2] *Council Report to Council 14 December 2017 – Bangalow Village Plan and Our Mullimbimby Plan*

SECTION 2

ENGINEERING



2. ENGINEERING

2.1 Condition Assessment

Approach

Critical to understanding the capacity of the corridor in terms of multi use transport operations, it was necessary to undertake an engineering assessment of the current condition of the corridor assets. This involved inspection of 38.5 kilometres of the Byron Shire rail corridor, categorised into the following sections for the development of estimates to inform the economic model:

- Yelgun to Billinudgel: 3.05 kilometres with tight curves and mostly downhill corridor
- Billinudgel to Mullumbimby: 6.85 kilometres with tight curves and steep climb and descent at Morrison Hill Tunnel
- Mullumbimby to Byron Bay: 15.6 kilometres with mainly straight and flat terrain
- Byron Bay to Bangalow: 13 kilometres with a very steep ascent to St Helena, tight curves and slight descent from St Helena to Bangalow

31 sites within the areas above were inspected. Inspection sites were selected to provide 100 metres of inspection over every one kilometre of track.

The following diagram shows the corridor and extent of the study and sites inspected.

Figure 5: Multi-Use of Byron Shire Council

2.2 Methodology

Visual walking and drone inspections were carried out every 100 m within each kilometer of track within the study.

Visual walking inspections were undertaken under the guidelines detailed in Railcorp's Engineering Manual Track Inspection Standard TMC, and asset condition assessments were carried out by Arcadis professional railway engineering personnel.

In addition to the visual walking assessment, an inspection drone was used to capture 20 megapixel camera shots during 18 successful flights of between five and 20 minutes. Vertical shots such as the one shown in Figure 6 clearly captured rail and sleeper condition, whilst horizontal shots captured vegetation overgrowth. All digital images captured information such as latitude and longitude to allow for GPS pinpointing. The combined used of the drone allowed successful and efficient capture of locations otherwise unsafe to access or inaccessible on foot.

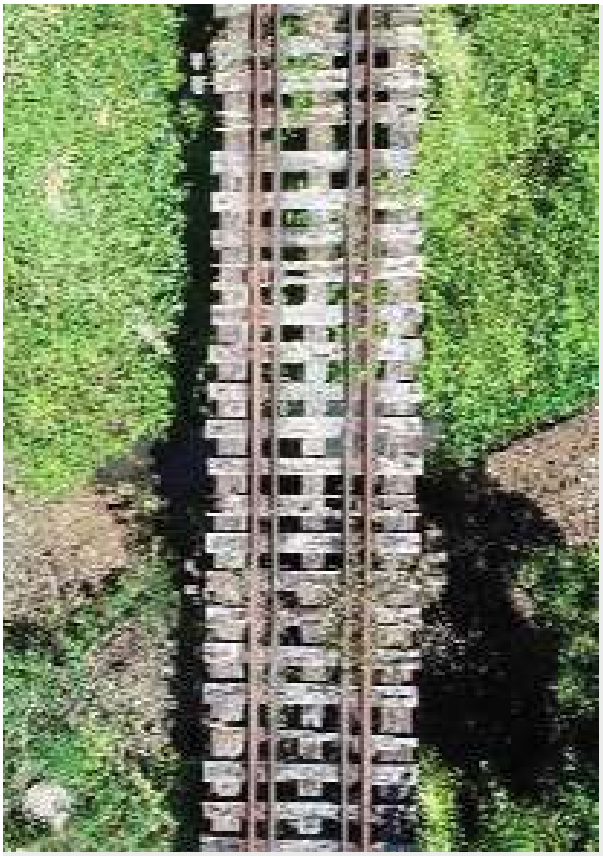


Figure 6 Vertical shot of rail bridge

An interactive map has been provided as part of this report which shows the inspection sites, key findings and drone footage.

2.3 Overview of key findings

This section provides an overview to the engineering assessment, some key findings have been drawn and are summarised in Table 1.

Table 1 Key findings from track condition assessments

TRACK ASSET

Track inspections undertaken indicated that the track assets appeared to be reasonably maintained prior to closure in 2004 with new sleepers and ballast works being undertaken prior to closure.

Key findings of inspections were:

- The 47 kg rail appeared in reasonable condition in areas inspected
- Many steel sleepers were dated 2001 and although surface rust was evidenced, structural integrity appeared sound
- Ballast was 20-25 mm in size, which is suitable for modern track maintenance plant
- Turnouts inspected were in reasonable condition with minimal profile wear on nose and points
- Despite vegetation growth, ballast shoulder and crib profile was still evident in majority of the inspected sites
- Majority of the sections inspected appeared to be 1 in 5 steel to timber sleeper, with some sections fully steel and some 1 in 7.

Since rail services were suspended in 2004, there has been little maintenance but also little usage, hence the condition of the track elements remain relatively unchanged, subject only to deterioration from exposure to environmental conditions and vegetation overgrowth.

VEGETATION AND FENCING

Vegetation overgrowth was found to be the main issue and significant clearance throughout the corridor will be required to reactivate the corridor.

Broken fencing and unsecured gates were found at most sites where fencing and gates were present.

Access roads were significantly overgrown and often unpassable.

STRUCTURES

Bridges and tunnels are the most valuable/expensive asset on the corridor. The inspection assessed that

- Tunnels appeared to be of sound structural condition
- Steel bridges inspected were found to be in very good condition
- Timber bridges were in varying condition and will need additional engineering inspection and analysis to ascertain load capacities and reparation requirements.

DRAINAGE

Drainage systems that were inspected were observed to be in fair condition and for the most part still working although overgrown.

Cross drains and cess drainage were still functioning as designed although around 90 per cent of that which was inspected was beginning to become fouled and will eventually fail and lead to track structure damage if not rectified.

LEVEL CROSSINGS

Level crossings where found to be in poor condition overall with signage and signaling systems removed. Safety management equipment will be required to be reinstalled as appropriate if the corridor is reactivated.

STATION BUILDINGS

The station buildings appeared to be in mostly fair condition, but graffiti and minor vandalism is starting to impact.

CONCLUSION

- Rail earthworks and formation appear to be in sound condition apart from a slip at Haynes Hill Tunnel
- The track geometry appears to be sound with both top and alignment in good condition. The interspersed steel sleepers are well packed and there were no signs of pumping or mud holes in the test audit areas
- The rails are in good condition with minimal top and side wear, they appear almost to be near design standard with minimum tonnages on them. The profiles were near design (270 mm) in most places inspected, even though covered by heavy vegetation in some areas
- The ballast profiles on the rail structure are to standard for welded rail with all shoulders and cribs being full. Inspection holes in the steel sleepers show they are well packed
- The track appears to have been well maintained with some major works being undertaken prior to the track closure. There is evidence of major insertion of steel sleepers at some time between 2001 and the closure.

Although the condition, alignment and grades make the corridor unsuitable for high or medium speed heavy rail solutions, the current condition was assessed as suitable to running low axle loads (maximum 10 tonne) vehicles at lower speeds of 40 – 50 km/hr.

2.4 Development and evaluation of options

On completion of the engineering assessment a list of transport solutions was developed that could be viably constructed on the corridor. The approach taken by the project team was "everything was on the table" from equestrian to a corridor for future Uber Drones.

From this list the following considerations (Figure 7) alongside engineering constructability were applied to define what transport multi use solutions would be practical, sustainable and fit for purpose for the Bryon Shire community and business needs. These were then conceptualised sufficiently to develop high order cost estimates to inform the economic model.

Figure 7 Summary of qualitative evaluation criteria

2.4 Multi use feasible solutions

The inspection results concluded that to reach the standards required for an operator such as TfNSW to operate XPT type trains, the project would require a full resleepering program, likely replacement of most, if not all bridges and possible ballast cleaning and replacement of 40 – 60 per cent of the track ballast. In addition to the above the vertical and horizontal gradient of the line does not lend itself to rapid heavy axle trains and would require significant speed restrictions and continual maintenance, therefore, this option was not considered further.

However, inspections highlighted that relatively minimal work will be required to run low axle load vehicles at speeds of 50/60 km/ph. Hence to reactivate the corridor using the existing track, two railway solutions are proposed:

1. Very Light Rail (VLR): axle loads equal to or under ten tonnes
2. Hi-Rail passenger vehicles and/or pedal cars

As it was considered that staging the works across the sections may be advantageous, a simple cycling solution, which provides for a cycling facility whilst preserving the railway track was the next solution developed (Figure 8). This was further developed to allow for pedestrian and motorised mobility aid access for the following solutions:

3. Cycle track (rail trail, simple construction)
4. Multi use cycle track which allows for usage for motorised mobility aids, Segway's and the like.

Figure 8 Simple rail trail maintaining rail infrastructure

(Source: Arcadis/Archr Design)

Finally, two solutions were developed that considered the full removal of the existing track to allow for vehicles. The first (Option 5) of these considers light weight vehicles which minimizes the requirements for structural reparation and the second provides for traditional buses (Option 6).

The following provides further details on the six options proposed.

Option 1 Very Light Rail (VLR) and Active Transport

Description

The concept of very light rail is relatively new, having been instigated by a growing need for rail vehicles that are lighter, more energy efficient and cheaper to purchase and operate than traditional urban light rail or regional rail, combined with a growing need from rural and suburban communities for more efficient, better connected public transport services that do not rely solely on conventional road-going solutions. VLR has been specifically developed for short routes where there is existing rail infrastructure in place but operating traditional heavy rail or tram (light rail) solutions is seen as uneconomical.

The option proposed combines a paved pedestrian and cycle path with VLR. A few examples of VLR operations are provided below.

The Very Light Rail Innovation Centre and Rail Line, UK has developed a new prototype vehicle to solve the above issues. The vehicle harnesses innovative and efficient technologies from the automotive and rail sector, resulting in a hybrid or all-electric self-propelled vehicle which is lightweight (less than four tonne axle loads), energy efficient, cheap to manufacture and operate and geared to the needs of rural communities (refer Figure 9)

Figure 9: Very Light Rail current prototypes

(Source: railway-technology.com)

Source: https://www.railway-technology.com/projects/very-light-rail-vlr-innovation-centre-and-rail-line-dudley/

Another example of VLR developed for regional committee rail tracks are the Parry People Movers (Figure 10). These are small lightweight railcars that are fuelled by gas or hydrogen engines and use flywheel energy storage to store energy for traction. These vehicles have been operating successfully on the Stourbridge line in the UK since 2009.

