Priority Cycle Route Improvement Plans

Guidelines for assessing and treating a priority cycle route

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Queensland Government

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Refer to the appropriate Risk Assessment Tool for relevant reviewer and approver

Date	Name	Position	Action required *(Review/endorse/approve)*	Due
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Introduction

Context

The vision of the *Queensland Cycling Strategy 2017-2027* is “more cycling, more often.” To make this happen, infrastructure needs to be fit for purpose, convenient and safe for experienced riders and people just getting started.

The Department of Transport and Main Roads (TMR) has developed the *Priority Cycle Route Improvement Plans – Guidelines for assessing and treating a priority cycle route* (PCRIP guidelines) to:

- facilitate development of complete cycle routes through coordinated planning and investment
- improve safety, accessibility and amenity on continuous routes for both existing and new bicycle riders
- implement best practice and innovative infrastructure to complete continuous routes
- better target investment in cycling infrastructure
- develop capability in cycling infrastructure provision i.e. across Local Government Authorities (LGAs) and TMR Regions
- the PCRIP guidelines are accompanied by a set of nine case studies showing how they have been applied in practice in projects across Queensland.

Purpose

When cycling networks are planned and delivered in small, uncoordinated segments, infrastructure is often inconsistent and not well connected. The PCRIP guidelines provide a framework for developing a coordinated plan for complete cycle routes. PCRIPs consider cycling infrastructure requirements over an entire route to provide solutions that:

- are achievable in the short to long term
- represent value for money
- are consistent with the needs of the community and broader network objectives
- provide quality treatments that will encourage more people to ride and which meet the needs of existing users.

The PCRIP guidelines cover all stages in the project life cycle up to, but not including, business case. Concept designs are a key output of the process.

The methodology may inform future funding of cycling infrastructure throughout Queensland through TMR’s Active Transport Investment Program (ATIP) or via the Cycling Infrastructure Policy as part of other projects.

Planning context

Principal Cycle Network Plans (PCNPs) show core cycle routes needed to get more people cycling more often. They are indicative routes and exist to guide further planning. They show three main types of routes:

- **Principal routes** form the spine to which local cycle networks connect. They provide connections between residential areas and major trip attractors such as business districts, industrial areas, public transport nodes, universities, schools and recreational facilities. They are the most important routes for bike riders within a region.

- **Future strategic routes** identify expansion opportunities for the principal cycle network, in areas where significant urban growth has been identified but land use planning is still in early stages.
- **Regional recreation routes** cater for longer distance recreation and cycle touring, highlighting both coastal and hinterland scenic opportunities.

In Queensland, PCNPs have been published for:

- South East Queensland
- Wide Bay Burnett
- Downs South West
- Central Queensland
- Mackay Isaac Whitsunday
- North Queensland
- Far North Queensland.

PCNPs guide state and local government delivery of a connected network of core cycle routes and prioritise cycle investment to the routes that need it most.

What is a priority route?

Priority cycle routes are the highest priority links in PCNPs. They are identified in Priority Route Maps (PRMs) which are published as an addendum to each PCNP. Priority cycle routes are generally 3-5 kilometres in length—a comfortable distance to cycle. A PCRIP does not need to cover an entire route but it should complete sufficient length to connect to the main generators on the route.

Levels of cycle network planning

PCRIPs are one level of cycle network planning. They should be prepared with consideration to the other levels described below and illustrated in Figure 1:

- **Network:** Strategic level plan showing indicative alignment of important cycle routes. The PCNPs serve this purpose.
- **Area/Corridor:** More detailed network planning for a smaller area. Area plans identify network deficiencies and priority cycle routes that require improvement. The PRMs serve this purpose.
- **Route:** More detailed planning that confirms the actual alignment of priority cycle routes and defines the preferred infrastructure treatments. The PCRIP guidelines cover this level of planning. The assessment of a priority route may consider alternative alignment options to achieve the objectives of the network or area plan.
- **Link:** Planning, design and project delivery of specific sections of a route.

These levels of planning are also considered in multi-modal planning projects.

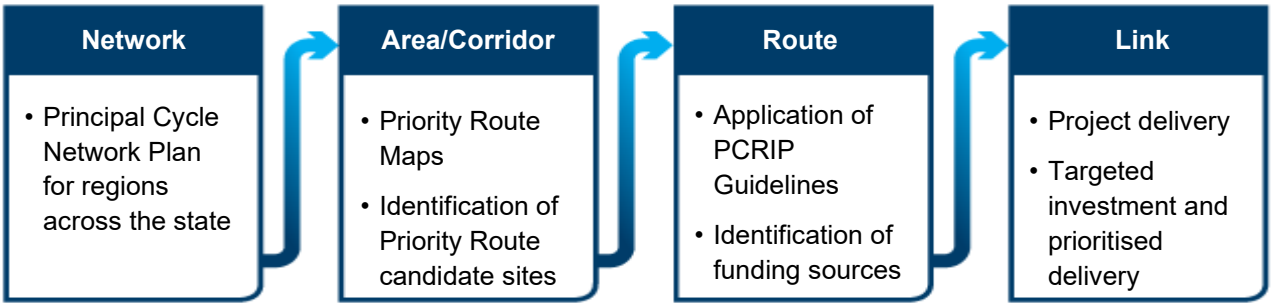

Figure 1 Relationship of PCRIP within wider planning and implementation framework

Abbreviations

ABS	Australian Bureau of Statistics
AS	Australian Standards
ATIP	Active Transport Investment Program
CAD	Computer Aided Design
CIP	Cycling Infrastructure Policy
CBD	Central Business District
CNLGGP	Cycle Network Local Government Grants Program
CPTED	Crime Prevention through Environmental Design
EDD	Extended Design Domain
GIS	Geographic Information Systems
LGA	Local Government Authority
LOS	Level of Service
MCA	Multi Criteria Analysis
MUTCD	*Manual of Uniform Traffic Control Devices*
PCNP	Principal Cycle Network Plan
PCRIP	Priority Cycle Route Improvement Plan
PRM	Priority Route Map
QPS	Queensland Police Service
RFID	Radio Frequency Identification
TMR	Department of Transport and Main Roads

How to use these guidelines

The PCRIP framework is split into the four distinct phases shown in Figure 2, with communication and engagement extending across all phases of the project.

Figure 3 shows a full breakdown of these phases, with links to further information in this document.

A typical reporting template for a PCRIP is included in Appendix A – Sample PCRIP form.

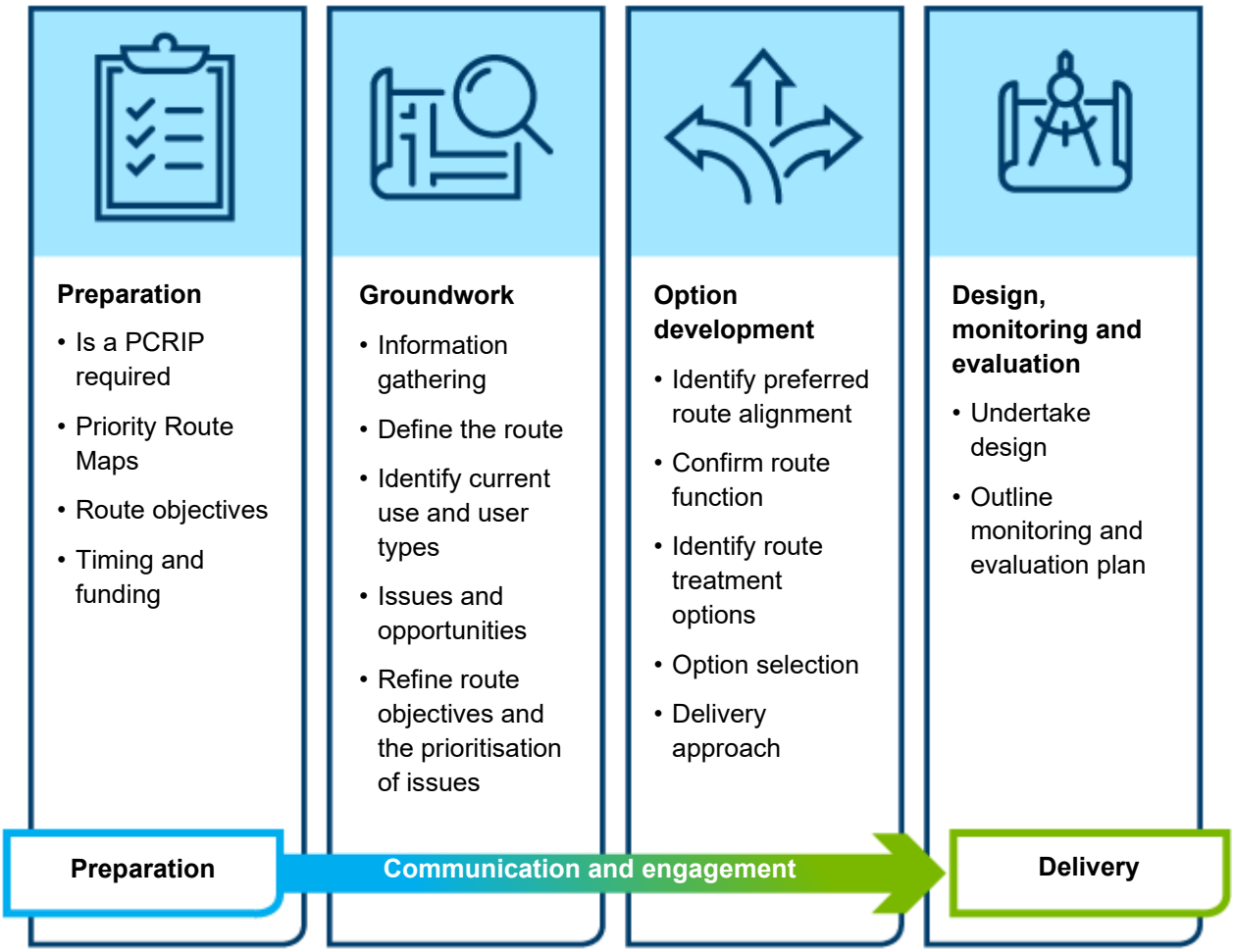

Figure 2 Phases of the PCRIP methodology

Phase	Task/Section	Aims/Outcomes
Preparation	**1. Preparation**	
	1.1 Is a Priority Cycle Route Improvement Plan required?	Establish whether a PCRIP is required, overarching objective/driver for undertaking a route improvement plan
	1.2 Developing route objectives	Define the initial high-level goal and route objectives from wider government planning and policies
	1.3 Timing and funding considerations	Establish timing and funding considerations for a PCRIP
	Deliverable for reparation phase – Initial route objectives	
Groundwork	**2. Information gathering**	
	2.1 Defining the route	Identify the scope of route for the PCRIP
	2.2 Current route environment	Identify existing facilities, road function, operation, streetscape
	2.3 Users	Identify the user types, behaviours and routes used
	2.4 Environmental constraints	Identify environmental and terrain constraints
	2.5 Safety	Identify route complaints, crash data, and user opinions of the route
	2.6 Policy and planning framework	Identify the policies and planning frameworks impacting the route and area, future road network upgrades/proposals/projects/works, major infrastructure
	2.7 Current and future land use	Identify catchments, population, trip attractors
	3. Issues and opportunities	
	3.1 Key issues for bicycle riders	Safety, coherence, directness, attractiveness and comfort
	3.2 Opportunities to benefit all users	Map the issues and opportunities on the route (summarise/review against Austroads principles)
	3.3 Refine route objectives 3.4 Prioritisation of issues	Refine or reconfirm route objectives. Prioritise the issues identified
	Deliverable for Groundwork phase – Agreed route objectives	
Basis of design	**4. Basis of design**	
	4.1 What is basis of design	Elements of the basis of design
	4.2 Establishing basis of design	Process to establish the basis of design
	4.3 Basis of design outputs	Example outputs
	Deliverable for basis of design phase – agreed basis of design outcomes	
Option development	**5. Option development**	
	5.1 Route alignment options	Review the existing route alignment alongside alternatives
	5.2 Route treatment options	Function of the alignment/route. Identify possible treatments to address the route objectives including innovative treatments
	5.3 Alternative options analysis process that combines route and treatment options	Alternative approach to analysis for certain projects
	5.4 Option selection	Evaluate and select options
	5.5 Delivery approach	Consider the approach for delivering the treatment options
	Deliverable for Option development phase – preferred alignment, option/s and treatments	

Communication and engagement

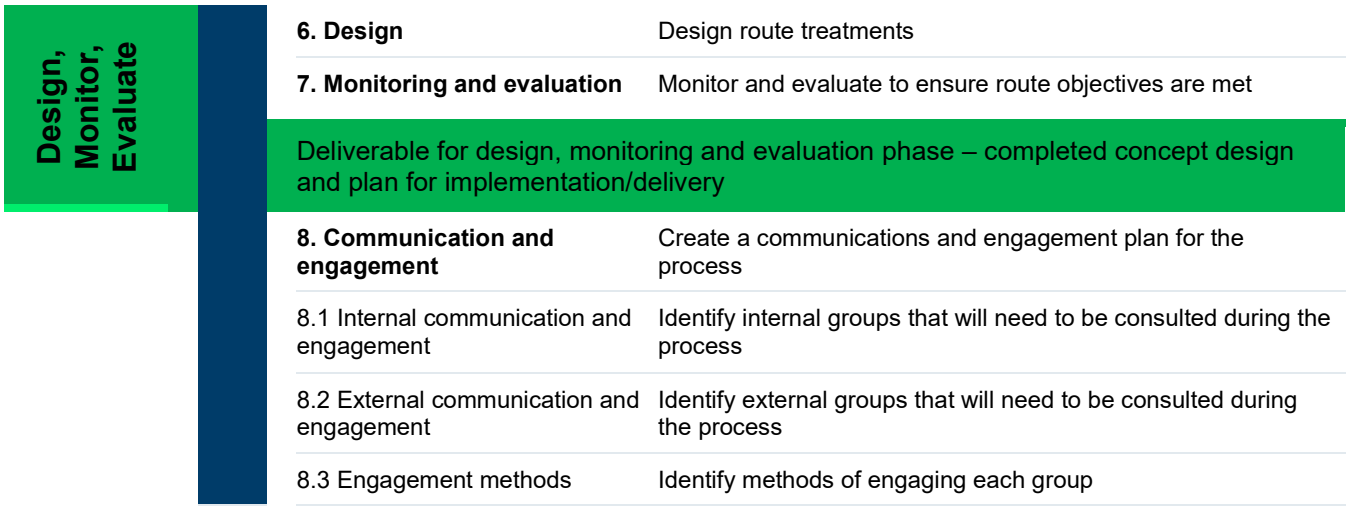

Figure 3 PCRIP methodology overview and navigation chart

1. Preparation

Consider these issues prior to undertaking a Priority Cycle Route Improvement Plan.

1.1 Is a Priority Cycle Route Improvement Plan required?

A PCRIP is required to inform investment decisions along a priority route and to ensure interventions support the ultimate goal for the route. Candidate routes for a PCRIP include:

- routes identified in the PCNP PRMs

- routes on the PCNP with planned infrastructure works. The TMR CIP applies in this situation and a PCRIP can inform cycling priorities
- multi-modal projects on a PCNP route.

Typical sites where a PCRIP may be required include:

- constrained urban settings which form a gap in the principal cycle network
- a complex section of network where alternative treatment options and alignments are available
- an area where the needs of different user groups are not currently being provided for, or wider network objectives are not being achieved.

The start and end of the route and key nodes should be known at the beginning of the process. The exact alignment of the route does not need to be specified and should be subject to the methodology in this guideline.

Once treated, a priority cycle route should be direct, continuous, safe and suitable for new and experienced bicycle riders.

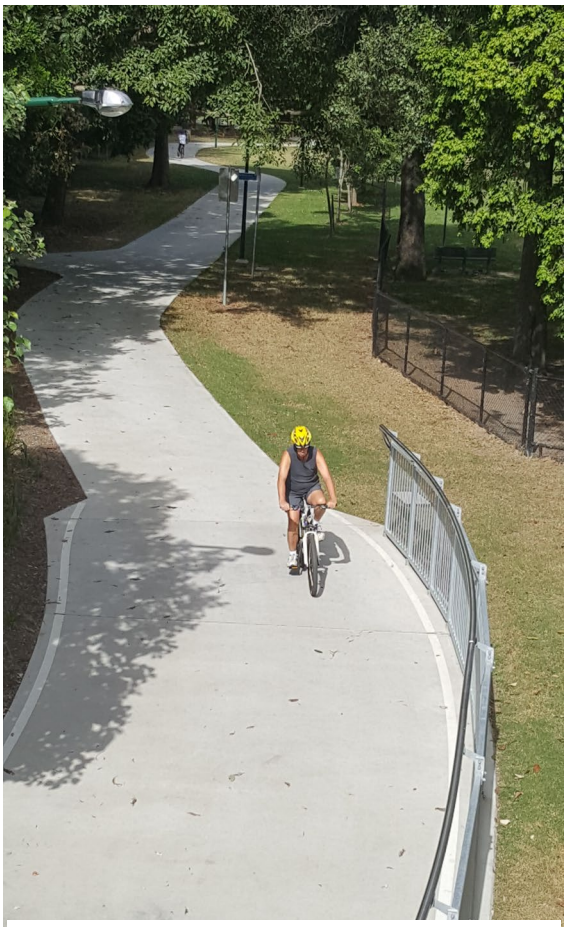

Figure 4 Widening on cycleway provides offset to fencing

(Source: ARUP, 2016)

1.2 Developing route objectives

The route objectives are used to clearly define what the PCRIP is seeking to achieve. Route objectives for PCRIP projects need to consider:

- general guiding principles for bicycle planning including coherence, directness, safety, attractiveness, comfort and end-of-trip facilities[1].
- additional PCRIP planning principles, including user needs, affordability and continuity (see Figure 5).