Figure 10: Parry People Mover Stourbridge Line

(Source: http://www.miac.org.uk/class139.html)

The concept has been sketched below. Segregated paths for pedestrians and cycles are shown, fencing would be required on both sides to deter access onto the trackform. The dual paths for cyclists and motorised mobility aids will be 2.5 to 3 m wide to enable simultaneous use from both groups and the walkway will be 1.2 m to 2 m, dependent on corridor constraints.

Figure 11: Very light rail (VLR) plus active transport

Source: Arcadis/ Archr Design

Constructability and engineering advantages/disadvantages

Reducing weight and improving energy storage and management will offer a number of engineering and constructability advantages to the Bryon Shire rail corridor solution:

- A vehicle with low axle weight will require less upgrade on track form and structures. Although it will be necessary to assess the load bearing capacity of the existing bridges, lower axle loads may potentially mean that not all bridges will need to be replaced for the rail option
- Reduced capital cost and construction time for the corridor
- Reduced infrastructure operational and maintenance costs
- Self-powered vehicles will provide energy and resource efficiencies

Key Considerations:

Key operational and economic advantages of this option include:

- Axle loads below ten tonnes
- Electric or hydrogen cell units, thereby providing minimal noise and environmental impact
- Vehicle capacity ranges from 25 to 50 people, therefore providing future proofing for patronage increases
- Retains track form for future growth
- Re-use of existing infrastructure thereby reducing material waste and the environmental footprint
- Medium construction impact as potentially may require renewal or significant reparation of most if not all timber bridges
- Good option for staging, i.e. commence with Option 2 and then as patronage requirement increases commence with VLR operations.

Key operational and economic disadvantages include:

- Limited flexibility as can only stop at designated stations
- Requires mode change for passengers going to events and facilities not along the corridor
- Many of these vehicles are prototypes hence may be a time lag in ordering and start of operations, although an alternative option could be to use adapted recycled tram vehicles or other light rail rolling stock.

Option 2 Hi-Rail and active transport

Description

This option of corridor reactivation combines a pedestrian and cycle path with small Hi-Rail vehicles and/or rail pedal vehicles running off the existing rails, with only minor restorative works. Hi-Rail vehicles have been used for a number of years on existing railways both for the transportation of materials and people. These vehicles travelled traditionally at approximately 25 – 35 km/hr and were adapted so that they can run on both rail and road infrastructure. They have been used for operational maintenance (Figure 12), and/or to transport railway crews and management for inspection runs (Figure 13)

Figure 12: Maintenance Hi-Rail Road/Rail Vehicle

(Source: ariesrail.com.au)

Figure 13: Hi-Rail Bus (22-seater) Wheelchair Access, (Source: TRAINU)

However, "quirky" adaptions, using classic or other road cars, have been made to run on "novelty" or heritage lines as well for commercial operations in the 1950's to 70's (Figure 14). More recently, Toyota and its truck-making subsidiary Hino Motors signed on with Japan Rail Hokkaido to develop a high efficiency vehicle that could travel on road and rail at the speed of a tram/light rail vehicle to service regional communities in Hokkaido, where patronage is less than 500 people, but Japan Rail did not want to reduce or cut services. The DMV (Figure 15) vehicle can carry 25 people, runs at approximately 60km/hr (or at the same speed as urban light rail) and can switch between modes in less than 15 seconds. In addition, the ability of the vehicles to be linked enables increases in capacity relatively simply.

Figure 14: Schi-Stra-Bus, Deutsche Bundesbahn

(Source: Wikipedia)

Revised DMV vehicles developed on a collaborative effort between Nissan and Japan Rail Hokkaido Source (Source: Wikipedia)

Linked vehicles can fit up to 84 passengers

(Source: Asahi.com)

Figure 15: DMV Vehicles

In addition to the above, other types of vehicles that could be considered include Railway Mokes, Speeders, and Rail Pedal Cars (Figure 16). The later of these are not road/rail compatible and only run on rail, however, these sorts of vehicles could share the line access thereby providing opportunity to use the line for "novelty" and "outdoor activities" as well as transportation. Road/rail vehicles adapted and combined with new technologies such as on board signalling and sensor equipment, which currently being implemented in AV road vehicles, could be considered safe and innovative solutions which could be provided to capture both the local and tourist market in the reactivation of the corridor.

Railway Mokes, used traditionally for transport and maintenance (Source: moke.com.au)

TasRail Moke, Eyre Peninsular (Source: MokeWerx)

Maintenance speeders: (Source railspeeders.com)

Adapted road/rail maintenance: (Source: Pinterest)

Figure 16: Example of Hi-Rail vehicles and railspeeders

Constructability and engineering advantages/disadvantages

Reducing weight and providing DMV will offer a number of advantages to the Bryon Shire Rail Corridor solution:

- As per the VLR, a vehicle with low axle weight will require less upgrade on trackform and structures with all the advantages of reduced capital and maintenance costs
- Dependant on the on board signalling technologies and safe system of working in place, shared operations could be serviced on the corridor
- Dependent on the safe system of working, signage only may be appropriate for railway crossings
- Significant reduced capital cost and construction time for the corridor
- Flexible for future proofing in that vehicles can be operated under small headways (dependent on safety system management in place) and/or replaced by VLR units in the future
- Reduced infrastructure operational and maintenance costs
- Self-powered vehicles will provide energy and resource efficiencies.

Key Considerations

Key operational and economic advantages of this option include:

- A Hi-Rail/DMV vehicle is able to travel rail/road circuits to specific activities and/or facilities. For example, a circuit from Byron Bay directly to The Farm can be implemented
- Vehicles can be flexible, even allowing for demand responsive transport solutions
- Business and local employment opportunities to provide specific operations on a shared corridor (such as rail pedal cars in "quiet" times when Hi-Rail is not operating, or Hi-Rail Mokes or other adapted vehicles for special occasions or excursions, and the like)
- Business and local employment opportunities to develop digital applications for operations if a corridor is provided for shared access
- Dependent on safety management system and on-board sensors vehicles may be able to operate adjacent to the active transport path without fencing
- Constant "smaller" vehicles on the rail corridor can provide the "security" surveillance (if cameras are provided on the vehicles) for cyclists and pedestrians using the active transport path.

Key operational and economic disadvantages include:

- Some usage of the road infrastructure
- Vehicles restricted to 50 to 60 km/ph maximum speed.

Option 3 and 4: Active transport rail trail (walking, cycling and mobility aids)

Description

Two active transport only solutions have been proposed, the first (Option 3) is a simple solution to reactivate the corridor by developing it into a basic cycle and walking path without removing any of the existing rail infrastructure and the second (Option 4) is a more complex solution which provides for the construction of a surfaced pavement to allow for use by cycling, walking and motorised mobility aids.

Option 3 retains the existing rail infrastructure hence allows for reactivation of the rail corridor in the future whilst Option 4 requires removal of the existing rail infrastructure but enables adaption to driverless pods in the future.

Constructability and engineering advantages/disadvantages

The advantage of Option 3 is that it is relatively cost effective, retains the rail infrastructure for future development and allows for quick reactivation. Disadvantages are that it does not prevent further deterioration of the trackform itself and unless rubber mats (Figure 17) or other alternatives are used to infill the track gauge (space between the steel rails), significant reparation will be required in the future if the corridor is to be reinstated for VLR or other rolling stock.

Figure 17: Rubber matting options

Option 4 proposes the construction of a surfaced pavement of sufficient width and standard to be comfortably used by pedestrians, cyclists and mobility aid users (Figure 18). The disadvantages of this option are that the existing rail infrastructure will need to be removed and a new pavement constructed. If significant capacity increases are required in the future, this pavement may need to be reconstructed to allow for the passage of trackless trams or heavier road vehicles.

Figure 18: Mary to the Bay Rail Trail

(Source: Rail Trails Australia)

Key Considerations

Key operational and economic advantages of these options include:

- Option 3 is relatively quick, minimises construction impact on the corridor and allows for future proofing of the transport rail corridor
- Relatively low maintenance costs for both options.

Key operational and economic disadvantages of these options include:

- Option 4, the removal of existing infrastructure and replacing with paved surfacing is costly and wasteful of assets with significant asset life and capability
- Without regular rail traffic, or other regular traffic passing through the corridor, sections of the corridor may become security risks
- Option 3, does not provide equitable access for everyone, it only provides active transport for those who are physically able to Option 3 also does not provide for mobility scooters or any other form other than cycling and/ walking, hence is restricted for usage
- Cycling and pedestrians are not physically segregated, hence potentially a safety risk in remote areas along the corridor.

Option 5: AV Vehicles/Driverless pods plus active transport

Description

This option combines a cycle and pedestrian path with a paved area to facilitate the use of small driverless pods or shuttles (Figure 19 and Figure 20).

Constructability and engineering advantages/disadvantages

Disadvantage which increases construction cost and time is that it involves removing the existing rail infrastructure and building a road pavement. Similar to Option 4 this is considered a waste of existing asset materials that are currently fit for purpose.

Key Considerations

Key operational and economic advantages of these options include:

- Future driverless pods and AV vehicles may be able to extend their journey beyond the corridor to provide door to door or flexible response transport (FRT) options
- The safety and segregated nature of the corridor would provide an optimum testing track for trailing the technology. As capacity demand increases, the pods could be removed and a trackless tram or other technology could be implemented, hence the solution remains flexible for future capacity increases
- Driverless pods or such similar options are considered energy efficient and due to their potential for responsiveness in the future, it could be an advantage over a rail line, which will be constrained in terms of flexibility and access
- Improved safety through the use of sensor technologies on the vehicles. Reduced need for safety gaps between vehicles could mean that significant capacity could be opened along the corridor
- The pods and/or AV shuttles would be fully electric meaning greater energy efficiencies.

Key operational and economic disadvantages of these options include:

- Technology is relatively new, therefore may take time to implement.

Figure 19: Driverless pod example

These types of technologies are advancing at significant rate with many prototypes and designs being made available. For example, "2getthere" pods being developed for use in Singapore, run totally on electricity, can travel autonomously, are self-charging and are expected to handle a load of 8000 passengers per hour going in a single direction.

Figure 20: Trials of driverless pods - Cambridgeshire Cycle path

(Source: https://www.connectingcambridgeshire.co.uk/2017/10/7843/)

Figure 21: Proposed multi-use corridor driverless pods and active transport

(Source: Arcadis/Archr Design)

Option 6: Bus Rapid Transit (BRT) or Segregated Busway

Description

This option assumes a full hard surface road to be built on the corridor and removal of the existing rail infrastructure to allow for large buses to operate. The solution is similar to the Brisbane BRT in that the corridor would provide a segregated lane for buses, inaccessible to other vehicles, hence avoid the issues of road congestion for its passengers. The busway would be provided alongside a pedestrian/cycle path which, for safety considerations, would need to have physical separation.

Constructability and engineering advantages/disadvantages

A disadvantage is that it involves removing the existing rail infrastructure and building a road pavement which increases construction cost and time. Similar to Option 4 this is considered a waste of existing asset materials that are currently fit for purpose. In addition, as the pavement required would need to be of sufficient standard to allow for heavier road vehicles, this option would require significant investment in construction of the pavement as well as full replacement or significant reparation to all bridges.

To meet safety requirements, segregation will need to be provided from pedestrian and cycle paths (Figure 21).

Key Considerations

Key operational and economic advantages of these options include:

- It provides the corridor for use by existing bus services who will be able to extend their route via the corridor.
- Buses also can provide door to door transport
- It allows lexibility in that bus can stop anywhere on the corridor route and can provide door to door services to specific events and facilities

Key operational and economic disadvantages include:

- If opened up to existing bus services, some existing vehicles may not be electric, thereby creating environmental impact for adjacent residents in terms of noise and air pollution.

Figure 22: Cambridgeshire guided busway (Source: https://www.youtube.com/watch?v=10UY3WC4nDY)

Capital and maintenance costs

The following table provides a summary of estimated total capital and operational costs per kilometer for each option.

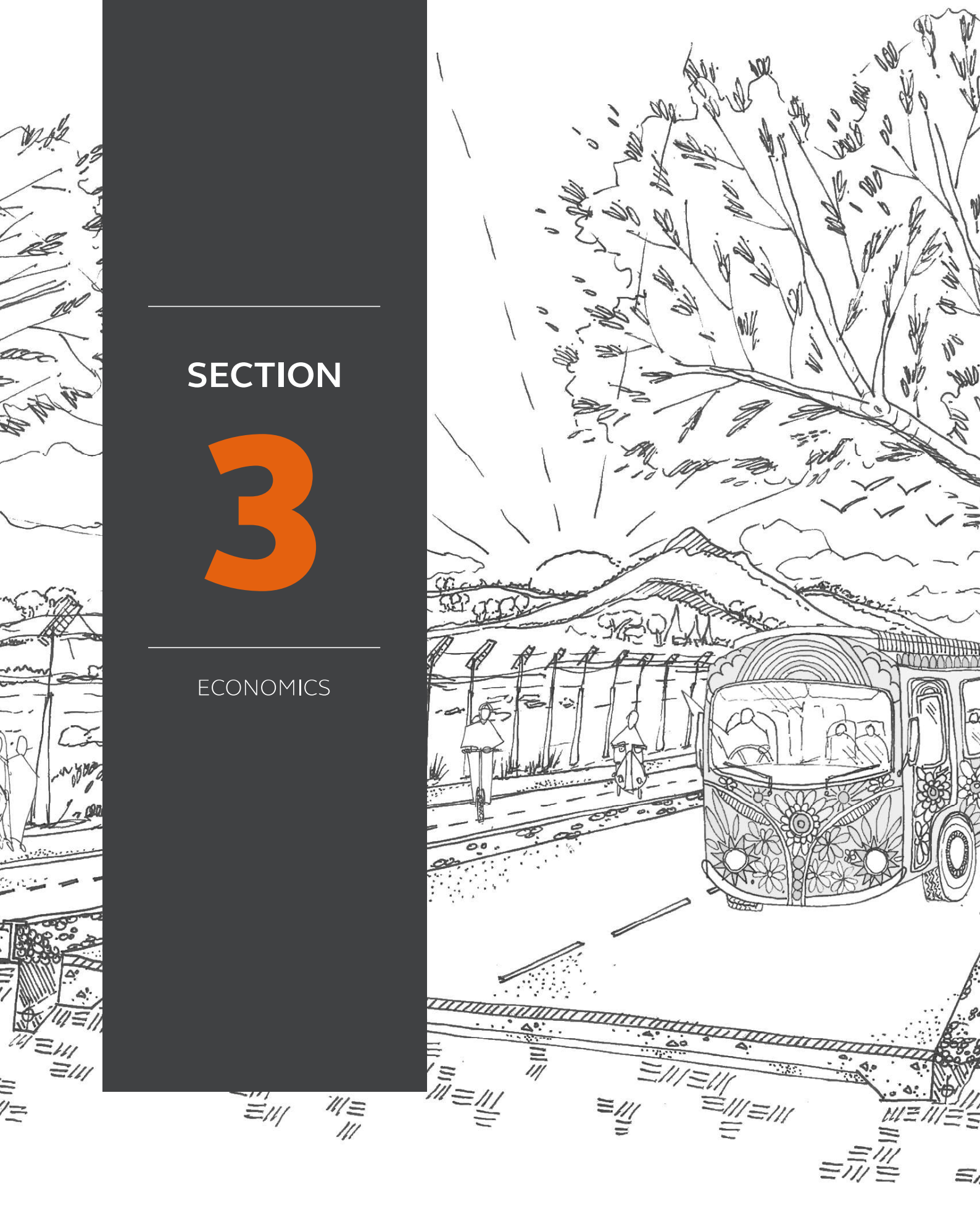
Table 2: Capital and maintenance costs

OPTION	OPTION 1 ($m)	OPTION 2 ($m)	OPTION 3 ($m)	OPTION 4 ($m)	OPTION 5 ($m)	OPTION 6 ($m)
Capital Cost Total	**$67**	**$31.4**	**$11.5**	**$20**	**$105**	**$209**
Yelgun to Billinudgel	$7.3	$3.4	$1	$1.7	$10.3	$25.9
Billinudgel to Mullumbimby	$14.8	$7	$2.2	$3.7	$21.5	$53.9
Mullumbimby to Byron Bay	$26.9	$12.6	$4.5	$8.1	$42.7	$52.3
Byron Bay to Bangalow	$18	$8.2	$3.8	$6.8	$30.7	$76.9
Annual Maintenance costs per km	$1.1 to $2.36	$0.97 to $2.3	$0.97 to $1.3	$0.6 to $1.3	$0.6 to $1.3	$1.81 to $2.3

Table 2 highlights the opportunity to stage the multi use solution. For example, for relatively minimal investment (and only marginally higher than providing solely a rail trail) a rail with trail solution such as a Hi-Rail/DMV solution can be implemented from Byron Bay. Simultaneously a rail trail can be developed from Mullumbimby to Billinudgel whilst still maintaining the rail infrastructure to enable extension of the rail with trail solution at a later date. If the rail with trail multi use solution is popular and capacity increases, the section can be extended, or alternatively if patronage increases significantly VLR services can be implemented on the previous Hi-Rail section.

SECTION 3

ECONOMICS



3. ECONOMICS

To inform the economic modelling and multi-criteria analysis, a series of economic reports were developed. These reports form the foundation of the economic analysis and list the basis around the assumptions applied for the cost-benefit analysis (CBA). These reports are provided in Appendix B of this report and include:

1. Case studies
2. Park and ride options
3. Events and festivals
4. Markets
5. Patronage
6. Community Benefits
7. Land Value
8. Tourism numbers
9. Funding opportunities.

The following sections provide a summary of these reports and the various inputs that have been applied to the economic model.

3.1 Demand inputs

Benefits are largely derived from the potential demand for the rail corridor, which is based upon the numbers that may use the new transport facility and anticipated future travel patterns. Demand inputs were derived from the research and analysis undertaken of Byron Shire's tourism numbers, patronage from events and festivals, markets and resident population.

The following figure shows the major population catchment areas.