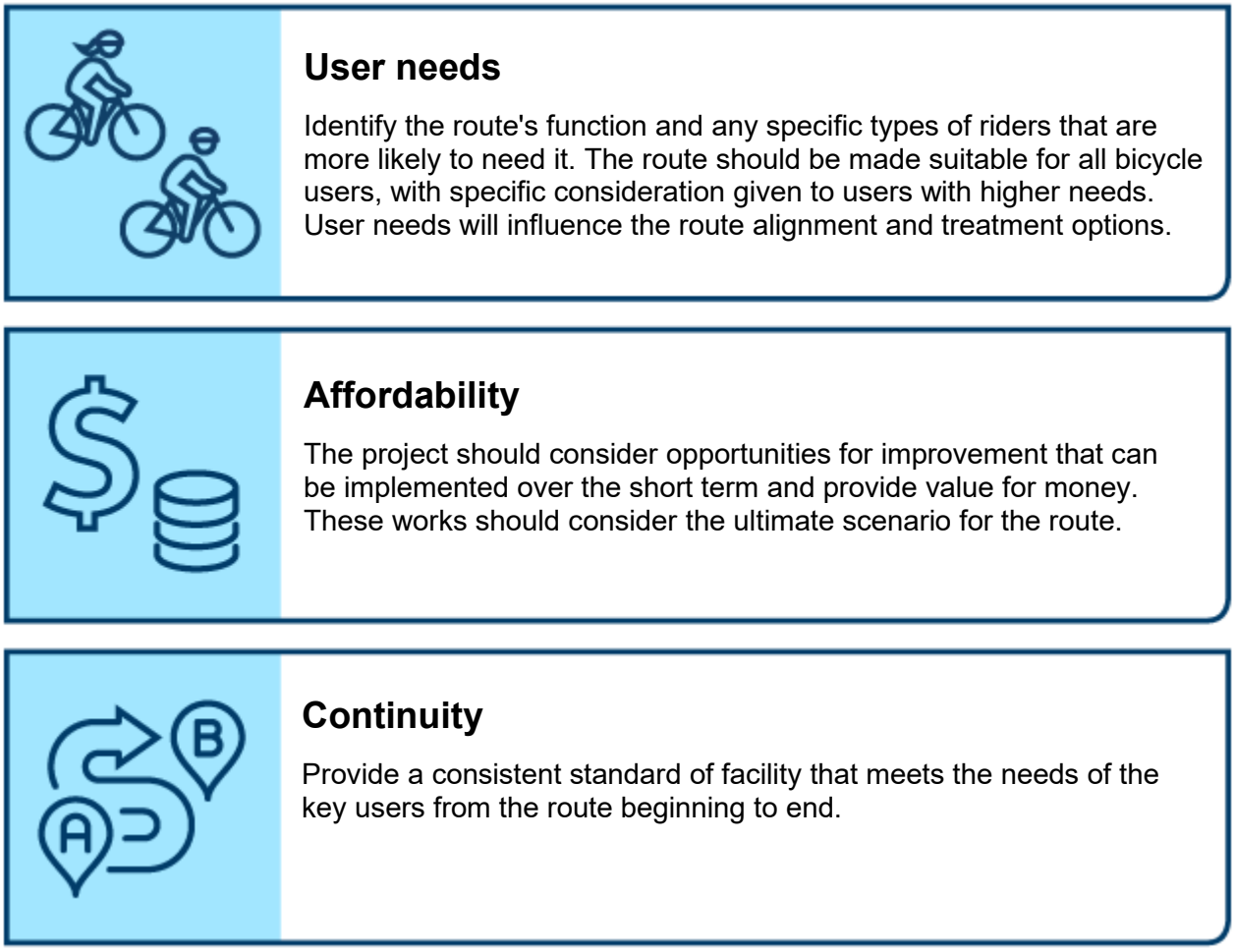

Figure 5 Priority Cycle Route planning principles – defining the route objectives

Route objectives may reflect issues with safety, directness, coherence, comfort or attractiveness or affordability. They may also be motivated by a need to encourage bike riders onto an alternative route that can be delivered in the short term or as an interim solution.

An example of route objectives that consider general bicycle planning principles and PCRIP objectives is provided in Table 1.

See Appendix C3 – Case Study 2 for examples of setting route objectives in three PCRIP pilot projects.

[1] Table 2.7, Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads.

Table 1 Example route objectives for undertaking a PCRIP

Principle	Consider	Example PCRIP objective
Directness / delay	Is there a need to improve the directness of a route or reduce delay to users?	Enable priority at key intersections to provide a comparable travel time along a quieter or safer route.
Safety	What are the key safety issues that the PCRIP needs to address?	Provide safe connections through intersections. Provide high level of separation from vehicular traffic.
Users	What users are targeted and what trip function does the route serve? Are there users other than bike riders that could benefit?	Enable commuter trips on a direct route. Cater for new bicycle riders, pedestrians and personal mobility device users.
Connectivity	Are there key destinations that the route must provide connectivity to, either directly or by connecting to other routes?	Provide for connections between a school and a new development area.
Coherence	Is there a need to improve the ease with which bike riders can access or follow the route?	Provide continuity of the network along a busy corridor.
Attractiveness / comfort	Is there a need to address issues that reduce the attractiveness of cycling on the route or the ride comfort?	Improve overall amenity along the route through de-cluttering, landscaping and removal of obstacles.
Cost effectiveness	Are there specific cost constraints?	Consider lighter, cheaper, short-term treatments to improve continuity and safety.

1.3 Timing and funding considerations

The PCRIP should focus on developing solutions that meet the needs of all users and can be delivered within 1-5 years. However, on more complex or difficult routes, this may not be realistic. For these routes, it is suggested that the ultimate scenario is also identified, as well as a staged program of interim works until the ultimate the scenario can be developed (or incorporated into future works or new developments). Interim works including quicker, lighter, cheaper solutions may be able to meet the needs of key users. A typical staged program might include relative timeframes for treatments with regards to short-term, medium-term and ultimate scenarios.

Timing of planning, design and construction varies depending on the complexity of the project. The cost of preparing a PCRIP is influenced by:

- length of route
- level of complexity (including route options, community concerns, interim projects and staging)
- availability of information
- level of detail required in design.

It is important to carefully scope a PCRIP with consideration to these variables because they will impact the amount of investigation, consultation and design required. Also consider whether the PCRIP will be undertaken internally or via a consultant/contractor.

2. Information gathering

This section provides guidance on:

- Information to inform the Priority Cycle Route Improvement Plan
- Potential sources of information and information management tools.

The following types of information should be collected to inform the PCRIP:

- current route environment
- current and potential users
- environmental constraints
- safety
- policy and planning framework
- current and future land use.

Background information should be reported in a simple, synthesised format that can inform subsequent planning and decision making. Reporting options include:

- mapping the route environment (or study area) and providing additional overlays for information on specific issues
- a tabular format that documents data by link (see Appendix A – Sample PCRIP form and Appendix C3 – Case study 3).

Section 3 describes map and table reporting formats that are also appropriate for documenting preliminary information.

2.1 Defining the route

Routes and route options can be divided into links that have similar characteristics such as gradient, land use, frontage activity, bicycle facility type, road carriageway, road function and barriers.

The links will be used to identify opportunities and issues and identify the preferred alignment. The level of detail for each link should be sufficient for this purpose. Link data can be tabulated (see Appendix A – Sample PCRIP form) or mapped. Figure 6 (right) which shows a map of links with similar characteristics on a priority cycle route.

Availability of information will vary across local government areas or contexts. The extent and type of information collected should be determined with consideration to funding, time and availability of information.