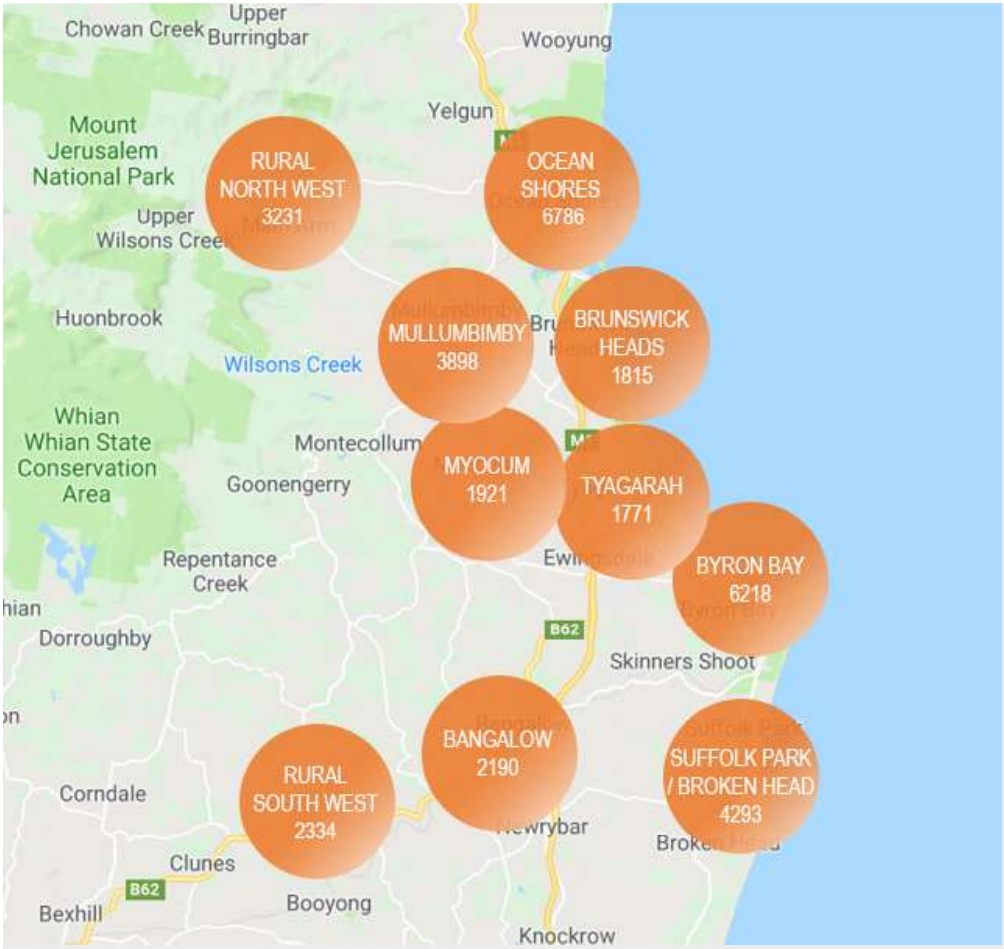


Figure 23 - Population catchment areas within Byron Shire

Tourism demand

According to Tourism Research Australia (TRA), over two million people visit Byron Shire each year, which range from domestic day visitors to overseas tourists. In 2018, there were:

- 201,000 international overnight visitors (1,315,000 international visitor nights)
- 818,000 domestic overnight visitors (2,733,000 domestic visitor nights)
- 1,024,000 domestic day visitors.

Tourism attractions are centred around Mullumbimby, Byron Bay, Brunswick Heads and Bangalow. These towns are assumed to attract the majority of both domestic and international visitors. Most visitors arrive from the Gold Coast Airport.

Tourism is the largest employer in Byron Shire, accounting for 23 per cent of Byron Shire's jobs (3506 jobs) and 14.1 per cent of output/sales ($463 million) in 2016/17.

The economic analysis has assumed an annual increase in tourist numbers of around 47,000 people per year based on the average change in tourist numbers from 2002 to 2018. This is a moderate estimate based on a growth rate that tapers down from around three per cent down to one per cent in fifty years' time. The reducing growth rate is due to the highly volatile and uncertain nature of tourism growth.

Resident demand

Byron Shire has grown from 29,209 in 2011 to 31,556 in 2016 (Australian Bureau of Statistics) (ABS) to 34,457 as of 30 June 2018 [3]. To inform the demand analysis, 50-year population growth estimates have been made based on a historical five-year (2012-2016) average population growth rate of 1.72 per cent, compounded annually. The forecast resident population in 2066 is about 74,000.

Events and Festivals

Byron Shire is home to some of the most popular music festivals, surfing and other cultural events in Australia. Hosting these events has a positive impact on the regional economy, boosting local businesses and providing economic opportunities for the community. However, managing the additional traffic and consequential congestion and wear and tear of infrastructure caused by the number of visitors to these events is a challenge for Byron Shire Council.

The largest three events (Splendour in the Grass, Fall Festival Byron Bay and Bluesfest) represent 74 per cent of all 25 events in Byron Shire per year and are all held at either Yelgun or Tyagarah, which are both close to the railway corridor.

Currently a bus network services the festivals, operating to/from the festival locations, providing either frequent shuttle services or timetabled scheduled services. In addition, several taxi services and other rideshares such as Uber, service locals and visitors attending the festivals. These road vehicles are a major cause of traffic congestion during the festival periods.

Based on the number of attendees, location of the event in relation to proximity of the corridor and previous studies[4], between 20 and 50 per cent (dependent on location) of patrons from Bryon Shire events and festivals may utilise the multi use corridor. This results in approximately 200,000 reduced car trips annually.

Markets

There are a variety of both farmers markets and general markets in Byron Shire and local businesses and organic producers seek to maximise the opportunity these markets provide to access the spending power of the visitor economy of Byron Shire.

Farmers markets and general markets will have different demand profiles, including origin/destination and timing of each participant. Assumptions for patronage were based on the location of the market and the accessibility of the corridor. Accessibility and convenience are critical for market patrons as they often will be carrying goods purchased and hence will not want to walk too far to transport, 50 per cent potential corridor usage was assumed for the Byron Bay Farmers Market due to its location at Butler Street Reserve and therefore close proximity to Byron Bay Station. Reduced percentages were assumed for farmers markets that are less accessible to the corridor such as the Mullumbimby Farmers Market. Different patronage assumptions were also applied to weekday and weekend markets, with the general assumption that weekend markets are more likely to attract day trippers from South East Queensland or surrounding regions.

3. *https://profile.id.com.au/byron/population-estimate?WebID=180*
4. *2011 position paper, Accessing Major Events, at the Tourism & Transport Forum*

In summary a total of approximately 500,000 reduced car trips were estimated per year from within Byron Shire, adjacent regions and South East Queensland through the reactivation of the railway corridor, with the later reliant on additional incentives such as park and ride. A geographical split of assumed patronage expectations for markets collated within geographical boundaries is provided in Figure 24.

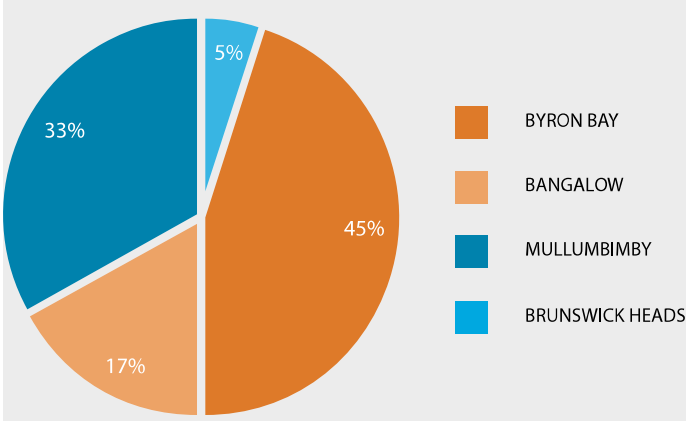


Figure 24 - Split of assumed market patronage that will divert to rail corridor transport

Travel demand

Information on local resident travel patterns is readily available through the ABS Journey to Work data which is derived from the five-yearly Census of Population and Housing. However, tourist travel demand is far more difficult to predict as they have very diverse travel patterns (e.g. destinations, time of travel, distance travelled, etc.).

Travel demand estimates are broadly based on a two-step process. First, by estimating what share of the Byron Shire population is likely to use public transport. Second, how many trips per year these people are likely to make.

Demand estimates for rail and busway options included a low scenario where there are limited incentives to discourage driving and a high scenario where there are incentives, such as transport demand management (TDM) measures, in place to discourage driving in conjunction with the project. As there is a lack of information and understanding on the potential demand for driverless vehicles, the demand estimate has been conservative, and is relatively low.

The key assumptions applied to estimate future travel demand is as follows:

- **Public transport** - The current resident public transport mode share in Byron Shire (0.27 per cent) is significantly lower than Australian major cities (~4 per cent to 10 per cent) and the regional NSW average (0.8 per cent). However, as a significant portion of the Byron Shire Multi Use Corridor demand is expected to come from tourists, the potential for increased public transport demand is likely if the infrastructure is provided.
- **Rail** - The demand for rail-based travel has been estimated using the average proportion of the population that use trains in other Australian cities (3.44 per cent)
- **Busway in the rail corridor**- Currently, buses are the main form of public transport in Byron Shire and there are a number of private companies that provide daily services. Services are provided between towns, to airports (Brisbane, Gold Coast, and Ballina), school buses, festival and events. Stakeholder consultation and research indicated there are approximately 48,354 bus trips per year that carry an estimated 823,011 passengers, not including school buses. This figure has been inflated by the population growth rate and combined with the average proportion of public transport users across Australia and the capacity of buses to estimate future demand
- **Hi-Rail** - Hi-Rail is assumed to be a bus that is adapted to enable it to operate on the light railway system. The demand for Hi-Rail is assumed to be the same incremental increase as busway but only attracts half of the current buses operating in the Byron Shire at this time. The assumption is that some bus operators will not spend the required money to convert their buses to be Hi-Rail capable
- **Active transport** – Similar to public transport demand, active transport demand has been estimated based on population estimates and the typical mode share for active transport in other cities.

[5] *Wallis I., Ballantyne J., Lawrence A., Lupton D., & Weir D., 2015 "Economic benefits of park and ride", Australasian Transport Research Forum 2015 Proceedings, 30 September - 2 October 2015, Sydney. See: atrf.info/papers/2015/files/ATRF2015_Resubmission_148.pdf.*

Park and ride - The availability of park and ride facilities would positively influence the demand for a new transport corridor. There are various opportunities to provide park and ride facilities within the public transport corridor, thereby providing visitors the opportunity to park at a convenient location and catch a VLR, Hi-Rail, ride or walk into Byron Bay township, thus saving individual travel time and easing congestion. Park and ride could also provide the opportunity to include tourist accommodation, cafes, bike hire, food outlets and other complementary services and amenities. However, it is noted that additional measures may also be needed to incentivise the visitors to use the park and ride facility (such as increasing the cost of parking in Byron Bay or implementing dynamic tolling on Ewingsdale Road for visitors).The range of possible park and ride sites is shown in Figure 25. It is noted however, that the potential park and ride facility locations are subject to further investigation (e.g. land use impacts, traffic impacts, safety, etc.). Due to the lack of publicly available studies that indicate the likely use of the park and ride facilities, the analysis has relied on a 12 per cent diversion rate as cited in one New Zealand study. Therefore, the assumption is that 12 per cent of total tourists (deducted from compounded tourist increase calculation) would use a park and ride facility, and in turn the re-activated rail line.

Figure 25 Park and ride proposed site locations

Figure 26 shows the total estimated demand across the six options over 50 years. "High" refers to options with TDM (eg. pay parking in town centre). "Low" refers to options without travel behaviour change measures.

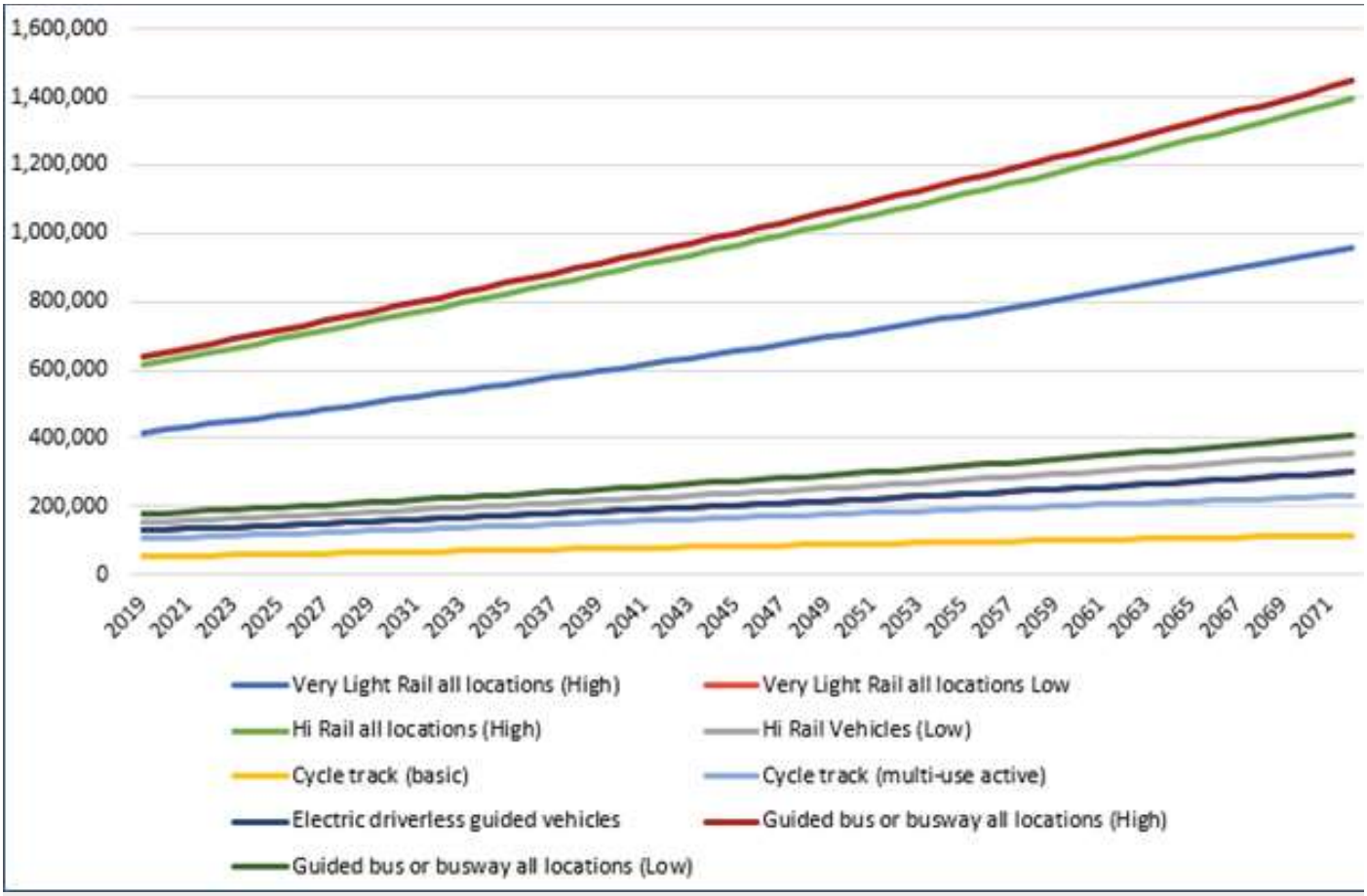


Figure 26 - Estimated demand across all options

3.2 Benefits

The economic analysis provides an indicative BCR for each option based on readily available information and by applying standard NSW CBA guidelines.

The BCR is a representation of the net present value (NPV) of the quantity of benefits in comparison to the costs over the 50-year assessment period. A BCR of more than one represents an option that is estimated to have a net benefit, a BCR of less than one indicates the estimated costs are more than the estimated benefits.

The benefits included in the BCR are largely derived from the number of people that may use the new transport facility (i.e. demand).

A BCR was estimated for each of the options based on the costs of each project option, compared against the sum of the following benefits:

1. Reduction in congestion costs – based on rate of reduced vehicle use. This used 2010 Ewingsdale Road traffic count data, BITRE 2015 congestion costs and general council statements to forecast the possible congestion costs in Byron Shire over the next 50 years
2. Reduced crash costs - based on the number of vehicle crashes over the assessment period and applying crash parameters. This is based on the assumed rate of reduced vehicle use
3. Health benefits – based on an incremental increase in people walking or cycling
4. Fare revenue – based on the average NSW public transport fare for a similar distance track
5. Reduced track maintenance – based on the assumption that the new transport facility will reduce the need for this maintenance cost on the relevant section of track

6. Reduced road maintenance costs – based on the assumed rate of reduced vehicle use, therefore road use
7. Reduced emissions costs – based on the National Transport Commission light vehicle emissions quantity estimates and the Clean Energy Regulator's June 2018 Emissions Reduction Fund's auction for a tonne of emission abatement.

The preliminary assessment estimates that the six options have an estimated BCR of 0.11 to 1.51 over a 50-year period depending on assumptions. The positive externality effect, as per the benefits summarised above, of each option is shown comparatively in Figure 27. "Low" options are variants of the original ("high") options which represent scenarios where travel change incentives (e.g. TDM measures like town centre parking pricing) are not provided.

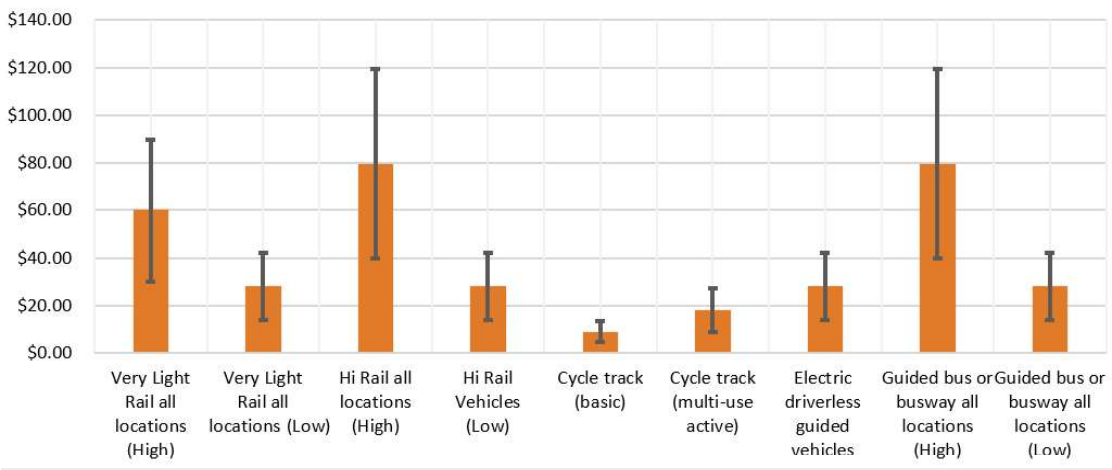


Figure 27 Preliminary mid-range total benefit estimates

Note: all benefits are 2019 net present value estimates over a 50-year period, values used are real and discount rate is pre-tax seven per cent real. Error bars show 50 per cent variation

Non-quantifiable benefits

In addition to the quantifiable benefits included in the BCR analysis, a multi-criteria analysis was undertaken. This included the following additional benefits:

- Environmental sustainability
- Accessibility and mobility
- Amenity impacts to residents
- Employment
- Support of existing events, markets and the like
- Land value
- Regulatory
- Equity in access
- Cultural diversity and participation
- Economic growth and development
- Recreation.

Figure 28 provides a comparative assessment of the six options.

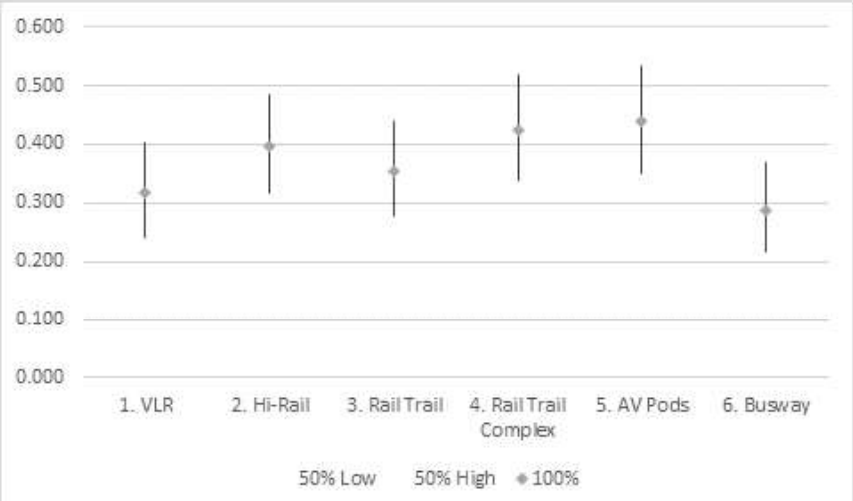


Figure 28 Shows the results of the MCA analysis where at 50% probability Option 2, 4 and 5 compare favourably in terms of the qualitative criteria.

Potential land value uplift

Due to unpredictability in land value uplifts and significant differences in uplift for each of the multi use options, the analysis did not include the benefit of land value uplift.