Figure 6 Segmentation of a priority cycle route into links of similar characteristics

(Source: Sunshine Coast Council, WSP Parsons Brinkerhoff, 2015)

2.2 Current route environment

A good understanding of the route and study area is required. At least one site visit should be undertaken to assess the infrastructure and understand issues experienced by current users (see Appendix C3 – Case study 1). Considerations for investigating the current cycle route are described in Table 2.

Table 2 Current route environment information

Information to collect	Example considerations	Potential information sources	Comments
Existing cycling infrastructure	Intersection facilities (bicycle storage boxes, loop detectors) Mid-block facilities (on-road lanes or off-road paths) End of trip facilities Wayfinding signage Maintenance/surface quality	Site inspection (saddle survey) Asset management systems Aerial photography Video survey (e.g. GoPro)	A saddle survey involves cycling the existing and proposed routes. Local or state government may have GIS/CAD inventories or asset management systems which provide data on cycling and other related infrastructure.
Road environment and road function	Road hierarchy Public transport and freight routes Effective road width Kerbside use (parking, loading, taxi, public transport, post boxes) Shoulder space Property accesses (single dwellings, units, shops, offices) Route conflict points (heavily trafficked/multi-lane roundabouts, traffic lights)	Local and state government asset databases Queensland Globe Site inspection	The road function and vehicle speeds can help identify the subsequent selection of facility types or deficiencies of existing facilities.
Vehicle traffic	Traffic volumes (mid-block and turning) Vehicle traffic speed Vehicle traffic composition	Traffic counts Traffic counts from other projects Traffic models Inferred traffic volumes based on road hierarchy	Intersection turning volumes used to identify appropriate intersection treatments. Volume, speed and heavy vehicle composition of traffic impacts actual and perceived safety for cyclists. It also helps in identifying treatment options.
Pedestrians, cyclists and other route users	Pedestrian and cyclist volumes Speed and trip purpose of pedestrians (e.g. tourism, recreation Volumes of other users such as roller bladers, skateboarders and people with mobility devices, wheelchairs, motorised mobility devices or personal mobility devices	Pedestrian and cyclist counts Inferred volumes based on local knowledge and land use data Intersections traffic surveys	Consider the needs of pedestrians. Areas with high pedestrian numbers (CBDs, major activity centres) may require separate cyclist and pedestrian facilities. Cycle infrastructure is often used by people on wheeled recreational or mobility devices.
Level of service (LOS) of existing transport infrastructure	LOS needs for all transport users relate to mobility, safety, access, information and amenity. Specific measures for pedestrians and cyclists are listed in Table 4.1 of Austroads (2013)[2]	Level of Service Metrics for Network Operations Planning[3] Saddle survey	Consider attributes of the corridor such as traffic speed and volume, parking, availability of dedicated bicycle facilities.
Travel Time	Time from start to end of route Consider measuring on-road and off-road routes	Record trip length and time with a suitable app (for example, Strava) Volunteers to ride route to measure time	Try to use an even mix of men and women, experienced and novice riders to obtain results that reflect different user needs.

[2] 2013, Austroads, *Level of Service Metrics for Network Operations Planning*, 2015
[3] 2013, Austroads, *Level of Service Metrics for Network Operations Planning*, 2015

Information to collect	Example considerations	Potential information sources	Comments
Alternative route	Is there an alternative route that is more likely to provide a basis for a fit for purpose facility? How far does the alternative route diverge from the preferred route or attractors?	Length of alternative route Travel time on alternative route with consideration to delays	A study undertaken on Brisbane Cycleways found that cyclists were willing to extend their journey by up to (but not more than) 27% to travel on a dedicated off-road bicycle facility.[4]

The assessment may occur in two stages:

1. As part of the issues and opportunities task where the existing route (and alternatives) are assessed.
2. As part of the option development task to inform the identification or selection of route or treatment options.

2.3 Users

It is important to understand who is using the route and who might want to use the route given its location and existing or future land uses. Some questions that should be asked include:

- Given the surrounding land use and attractors, what sort of riders would you expect to see on the route? Does the route service primary or secondary schools where you would expect children? Does the route service a Central Business District (CBD) where you would expect commuter bike riders? Does the route service a number of attractors which would provide for a diverse range of users?
- What are the characteristics of the users observed? Do they appear experienced, fast, adult, male or female? Are children noticeably present or absent? Are children alone or accompanied?
- Where are people choosing to ride? Are they riding on the road or on the pathway? Why might they be making these choices?
- Are they riding at all times of day, or only inside/outside peak periods?
- Are there alternative roads or pathways that bike riders are currently using?
- What are the likely barriers to attracting new riders?

Many people are interested but concerned about bike riding and will ride more with the right infrastructure[5]. Bike riders can be considered according to their confidence or capabilities as shown in Table 3. To appeal to all riders, the infrastructure needs to meet the needs of all these groups. In some limited situations this may require parallel facilities for different user groups.

[4] 2013, Proctor, M. *Analysis of Brisbane cyclists' travel behaviour to determine corridor catchments and route choice*, 2010

[5] Portland Bureau of Transportation, *Four Types of cyclist* https://www.portlandoregon.gov/transportation/article/264746

Table 3 Categories of bicycle riders and their characteristics

Bike rider category	Characteristics
Confident bike riders	Experienced and confident May interact assertively with traffic and defend lanes when not enough room May divert to separate cycle path if it provides an equivalent travel time More likely to be male Constitute a small percentage of existing or potential bike riders Willing to travel further to avoid routes perceived as high risk May have the confidence to claim a lane in some environments
Cautious bike riders	Experienced but more risk averse than confident bike riders May avoid routes without bicycle facilities (other than minor streets with minimal traffic) Avoid routes with large volumes of traffic, multiple lanes, and roundabouts May lack the confidence to defend a lane on narrow sections of road Willing to travel further to avoid routes perceived as high-risk Includes most of the bike riding population Likely to avoid riding if a safe environment is not provided
Novice bike riders	Includes adults with limited riding experience Includes all young children, as they are not aware of risks inherent in riding a bike on the road Can be unpredictable Prefer full separation from other traffic Avoid interacting with vehicle traffic and may use narrow footpaths if they are considered safer, despite decreased speed and enough space on-road Prefer grade separation, signalised intersections or intersections where priority is given to bike riders when crossing roads Will avoid riding if a safe environment is not provided
Potential bike riders	People who would be willing to ride a bike if the route was perceived as safe and comfortable

Knowing who is using the route and who is not using the route can reveal infrastructure deficiencies. For example, the route may already be providing a good level of safety if women and children are frequent users. If only sports riders are observed, the route is more likely to have significant safety issues. Table 4 summarises the information to be collected about the route's current use and users. Also consider capturing the various pedestrian users of the route where applicable.

Table 4 How is the route being used

Inquiry questions	Example considerations	Potential sources	Comments
What sections of roads or pathways are currently used by bike riders?	Volumes and categories of riders using each part of the route Changes in use throughout the day and week Start points and end points of journeys Access points on the route	Community consultation Crowd-sourced cycling databases (e.g. Strava[6], RiderLog, MapMyRide) Existing cycle counts (permanent sites, other projects) Volunteer visual counts (e.g. Super Tuesday/Sunday[7]) Commission your own travel survey or cycle counts (e.g. visual, tube, video) Social media (e.g. Facebook, Twitter) Usage data for end-of-trip facilities (e.g. RFID log history)	Data from crowd-sourced counts may have sample bias due to the use of such applications by bike riders on training rides. Data from volunteer counts may be of poor quality or wilfully inaccurate due to vested interest of participants. Generally only data for current usage is available. Larger metropolitan and regional areas may have population or traffic forecast models. Models are typically not designed for cycle planning but could still be used to understand future patterns of demand or traffic volumes along roads. See Land Transport New Zealand *Cycle Counting in New Zealand*[8] for further guidance.
What are the characteristics of users?	Speed Bicycle type Behaviours such as overtaking, defending lanes Gender Adult/child	ABS Census (journey to work data only) Existing travel surveys (e.g. SEQ household travel survey) Community consultation (e.g. social media) Usage data for end-of-trip facilities (e.g. RFID log history) Cycle counts	It is important not only to count riders but also understand trip purpose, bicycle and rider type, origin and destination, trip length and cyclist demographics. Some organisations provide summaries of Census data. Demographic data offers more value if linked to travel behaviour.
What are the purposes of their trips?	Trip origin and destinations Trip length Local attractor types Time of day riding Carrying luggage	ABS Census (journey to work data only) Existing travel surveys (e.g. household travel survey) Traffic or population models Land use planning maps showing attractor types Site visit data Bicycle counts that capture specific data such as whether bike riders are carrying luggage, riding in a group or are children Intercept surveys.	The trip purpose may also be influenced by a person's level of skill. Site visits may confirm whether users are young, carrying luggage, riding in pelotons, wearing uniforms or sporting gear. This information may provide clues about trip purpose.

[6] http://labs.strava.com/
[7] https://www.bicyclenetwork.com.au/our-services/counts/
[8] Land Transport New Zealand. (2018). *Cycle Counting in New Zealand*. http://www.nzta.govt.nz/resources/sustainable-transport/cycle-counting-in-nz/cycle-counting/

2.4 Environmental constraints

Environmental constraints that should be considered in the PCRIP process include:

- **Environmental issues/overlays** that may affect the ability of the land to be changed for a facility. These are particularly common in open space corridors and need to be well understood in the option development phase.
- **Steep terrain** as most bike riders prefer to avoid steep terrain and will sometimes choose a longer flatter route over shorter steeper ones. Terrain may also create opportunities for grade separation at intersections.

Table 5 summarises key considerations for identifying environmental constraints associated with environmental overlays and gradients.

Table 5 Environmental constraints information

Information to collect	Example considerations	Potential sources	Comments
Environmental overlay	Overlays of: Acid sulfate soils Bushfire Coastal hazard Flooding Heritage Landslide Flora/fauna Wetlands Fisheries	GIS databases Planning scheme maps Queensland Globe [9] Flora and fauna surveys Geotechnical and soil surveys	Environmental constraints should be carefully investigated, particularly in open spaces which are more likely to be affected. Many landscape architects are experienced in working with these constraints and may be a useful PCRIP team member if an open space corridor is being considered. Mapping overlays can highlight major risks or constrained areas. The layers considered will vary case-by-case.
Gradient/ terrain	Average gradient over the route or route section Worst gradient (maximum gradients over a 20m and 100m or 200m section) Gradients at intersections Are there alternative flatter routes that may be preferred by bike riders? Does the route provide opportunities for grade separation at intersections?	Google Earth GIS databases Queensland Globe Terrain surveys from other projects Section 7.5.5 in Austroads (2017) *Cycling Aspects of Austroads Guides* Section 5.4 in Austroads (2017) *Guide to Road Design Part 6A: Pedestrian and Cyclist Paths*.	Map the gradient of the route while riding with a GPS logger such as Strava. Compare gradients for each route option. Steep gradients dramatically affect the comfort of the route, particularly for novice riders or riders with limited physical fitness. Less direct routes that avoid steep climbs could be considered. Does the terrain lend itself to grade separated crossings and can this have a positive impact on travel times? Undertaking terrain surveys of a route is costly. Freely available data or data from other projects can be used. Grades over 5% should be avoided and are acceptable only over short distances on cycle routes.

[9] https://www.business.qld.gov.au/running-business/support-assistance/mapping-data-imagery/queensland-globe

2.5 Safety

TMR Road Safety Policy adopts Safe System principles, processes and practices. Under this policy, TMR projects must follow the Safe Systems Project Management Control Checklist and Austroads Safe System Assessment Framework across the planning, concept, development, implementation and finalisation phases[10].

Safe System principles revolve around that central premise of preventing crashes that result in serious injuries or fatalities. To this end, traffic environments should be forgiving, so that when people make mistakes the consequences are not severe. Under this model practitioners providing for bike riders consider questions like:

- What does the traffic environment look like at this location? What type of crashes might occur in this environment? Could severe injuries or fatalities result from these types of crashes, given the speed environment and the transport modes involved?
- At locations where crashes between bike riders, pedestrians and vehicles could occur, can vehicle speeds be managed so that crashes only occur below critical impact speeds to reduce risk of severe for fatal injuries?

Safety issues are repeatedly raised by users as a barrier to riding a bike. Infrastructure, traffic speeds and unsafe driver behaviour have also been identified as more specific concerns for active transport users[11] [12]. These issues are all considered as part of Safe System principles, processes and practices, addressing some of the most important barriers to getting more people riding bikes.

In the context of cycle infrastructure, key aspirations for designing a Safe System are:

- Speed limits on roads and verges reflect critical impact speeds for major crash types (see Table 6). These speeds reflect a 10% severe (FSI) injury risk.
- Infrastructure is designed to support appropriate speeds. Key considerations for bike riders and other vulnerable users are:
    - where pedestrian and bike rider desire lines cross streets or vehicle paths, vehicle speeds are desirably managed to below critical impact speeds (or 30km/h absolute maximum)
    - where bike riders are expected to share space with traffic, vehicle speeds are desirably managed to critical impact speeds (or 30km/h maximum)
    - the network is designed and built in such a way that it provides a safe operating environment for all users.
- Infrastructure is self-explaining, forgiving, and protects all users from excessive crash forces.
- Infrastructure is self-explaining and reinforces priority of path users at driveways, crossings, intersections and side road crossings.
- Infrastructure is designed to be safe and accessible for pedestrians and bike riders of all ages and abilities – diminished capacity and elevated vulnerability to injury may affect the ability of older people, children and some people with disability to respond to situations and recover from injury. In urban environments, and where demand exists (or may develop in a more rural environment), projects must include consideration of the needs of pedestrians and bike riders inclusive of people with disability.

[10] TMR Road Safety Policy https://www.tmr.qld.gov.au/Safety/Road-safety/Road-Safety-Policy

[11] Gerrard. J. (2017). *Walking, riding or driving to school: what influences parents' decision making?* South Australia

[12] Kristof Nevelsteen, Thérèse Steenberghen, Anton Van Rompaey, Liesbeth Uyttersprot. (2012). *Controlling factors of the parental safety perception on children's travel mode choice,* Accident Analysis & Prevention, Volume 45, 2012, Pages 39-49, ISSN 0001-4575

Table 6 Approximate Safe System critical impact speeds for common crash types [13]

Crash Type	Critical impact speed (km/h)
Pedestrian-vehicle	20
Head-on	30
Adjacent direction	30
Opposing-turning	30
Rear-end	55

Safety issues should be investigated from the perspective of all road users, with a specific focus on bike riders and other vulnerable road users. TMR requires that projects follow the *Safe Systems Project Management Control Checklist* [14] across the planning, concept, development, implementation and finalisation phases. This includes undertaking of a Safe System Assessment, which among other things, require that a planning decision considers key crash types that lead to fatal and serious crash outcomes, as well as the risks associated with these crashes (exposure, likelihood and severity). "Cyclist" is explicitly one key crash type that is considered in the risk scoring process, and a Safe System Assessment should encourage identification of treatments that could reduce the risk (being a numerical product of exposure, likelihood and consequence) of a bike crash. These four sources of information will inform the bicycle safety aspect of this process:

- **Traffic environment and perceived safety.** A thorough review of the traffic environment along the route should consider what types of crashes cyclists (and other road users) could be involved in and whether the consequences of these crashes are likely to cause fatal or serious injuries. Critical impact speeds for major crash types are a key input to this process. These speeds, which represent a 10% likelihood of severe (fatal and serious) injury outcome, are approximations and should not be taken as precise values. It is desirable to manage vehicle speeds to not exceed these critical impact speeds at locations where vehicles and people riding bikes are mixing.
- **Crash data**. This data may highlight some safety issues on the route. However, an absence of crash data does not demonstrate that the route is safe. Crashes involving people riding bikes are typically under reported in crash databases. Bike riders are also likely to avoid areas where they do not feel safe.
- **Route complaints.** These complaints are more likely to highlight major or high-profile safety issues. They are very important to consider but may represent a small snapshot of issues.
- **Infrastructure design preferences** are related to perceived risk as illustrated in Table 3.

A summary of the safety information to be collected for a PCRIP is presented in Table 7.