The NPV of land value uplift benefits can be substantial and if these benefits were included in the analysis, it is likely that more options would produce a positive net return. The potential range of land value change related to the considered options is shown in Figure 29.

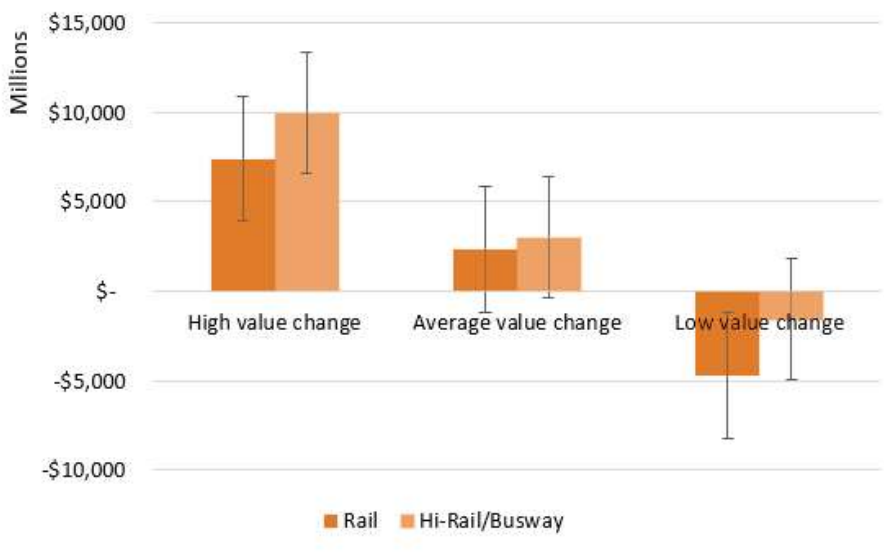


Figure 29 - Possible range of total net present value of land value change related to considered options

Note: value uplift applied to all properties within the sample surrounding transport corridor using the BITRE average per cent value uplift however, in reality this value could be significantly higher or lower.

(Source: DPP calculation, NSW Valuer General, BITRE [6])

3.3 Summary and conclusion

A summary of the costs and benefits of the economic analysis are presented in Table 4.

The results presented in the quantitative economic analysis are the outputs from a model used to collect and calculate all the costs and benefit estimates for all options and scenarios considered in this project. All results are to be treated as the current estimates given the limited known information at the time of assessment and will need to be refined in later more detailed assessments once more decisions are made regarding the specifics of the actual project.

[6] *BITRE 2015 Department of Infrastructure, Regional Development and Cities, Bureau of Infrastructure, Transport and Regional Economics (BITRE), Information sheet 69: Transport Infrastructure and Land Value Uplift, viewed 5 April, https://bitre.gov.au/publications/2015/is_069.aspx*

Table 3: Summary of Economic Analysis

Parameter	1. VLR*	1.5 VLR	2 Hi-Rail*	2.5 Hi-Rail	3. Active Transport (Basic)	4. Active Transport (multi-use)	5. Electric driverless vehicles	6. Guided busway*	6.5 Guided busway
Net benefit	$59.93m	$28.07m	$79.55m	$28.07m	$9.00m	$17.99m	$28.07m	$79.55m	$28.07m
Capital cost	$67m	$67m	$31m	$31m	$11m	$20m	$105m	$209m	$209m
Annual operating/ maintenance cost	$2.36m	$2.36m	$2.30m	$2.30m	$1.30m	$1.32m	$0.44m	$0.65m	$0.65m
Maintenance cost every 5 years	$0.97m	$0.97m	$0.97m	$0.97m	$0.97m	$0.97m	$0.06m	$1.81m	$1.81m
Maintenance cost every 20 years	$9.50m	$9.50m	$9.50m	$9.50m	$9.50m	$9.50m	-	$23.25m	$23.25m
BCR (4% discount rate)									
BCR (7% discount rate)									
BCR (10% discount rate)									

*Scenarios which include travel behaviour change incentives (e.g. town centre parking pricing)

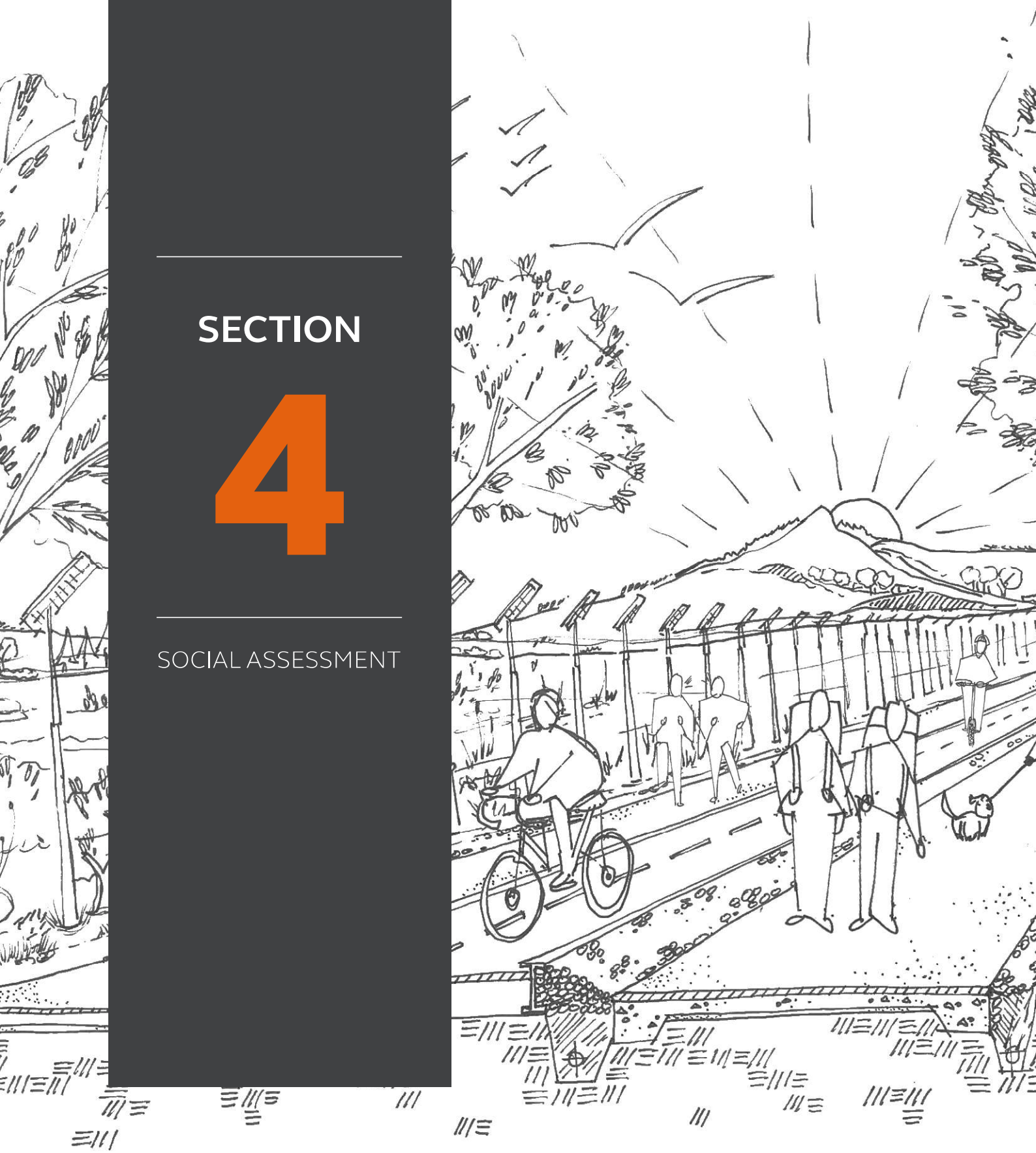
BCR > 1 BCR 0.5 TO 0.9 BCR < 0.5

In summary, the quantitative economic analysis demonstrates that for every $1 invested in Option 2*, Hi-Rail with active transport and travel behaviour change incentives could be associated with a return that is greater than $1. That is, a positive net benefit is likely with Option 2* and this option is relatively most likely to be 'fit for purpose' in terms of technology, sustainability, community need and economic viability.

However, the change in demand and other assumptions made in this analysis are to some extent arbitrary due to limited information and resources and will need to be improved when the project moves to feasibility stage assessment. At that time, further studies could focus on the elasticity of demand in Byron Shire as well as the many other costs and benefits associated with an individual taking each type of transport option (e.g. comfort, time taken, frequency of transport, and distance from the persons home to the facility). Each of these estimates should be tested with sensitivity analysis to consider the possible range of outcomes given a certain infrastructure scenario.

SECTION 4

SOCIAL ASSESSMENT



4. SOCIAL ASSESSMENT

Social Assessment Overview

The social assessment run concurrently and complementary to the engineering and economic assessment of multi use rail corridor options is critical in ensuring there is a wholistic approach to identification and assessment of potential impacts that considers all community needs.

The social assessment followed a structured approach to capturing the opinions, inputs and potential impacts on the community, as summarised in line with the following headings:

- Need for social assessment
- Methodology
- Policy context
- Stakeholder engagement
- Community profile
- Engagement outcomes
- Social implications of multi-use options.

Further detail on all of the above areas can be found in the Multi Use Byron Shire Rail Corridor Social Assessment Report 28th May 2019 in Appendix C.

Need for Social Assessment

“Listen to the locals please the area really needs a……”

Comprehensive and inclusive social assessment incorporated into all phases of a project allows for the capture of insights, challenges risks and opportunities gained through various stakeholders. For the Multi Use Byron Shire Rail Corridor project, it will help to define community needs and aspirations regarding uses of the corridor which in turn provides a deeper understanding of community impacts and opportunities in designing the optimum uses to of the corridor.

In addition to meeting the expectations of the Byron Shire community and ensuring that the multi use of the rail corridor project addresses all potential impacts from a quadruple bottom line perspective (social, environmental, economic and civic leadership), the need for social assessment is also driven through Federal, State and Local planning and policy frameworks (see Policy Context).