[13] Austroads Guide to Traffic Management Part 6 (AGTM6). Austroads 2020. These speeds, which represent a 10% likelihood of severe (fatal and serious) injury outcome, are approximations and should not be taken as precise values.
[14] TMR Road Safety Policy https://www.tmr.qld.gov.au/Safety/Road-safety/Road-Safety-Policy

Table 7 Safety information

Information to collect	Example considerations	Potential sources	Comments
Traffic environment and perceived safety	Is the current environment consistent with the Safe System principles – such that if a bike rider makes a mistake, are they unlikely to be killed or seriously injured? In what types of crashes could bike riders be involved in the current environment? Are riders likely to be killed or seriously injured if a crash did occur? Is the route currently being used and is it attracting all types of users who would be expected given surrounding land uses?	Site visit and inspections Road safety audits Review of speed survey data Critical impact speed data for pedestrian/bicycle crashes and vehicle crashes Intercept surveys, online surveys, focus groups Crowd sourced maps	Perceived risk causing bike riders to avoid the route entirely, or during peak periods Perceived risk causing specific user groups to avoid the route, such as cautious, novice and potential bike riders. Confident bike riders observed on low quality paths, indicating the road network is deficient.
Road safety performance	Details of crashes involving bike riders or pedestrians in the investigation area in last five years Other crashes in the investigation area Was cycle infrastructure or lack thereof a causal factor? Are there crash clusters? What percentage of the total crashes in the region that involved bike riders was on the identified route? Is there existing road safety audit information to aid understanding of issues?	Publicly available crash data is accessible at • Queensland Government Open Data portal[15] and • TMR Road Safety Statistics website[16] Registered users can access more detailed information via the Crash Analytics Reporting System (CARS)[17] QRAM data[18] Crowd-sourced issues mapping Crash prediction models (where available) Hospitals, insurance companies Traffic management centres Risk and liability claim databases	Cycling crashes are often under-reported, particularly if no injuries are sustained. Safety issues may be causing cyclists to avoid the area and thus few crashes are recorded. Analysis and interpretation of the crash data is important to identify contributing factors. Analysing the overall crash history for a road or identifying crashes that involve pedestrians could also provide an understanding of safety risks for bike riders.
Route complaints	Overall route sentiment Route complaints received by TMR or local government over last five years Locations of specific issues and opportunities	Public and stakeholder consultation Existing local government complaint registers/databases Social media (e.g. Facebook, Twitter)	Consider potential biases of topical issues and passionate enthusiasts. Social media presents risk of trolling and web-related abuse. Process should be managed by person with communications and digital media experience.

[15] https://data.qld.gov.au/dataset/crash-data-from-queensland-roads
[16] https://www.tmr.qld.gov.au/Safety/Transport-and-road-statistics/Road-safety-statistics
[17] https://cars.tmr.qld.gov.au/cars/
[18] Accessed from the Land Transport Safety SharePoint for historical road crash data and crash risk

2.6 Policy and planning framework

Relevant policy and planning documents may apply at a national, state or local government level. Understanding the policy context is required to:

- justify the project by demonstrating the route's role within the wider strategic transport network
- identify the function of the route (e.g. transport, recreation, tourism, combined)
- garner support of key stakeholders by aligning with other key policies and plans where appropriate and identifying and mitigating potential areas of policy conflict
- improve integration and minimise conflict with other road users (e.g. freight and public transport)
- identify support (and potential funding) from inside and outside council or TMR.

Relevant policy considerations are provided in Table 8.

Table 8 Policy and planning framework information

Information to collect	Example considerations	Potential sources	Comments
Policies and plans affecting the route	Queensland Cycling Strategy (QCS) PCNP and PRMs TMR Cycling Infrastructure Policy TMR Road Safety Policy Planning schemes and applicable local area plans Relevant council operational plans and programs (e.g. parking, road safety) Network operations plans such as TMR's Planning 4 Operations (P4O)	Cycling and transport plans TMR Cycling Infrastructure Policy TMR Road Safety Policy Health and community well-being plans Tourism and economic plans	Tourism and economic plans may be more relevant to rural and regional areas which aim to have bike riding playing a role in building their economy.
Current and proposed projects affecting the route	Future road network upgrades Road Reseal and Rehabilitation programs Future developments in the area	Local and state government planning documents Local and state government project proposals Development applications	Cycling infrastructure improvements may be able to be integrated with other projects, reducing funding requirements.

2.8 Current and future land use

An understanding of current and future land use patterns is required to:

- identify current and future trip origins, destinations and desire lines
- ensure route improvements align with long-term planning
- prioritise connections to land uses.

It is important to consider the following key land uses:

- **Employment and activity centres**: Activity centre importance will depend on the hierarchy of centres identified in regional plans or planning schemes–catchment radius determined by hierarchy.
- **Key educational institutions**: School, university, TAFE– three kilometre catchment radius.
- **Public transport nodes:** Railway stations, and key bus stations/interchanges– five kilometre catchment radius.
- **Greenfield development sites**: Best practice cycling facilities are encouraged in these locations. Shorter trips may be provided for within the development to link to education and public transport.
- **Urban renewal areas**: Proximity to higher density employment and residential areas mean these areas have a high potential for cycling to, through and within them.
- **Public open space and tourist attractions**: Can serve as attractors for cycling trips and provide space for high-quality off-road networks connected to recreational facilities.

A summary of land use information to be considered is presented in Table 9.

Table 9 Land use information

Information to collect	Example considerations	Potential sources	Comments
Land use	Land use overlays Locations of key land uses Locations of easements, transport, power, utility and other linear corridors Cadastre boundaries and properties in government ownership	GIS land use data GIS tenure and property boundary data Planning Schemes and other land use planning documents	Current and future trip generators/attractors should be identified. Easements, transport, power, utility and other linear corridors may be either suitable for bike routes or a barrier for bike routes.
Future growth areas	Areas allocated for urban renewal Areas allocated for residential developments	Council policy and planning documents Planning Schemes and other land use planning documents	If significant population growth is expected in the area surrounding the route, different issues, opportunities and treatments may need to be considered.
Demographic information	Age, income, car ownership Travel patterns Modes of travel commonly used	ABS Census (e.g. age, income and car ownership) Population or traffic models	Demographic data from the area in a 500m radius of the project is required.

3. Issues and opportunities

This section provides guidance on:

- Understanding barriers to cycling and identifying opportunities along a route
- The importance of refining route objectives prior to progressing to the option development phase
- The need for issues to be prioritised

The information gathering phase (see Section 2) identified relevant background information. This information should be synthesised to succinctly document issues and opportunities for the route:

- **Opportunities** are ways that the cycle route can be improved
- **Issues** are barriers to bike riding or constraints that could inform route or treatment options

Issues and opportunities are usually documented using maps, tables or a combination of both. Selecting an appropriate presentation model that can quickly and accurately communicate the issues and opportunities for the route is critical.

Table 10 Presentation of issues and opportunities

Format	Advantages and Disadvantages	Key Considerations
Map Format	Accurate form of communicating issues at specific locations. Limit to amount of information that can be displayed on a map before important content is lost. Effective tool for communicating information with stakeholders. Easier to interpret than standalone street names for stakeholders not familiar with street names.	Not all stakeholders will be familiar with the route. Ensure key landmarks including major roads and crossroads, attractors (CBDs, schools, hospitals, universities and commercial areas). Use symbols and keys where practical to increase the amount of information that can be communicated. Ensure maps are appropriately scaled to ensure important information is communicated. Figures 7 and 8 are annotated aerial photos that clearly communicate the context. Get a peer review of the map from someone not involved in the project to ensure that map can be interpreted by external audiences. Maps provide effective tools for stakeholder engagement workshops and at large scale may also be used to document input. Consider supplementing with photographs.
Table Format	Allows more detail to be communicated about specific sites. Issues can be organised by attributes other than location and added to link table\. Provide a simple structure for discussing and addressing issues. More room for interpretation error as readers may not fully appreciate environment of treatments.	How does the table communicate the location of opportunities/constraints with readers/stakeholders? Where only street names are used, this can increase likelihood of readers not understanding the location or the site. Consider supplementing with photographs of locations as well as maps. Consider adding issues and opportunities to Link Tables (see Appendix A Sample PCRIP form).
Combined Map and Table Format	Allows for significant amount of detail to be captured and linked to specific locations. More room for interpretation error associated with cross referencing between tables and maps.	Consider using tables that are easily cross-referenced to maps with symbols and labels. Consider supplementing with photographs to provide a complete picture of each opportunity/constraint. See key considerations for Map Format and Table Format above.

Figure 7 Visual concept for Bribie Island cycleway study including prioritised treatments

(Source: 2016, Moreton Bay Regional Council.)

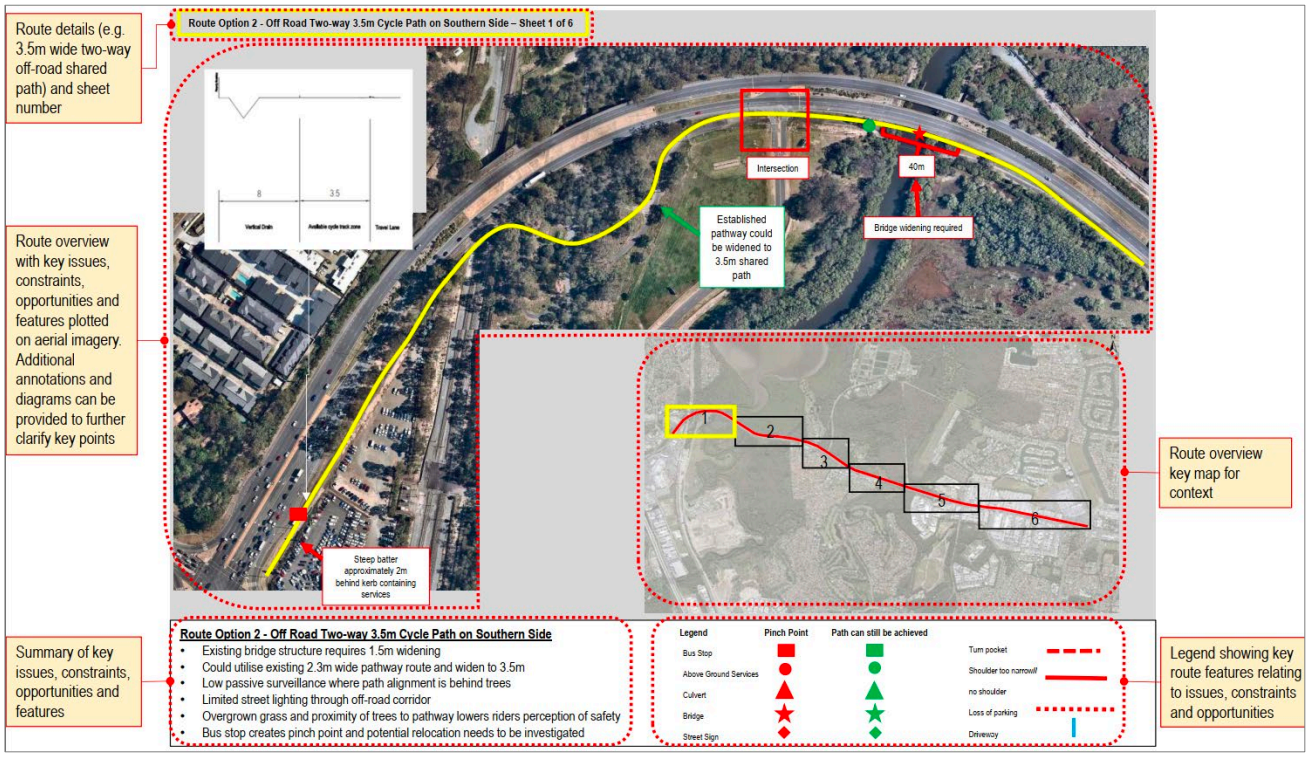

Figure 8 Issues and opportunities on route option efficiently and effectively communicated

(Source: Prepared by Bitzios Consulting for TMR, 2019.)

3.1 Key issues for bike riders

Key issues for planning cycling infrastructure are collected from the following information sources and are summarised in Table 11:

- The Austroads' guiding principles[19] for bicycle plans and TMR Road Safety Policy (2019)
- Queensland Parliament's 2013 Inquiry into Cycling Issues
- Issues identified in Information Gathering phase for the project (See Section 2).

Appendix C3 – Case study 6 provides an example of using intersection treatments to address multiple issues for bike riders along a new cycle connection.

Mann Street Cycle Connection, Cairns

Cairns Regional Council undertook a pilot PCRIP project to develop a 3.8km separated cycleway between western suburbs and the CBD.

By introducing intersection treatments to improve priority for bike riders, the project was able to achieve improved safety, reduced travel times, enhanced route continuity, improved journey experience and greater attractiveness to new bike riders.

Image: Completed cycle refuge crossing
(Source Arup 2016)

See Appendix C3 – Case study 6.

[19] Table 2.7, Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads.

Table 11 Key issues for bicycle riders and designing bike riding infrastructure

Austroads and Road Safety Guiding Principles Issues to consider	Issues identified in Queensland inquiry into cycling issues (2013)	Issues identified in information gathering
Safety		
Minimise risk of: • crashes on routes • conflict with cars • unsafe infrastructure • crashes that could cause fatal or serious injuries Consider the Safe System principles to avoid crashes that could result in serious injuries or fatalities.	Risk from motorist behaviour. Consider how new infrastructure could influence motorist behaviour (See Section 2.5). Insufficient space on the road for safe bike riding. These issues are worst around heavy vehicles and parked cars. Risk from heavy vehicles singled out as major issue. Routes with heavy vehicles but no continuous cycling facility of greatest concern. Parked cars identified as significant risk, severe injury or death from dooring in some places.	Are there crash hot spots for pedestrians or bike riders? Are there areas where crashes could exceed Critical Impact Speeds for bike riders? What types of crashes could occur between different users (bike riders, pedestrians, motor cars, buses, trucks)?
Coherence/Continuity/Connectivity/Legibility		
Continuity of routes Consistent quality of routes and facilities Easy to follow Choice of routes	No continuity of cycle infrastructure. Abrupt end or limited continuity in cycle infrastructure was cited as a significant issue. 'Pinch points' or gaps in infrastructure can discourage cautious or novice bike riders or create an unsafe environment for confident bike riders.	Does the route have a continuous and consistent standard of facility acceptable to the intended user? Are there pinch points where the standard of provision is lower? Is the route easy to navigate? Is there adequate way-finding signage, line marking, intuitive routing?
Directness		
Efficient operating speed Delay time Detour factor	Delay to people riding bikes at intersections.	Does the route generally follow desire lines to major attractors/generators? Delay factor – percentage difference from straight line distance.
Attractiveness/Security		
Support for the system Attractiveness of environment Perception of personal security System attractiveness	Consideration should be given to how the perception of safety may be an issue on a route.	What is the perception of safety of a route? A low proportion of female riders might suggest cautious bike riders feel it is unsafe. Are there issues that affect perceptions of personal security along the route such as lighting, dense vegetation, lack of passive surveillance? Are there issues with amenity such as air quality, lack of shade, noise?
Comfort/Gradient		
Smoothness of ride Comfortable gradient Minimal obstructions from vehicles Reduced need to stop Protection from climate	Changes to road rules now allow bike riders to ride across signalised pedestrian crossings and zebra crossings. Requests for rolling stops at stop signs and free left-turn on red not approved.	Is the attractiveness or comfort of the route impacted by poor drainage, potholes or poor ride quality? How many times are people riding bikes required to stop per kilometre? Can shade structures, trees be used to protect from climate?

3.2 Opportunities to benefit all users

Implementing improvements for bike riding can be difficult if they negatively impact traffic capacity, safety or parking on a road corridor. Opportunities can exist to achieve positive outcomes for all road users and develop solutions that are more acceptable to the wider community. Some examples of this include:

- **Increased traffic capacity:** Parked cars can reduce the capacity of a heavily trafficked road where traffic lanes are narrow, or parking turnover is high. Removing or offsetting parking and replacing with a cycle lane could improve traffic flow and reduce overall delay.
- **Excessive traffic capacity:** Some roads or intersections may have excessive traffic capacity or may be configured so that there is inefficient use of space. Reconfiguring these roads could free up space for bike riding without impacting on the operation of the road. The 'road diet' [20] is a typical approach.
- **Improved intersection safety:** Parked cars close to intersections can restrict sight lines and impact intersection safety. Addressing these safety issues could free up space to provide cycling facilities through intersections.
- **Addressing unsafe parking:** Some roads may be too narrow to provide on-street parking safely. Restricting parking and allocating the space to bike riding could improve road safety and bike rider safety.
- **Improving pedestrian safety:** Safety improvements to address pedestrian safety risks can be used to also improve cycling facilities. Since more people walk than ride a bike there is often greater public support for pedestrian safety improvements than improvements that are perceived to only benefit people riding bikes.
- **Improving safety of other road users:** Where vehicle speeds are reduced or intersections are simplified, it can reduce the crash exposure for other users, particularly vehicle occupants exposed to side impact speeds (See discussion of critical impact speeds in Section 2.5 Safety).
- **New growth areas:** Planned investment in new growth areas, or urban regeneration, could present a significant opportunity to facilitate improvements to a cycle route.
- **Planned projects:** Planned project investment presents an opportunity to improve provision for bike riding. These projects could include new, upgrading or rehabilitating roads, parks or open space projects.
- **Parallel routes:** Arterial roads are often identified as cycle routes in higher order planning. These roads may be constrained and difficult to retrofit. In some instances, parallel lower order roads may provide a more desirable route that is still direct, safe and legible.

3.3 Refine route objectives

After issues and opportunities have been identified, the route objectives established in Task 1.2 should be reviewed to ensure:

- objectives are still appropriate to guide the identification of treatment solutions
- the objectives reflect the issues and opportunities identified for the route
- input received from engagement with stakeholders and the community during the groundwork phase is reflected by the route objectives where possible.

When refining the route objectives, the three planning principles described in Figure 5 should be revisited: user needs, affordability and continuity.