"Thanks for involving the public. I hope you will hear our voice."

Methodology

The Stakeholder Engagement Approach diagram (Figure 30) summarises the approach that was undertaken for consultation, this approach ensured that a methodical process was incorporated which captured both previous consultation outcomes as well as the outcomes of targeted consultation specific to the multi use rail corridor. The approach was structured, dynamic and adaptive. This was critical to enable alignment with the engineering and economic analysis and development of multi use options.

Figure 30: Stakeholder Engagement Approach

Key stakeholder identification was essential in ensuring that key potential impacts and opportunities relating to the multi use of the rail corridor were identified. The process of stakeholder identification was guided by the Byron Shire Council Policy for Community Engagement (2018) which in turn has adopted the community engagement International Association of Public Participation (IAP2), which is considered the best practice benchmark in the world. Key stakeholder subgroups identified during the project included:

- Local, State and Federal Government (elected representatives, agencies, Byron Shire Councillors and representative Council committee members)
- Public Transport (advocacy groups, interest groups, private operators)
- Active Transport (advocacy groups, interest groups, Council committees)
- Infrastructure managers and operators
- Local businesses and commerce networks (including market, festival and event operator and organisers)
- Tourism agencies, networks and activity providers
- Community and interest groups (mobility impaired, youth, arts)
- Education community
- Environment and Cultural Heritage agencies and groups.

Engagement methods used to consult with the identified stakeholders were influenced by the level of consultation that has been undertaken (by local government and others) relevant to previous phases of this project's development as well as the status of the project as a pre-feasiblity study. Consulation within this group was mainly undertaken on a face to face basis, however some email correspondance and phone consultation was also undertaken.

In addition to the above, an online survey was developed to capture other community groups and individuals not identified on the list above. It was considered that an online survey provided the opportunity to maximise community input as efficiently as possible.

The project timeframe necessitated the delivery of the stakeholder engagement concurrently with other project discipline assessments (engineering, economic and environment) and so a staged approach to stakeholder engagement was implemented to benefit from the progress and complementary findings being identified throughout the project. This incorporated an intial and secondary phase engagement as described below:

- **Initial phase engagement,** where select stakeholder interviews with community representatives were conducted to initially test the community understanding of the project and gauge likely key issues. A target for this phase of engagement were industry groups working in Byron Shire with a focus on tourism and development.
- **Secondary phase engagement** commenced when more direction was available about the overarching community context and potential options. Engagement during this phase targeted Byron Shire Council representatives, formalised interest groups and key stakeholders with an identified interest in the corridor. This phase also captured input from the general community through participation in an online survey.

"The corridor is currently a wasted resource. A cycle/walking path would safely connect the shire and if managed wisely be a financial windfall. Refurbish or rebuild the old stations to supply accommodation or cafes for people riding the corridor".

Policy context

When considering the social impacts and opportunities arising from the multi use rail corridor options being assessed it was essential to consider the legislative framework and policies under which the land and proposed options may be positioned. This framework recognises that the options will utilise an existing transport corridor and identify the potential relevance under Federal, State and Regional policies, strategies and initiatives which may underly or overarch the foundations for the project moving forward.

Community profile

A fundamental component of a social assessment is to consider the community profile specific to the project area and ensure that engagement and assessment of impacts incorporates factors which are unique to a region such as culture shared beliefs, customs and values. This is particularly important for the Byron Shire community which has a culture influenced by a number of societal advantages and challenges, including:

- **Population.** The resident population is spread out across main centres including Byron Bay, Ocean Shores, Suffolk Park (-Broken Head), Mullumbimby, Bangalow, Myocum, Brunswick Heads, Tyagarah and the North and South Rural west. The enumerated population across Byron Shire is 6.6 per cent higher than the resident population, primarily due to tourism.
- **Tourism.** The natural beauty of the shire combining beautiful hinterlands, farming countryside and amazing beaches results in a popular international destination, but also a popular national destination receiving a large number of day trippers as well as visitors who attend the many festivals and music events held in the area. In 2017/2018 it is estimated Byron Shire welcomed more than two million visitors.
- **Infrastructure capacity.** The Byron Shire is currently faced with a serious road congestion problem, causing huge delays for the local the populations and tourists alike. This is because the shire's road networks and associated infrastructure were designed for a much smaller population and are currently operating beyond their capacities.
- **Vision.** Byron's vision is one of a sustainable, self-sufficient, environmentally aware "people place" and an economically balanced environment. The community is engaged, passionate and motivated.

Engagement outcomes

Despite a diverse range of stakeholder input, common themes that were dominant were:

- Support for the use of otherwise wasted asset and land
- Support for efforts to address traffic issues
- Broad Interest in active transport options
- Interest in sustainable corridor opportunities.

During the targeted, direct engagement activities in both the initial and secondary assessment phase it was possible to organise findings from some of the key stakeholder sub groups further into common themes and key discussion points.

The following diagrams present the common themes and key discussion points from industry groups (tourism and development) and Council and community interest groups.

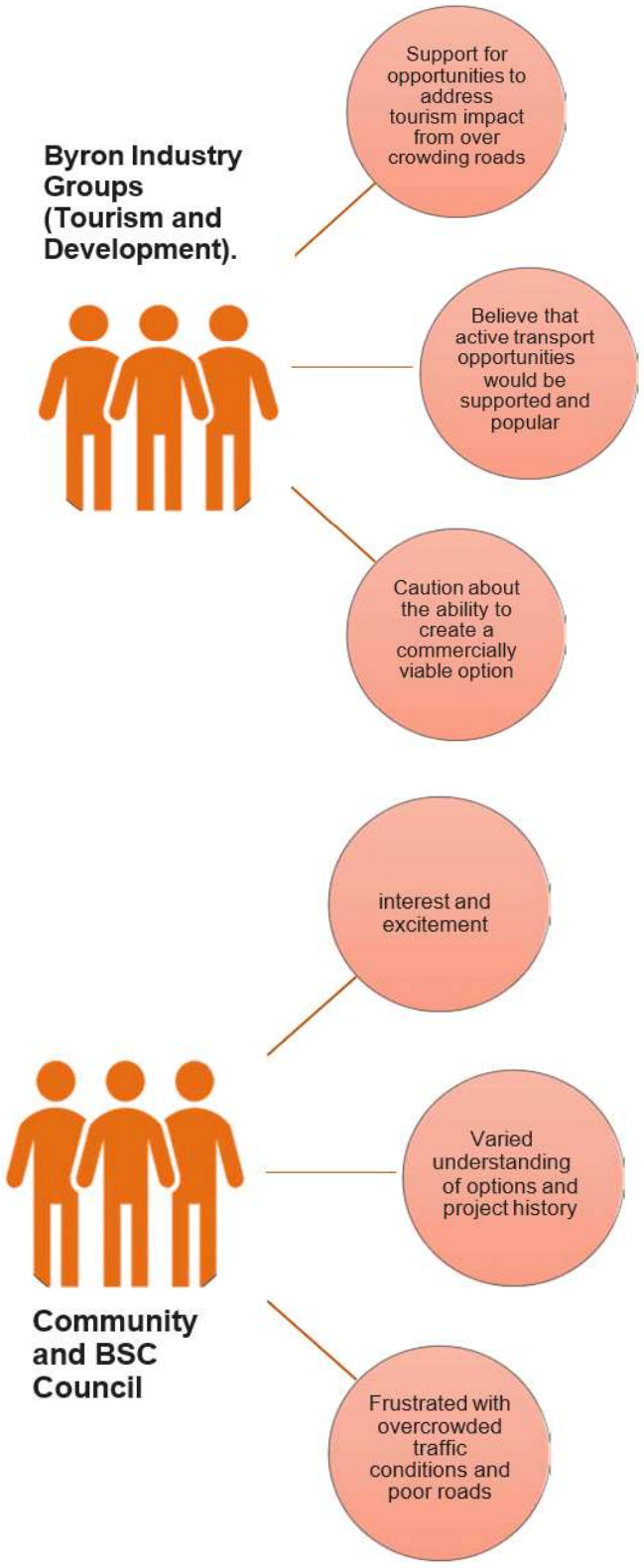


Figure 31

Key discussion points:

- The parties representing development and industry around the Byron Shire were all supportive of opportunities to utilise the corridor, with potential tourism industry benefits identified. Acknowledge that traffic congestion from tourism is impacting on the community.
- All saw that active transport options are likely to be very popular, and all were familiar with community interest in rail trail options.
- Those parties associated with the Byron Bay Railroad Company issued caution regarding licensing delays (through the rail operator), community perception and asset improvement costs if rail options are identified.
- All parties were sceptical of the ability to ever reinstate heavy rail options due to their understanding of construction constraints and the ability to provide a commercially viable option.

Key discussion points:

- Consultation with Byron Shire representatives has been very informative, identifying multiple connections and relationships between the Multi Use of Byron Shire Rail Corridor project and other Council policies, strategies and projects.
- Primary understanding of the importance of the project is to address congestion and transport asset maintenance costs that are impacting on the liveability of the region.
- During field surveys, opportunistic engagement with interested locals was unanimously positive regarding the use of what they considered to be wasted lands and assets.

Beyond the direct, targeted engagement with stakeholders, an online survey was made available to the general community. The focus of the survey was to verify (and quantify, where possible) the potential impacts which had been identified during the direct, targeted stakeholder engagement, while intending to allow broader community involvement and communication about the project. The survey was completed by 1088 participants with general support and encouragement for the reactivation a common theme.

The results from the survey indicated a strong preference for multi use and/or active transport (rail with trail) as reactivation solutions for the corridor (Figure 32)

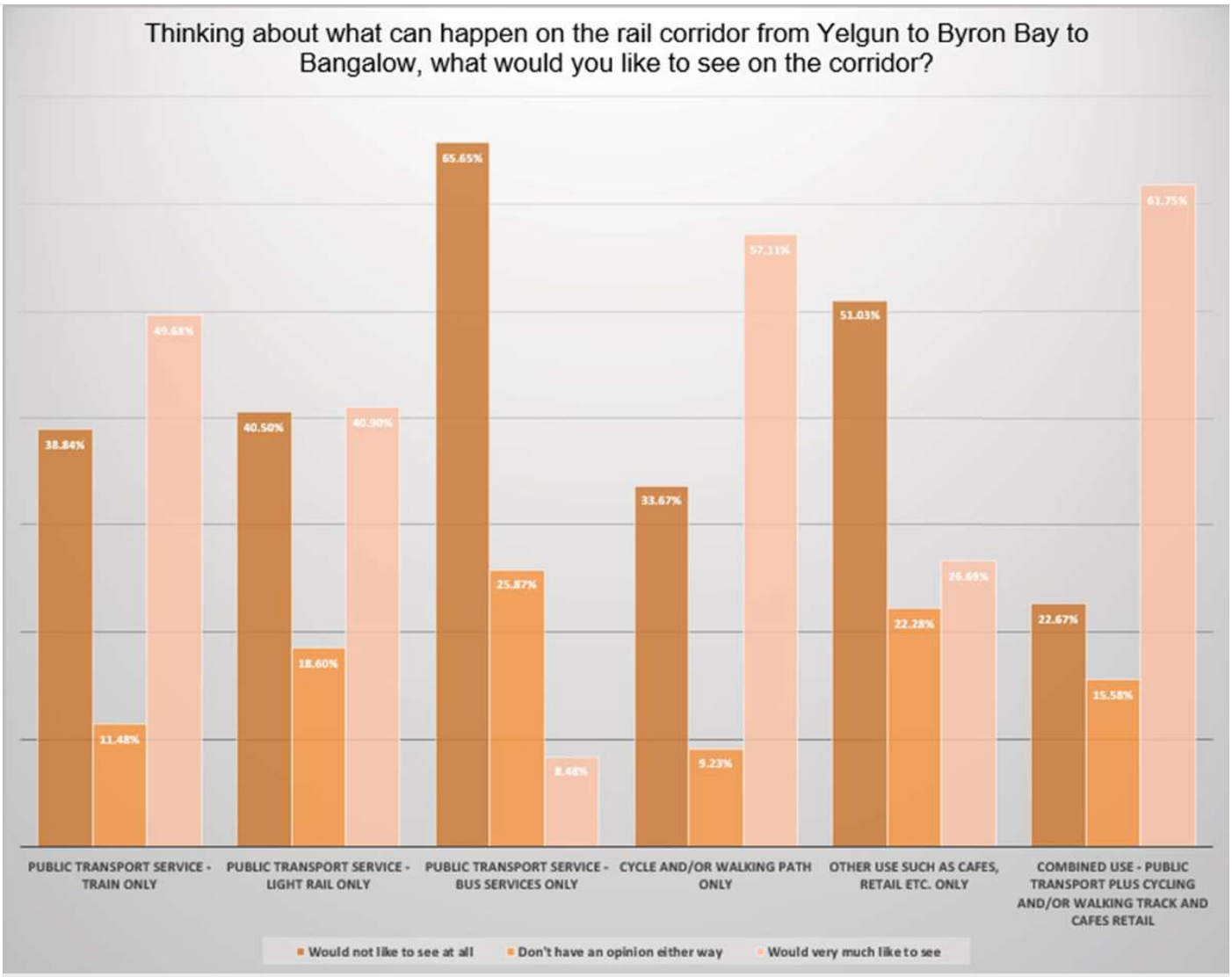


Figure 32. Online Survey Response to the question "What would you like to see on the corridor"

As a tourist i enjoy traveling to places that have great rail tourism and i also like the occasional bit of cycling. I think this is the perfect place to set the example that both rail and cycle paths can coexist together, Byron is a beautiful place, would be great to see this corridor of land used to share between everyone in the community and for tourists as well.

Other strong themes highlighted from the survey include:

- Heavy reliance on private car travel with limited current public transport use. This aligns with stakeholder feedback regarding insufficient public transport options within the shire resulting in traffic congestions and a lack of connectivity for the transport disadvantaged.

"So positive!! Not having it means more pollution, more wear on our roads, and huge opportunities missed for tourism and jobs"

- The highest number of participants responding to the category of "would not like to see at all" selected "public transport service- bus services ONLY" 64.53 per cent. This aligns with stakeholder feedback about lack of connectivity and inadequate services of current public transport bus services, and also highlights the importance placed on flexibility and accessibility of the transport solution

"They run so seldom - don't fit my travel times"

"Unreliable and irregular service"

- Desire for connectiveness and opportunity to travel to visit family, friends health and education facilities for the elderly, disadvantaged and very young.

As an older resident, it worries me that public transport to services, especially health services, is unavailable specially to go outside of the shire. Health referrals are invariably to Ballina, Lismore or Tweed/Qld. It would be great to have linking public transport to these places.

Social implications of multi use options

The social assessment process followed for the multi use of the Byron Shire rail corridor project has resulted in the identification of potential impacts which may result from the reactivation of the corridor, considering stakeholders across the community.

From an amenity, social and environmental perspective, there were a number of potential impacts identified relevant to the construction phase. These include impact on regrowth vegetation, water quality (erosion and sedimentation), noise, vibration and air quality impacts. These in general have industry-accepted mitigation measures which can be employed to lessen the impacts on the community and most sensitive receptors. Impacts during the construction phase which are not easily addressed through mitigation measures include impacts on cultural heritage values and items (Aboriginal and non-Aboriginal).

The direct and indirect impacts from an operational perspective are often more difficult to gauge and manage. The social assessment has identified impacts relevant to the reactivation of the rail corridor falling into the following categories:

- Tourism
- Employment
- Economic opportunities, assets and access
- Asset values – private and public
- Safety and security
- Transport mobility – traffic, school commuting, transport inclusion and connectivity
- Health and wellbeing- active transport and recreation
- Construction nuisance
- Environmental and amenity issues
- Cultural Heritage Values and Significance
- Market and event patronage
- Displacement of itinerant and youth populations using rail corridor land, tunnels
- Change of access to station buildings used for community forums, office space
- Change of land use activity adjacent to conservation areas and nature reserves.

The social assessment then captured social implications by considering these impacts for all potential reactivation options identified within the Engineering Report, to determine if the impact could be considered beneficial, negative or neutral.

A tabular format was used to present a matrix of where potential impacts may arise against key social criteria and indicators, based on the combined findings of the studies undertaken. This is a means of methodically working through the project-specific criteria, from which social issues or impacts can be discussed, agreed and presented within the social assessment - a process further informed by the background research and engagement phases of the social assessment. This matrix was developed around the MCA criteria, specific to social and environmental aspects of Byron Shire and rail corridor.)

Table 4 outlines areas where potential social issues or impacts may arise (both beneficial and negative) for the various options against the criteria defined for the MCA. The colour key below outlines the basis for initial identification of potential impacts against indicators and criteria.

Table 4

	Option 1 Very light rail & active transport	Option 2 Hi-Rail & active transport	Option 3 Cycle track basic	Option 4 Active Transport- cycle, mobility scooter, walking	Option 5 Automated Vehicles/ driverless pods & active transport	Option 6 Busway (traditional) & active transport
Sustainability in terms of environment (energy use, emissions - greenhouse gases)						
Future proofing for capacity and technology (innovation)						
Accessibility and mobility						
Safety, including safety from a user perspective						
Integration with local and regional transport networks						
Integration with interstate and other transport networks						
Environmental impacts (including emissions)						
Access to employment						
Support of existing events, markets and the like						
Reduced car reliance						
Economic growth and development						

Cost to users						
Amenity impacts to residents - sound/noise impact/ aesthetics						
Accessibility to events, facilities and attractions						
Health benefits (recreation and commute)						
Cultural Diversity and Participation						
Recreation						

Overall Social Impacts Identified	
	Beneficial/Opportunity
	Negative/Non-Beneficial
	Beneficial/Negative (options that may incur both beneficial and negative impacts relevant to a particular criterion
	Neutral/Negligible

The social assessment recommends that the social assessment process should continue and refine as the project progresses to future feasibility, concept and design phases. The methodologies used and consultation strategy developed was tailored specifically to the current project phase, however future, ongoing engagement with the community will be critical to continue to monitor and address the impacts preliminarily identified in this social assessment.

As the project progresses to future feasibility, concept and design phases consultation should be regular, open and inclusive to provide the community with a sense of empowerment and trust in the council, and to provide for the most sustainable long term development and use of the corridor. Importantly, no matter the rating the identified impacts should continue to be captured and addressed throughout future project phases.

Conclusion

The Multi Use Byron Shire Rail Corridor study has identified the following key points in relation to reactivation of the corridor:

- The current condition of the corridor renders feasible to incorporate light axle load shuttle, Hi-Rail, Dual Mode Vehicles or similar rail transit solutions
- Although multi use solutions incorporating rail trail and rubber tyred vehicles such as driverless pods or shuttles are also feasible, such options involve costly and invasive removal of existing infrastructure which has a remaining life cycle of at least 20 – 30 years and replacement with alternative bitumen or asphalt pavement, with significant environmental impact

- Both the multi-criteria analysis and economic cost-benefit analysis (BCR) has highlighted that multi use options which combine both public and active transport provide the greatest social and economic benefits, especially when combined with Travel Demand Management measures. A Hi-Rail or dual mode vehicle option combined with cycling/pedestrian (Rail with Trail) returns a BCR ranging from 0.9 to 1.51 over a 50 year period, while options assessed which provide only cycling/pedestrian or require high capital investment to remove existing infrastructure and reinstate with alternative pavements return a BCR range of 0.11 up to 0.93
- The results from the social impact assessment have highlighted that there is strong community support for a feasible and workable multi use solution on the corridor with preference being to maintain the rail and provide facilities for cycling and walking

In consideration of the above the next steps for Byron Shire Council is to determine a preferred option from the six multi use options discussed in this report. Further work can then be undertaken to validate the assumptions made in the engineering and economic assessments, finalise operational requirements and refine funding opportunities.