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[20] http://safety.fhwa.dot.gov/road_diets/

3.4 Prioritisation of issues

On complex routes it may be useful to categorise issues into critical, essential and desirable as follows:

- **Critical issues** need to be addressed in the short term; they may relate to safety, security or legibility.
- **Essential issues** need to be addressed but may not be able to be undertaken in the short term.
- **Desirable issues** could be delivered in the ultimate scenario. They may relate to amenity, comfort, attractiveness, capacity or ride quality.

Appendix A – Table A2 provides a template for documenting the refined route objectives and prioritised issues.

Prioritising issues will be helpful for subsequent option development and treatment identification tasks. Refer to Appendix A – Table A3.

Maroochydore Cycleway, SCC

Sunshine Coast Council undertook a pilot PCRIP project. One of its route objectives was “offering commuters and confident cyclists a more legible and safer route”.

After assessing the route environment, they identified issues and reconsidered route objectives. Safety was identified as a key issue. The route objectives were refined to include “cyclists would feel safe using the corridor”. Proposed treatments that delivered on this objective included:

- a right hook-turn treatment
- separation from parked cars
- dedicated space for bike riders mid-block and at intersections.

See Appendix C3 – Case study 5.

Figure 9 Cotton Tree, Maroochydore existing level of provision along the route

(Source: Sunshine Coast Council, WSP Parsons Brinkerhoff, 2015)

4. Basis of design

This section describes how the basis of design process can support option development. It covers:

- What is basis of design
- How the basis of design is established and documented

4.1 What is basis of design

The basis of design is a precise description of the outcomes sought by the project, and the opportunities and constraints for achieving these outcomes.

The basis of design is specific to the project and the site. It reflects the input of project stakeholders and the opportunities and constraints in the local area.

The following elements are crucial to basis of design:

- Undertaken early in the planning process and used as an opportunity to engage with stakeholders before outputs are developed. This is usually facilitated with a basis of design workshop.
- Objectives are developed in consultation with stakeholders from the investment program and the local area so that local issues can be considered in the project.
- Engagement captures the needs, interests and objectives of stakeholders and provides a more detailed breakdown of the overarching project objectives to develop objectives that are specific to the site and the project.
- Names and locates any specific generators and attractors such as CBDs, schools, hospitals, universities and commercial areas.
- Identifies issues, opportunities and constraints for delivering the objectives of the project.
- Considers the relative importance of issues identified by stakeholders in order to establish essential and desirable outcomes.

4.2 Establishing basis of design

Table 12 summarises a process that has been applied to establishing basis of design. See Appendix C3 for Case Study 8 Basis of design.

Table 12 Basis of design process

Step	Task	Description
1.	Review background materials	Project team reviews background information and familiarises themselves with the site conditions Information is used to inform who should be invited to attend the Basis of Design workshop
2.	Identify stakeholders for workshop	TMR and relevant local government should attend the basis of design workshop Consider inviting specific branches of local governments/TMR including traffic and transport, network operations, engineering and civil infrastructure group, active transport, development assessment, community services, drainage, local and regional branches. Cycling projects can become high profile issues for councils and TMR. Key stakeholders from TMR and the local government should be contacted individually and provided with an overview of the project and the important reasons for their involvement.
3	Workshop planning and preparation	A concise overview of the project and relevant background information should be provided in the workshop with a summary provided to participants prior to the workshop. The main body of the workshop should focus on engaging with stakeholders and collecting relevant information. Consideration should be given to how this information is going to be collected and documented. Some good examples include: • Printing large scale maps for stakeholders to mark up with issues, opportunities and constraints • Asking a series of questions, which stakeholders respond to individually and then as groups • Prioritising issues within the workshop.
4	Conducting the basis of design workshop	Provide sufficient staff to facilitate and engage with participants, document key outcomes, facilitate and provide essentials such as paper, pens, resources for workshop activities. Document and summarise information as part of the workshop Retain workshop information, maps, lists and so on.
5	Documenting and reporting the basis of design	Outputs of basis of design workshop are summarised in a precise list of statements about what the project is trying to achieve and the important considerations for doing so Background information and data is also provided in the basis of design report.

4.3 Basis of design outputs

Table 13 provides a simple example of basis of design outcomes. See Appendix C3 Case Study 8 Basis of design for a more detailed example of how outputs can be developed.

Table 13 Basis of design outputs example

Project objective	Example basis of design outcomes/objectives
Connected	The project is expected to connect to the state school at the northern end of the alignment, the high school on the alignment, the retirement village to the east and High Street at the southern end of the alignment. Crossing facilities will be required on the facility to allow people to access the facility from both sides.
Safe	The facility is expected to provide for people 8-80 years old, and ensure: • crossing facilities are provided at all major intersections • riders are separated from vehicles on the arterial road • the facility is designed to accommodate rider speeds of at least 30km/hr so that experienced riders are attracted to using it.
Encourages more cycling more often	The project is expected to be used by recreational bike riders, children attending the local state and high school, staff and visitors to the hospital on the alignment and by commuter cyclists coming the north and continuing to the CBD.
Meets the needs of the community	The project is also expected to provide a high-quality facility for pedestrians and allow for appropriate vehicle movements for people to access businesses and premises, so that the facility is considered an asset to the community.

5. Option development

This section addresses the various stages of option development which includes identifying and selecting:

- Route alignment options that meet the needs of target users
- Route treatment options, including innovative, value-for-money treatments
- Option selection
- Preferred delivery approach to address identified critical issues along the priority cycle route

Option development is an iterative process that results in the selection of the preferred route, treatments and delivery options. Option development considers three questions:

1. **Route alignment options:** What alignments could the route use?
2. **Treatment options / solutions:** What treatments are appropriate for the alignments identified?
3. **Delivery approach:** How will the treatments be delivered?

In some cases, the desire for improvements in the short term may require immediate and ultimate scenario options to be identified. Table 14 describes the differences between the two.

Table 14 Immediate and future route option characteristics

Immediate options	Future or ultimate scenario options
Realistically implementable within 1-5 years and does not conflict with the ultimate scenario	Five or more years until implementation
May include lower cost treatments that provide some benefits to users	Typically require substantial capital investment
Included in PCRIP output	Included in PCRIP output
Multiple immediate and future options may be generated and assessed/compared. Identify where immediate and ultimate scenario options are required.	
Immediate and future options may be influenced by programmed works of other projects. In this situation coordination may be desirable to deliver the infrastructure efficiently.	

This guideline is aimed primarily high-benefit improvements that are realistically deliverable within 1-5 years. If this is not realistic, the PCRIP should also:

- Identify treatments that can be implemented with 1-5 years that may include quicker, lighter, cheaper solutions to meet the needs of key users, until the ultimate the scenario can be developed.
- Identify ultimate scenario treatment options that achieve route objectives over a longer time frame with additional funding input.

Some priority cycle route projects may not require multiple options. If option selection is required, immediate and ultimate options should not be compared against each other as they have different purposes. Option selection techniques are discussed in Task 4.3.

5.1 Route alignment options

A route is a desire line with start and end points, and possibly intermediate destinations. In most cases a network plan has defined one or more alignments that could potentially serve this desire line. Viable routes are made up of individual links with consideration to treatment and delivery options.

Investing in upgrading the existing alignment is more likely to provide value for money in situations where a significant amount of cycling infrastructure already exists on an alignment. When developing a PCRIP in this situation:

- review the existing alignment to ascertain whether improvements can be achieved within 1-5 years
- consider alternative alignments if route objectives can't be achieved in this time on the existing alignment.

In cases where the route is only broadly defined and limited cycle infrastructure exists, the PCRIP should consider alternative alignments that can achieve route objectives. The route alignment selection process is described below. An example is provided in Figure 10.

1. **Potential links:** informed by the opportunities and issues analysis. Select links that could form components of a route.
2. **Route formation:** form potential routes made up of links. Consider the following:
   (a) Identify continuous routes made up of a combination of links.
   (b) Identify high level, feasible treatment options to ensure continuity of standards along the route.
   (c) Delivery options for each link (short to medium term or ultimate scenario).

(d) Check that the completed route makes sense when combining links to form routes. The 'best' individual links may not always form the 'best' completed route.

(e) Different route options may have common links (e.g. common links for most of the route, but different options at major intersections).

(f) Potential conflicts with other users, particularly on routes that have priorities for other modes of transport (e.g. routes with regular bus services or major traffic routes).

3. **Route selection:** A route should address the route objectives. It may not be possible to meet all route objectives in the short term. In this situation, consider identifying a route that can improve level of service in the short term, and another route that provide the optimal level of provision in the long term.

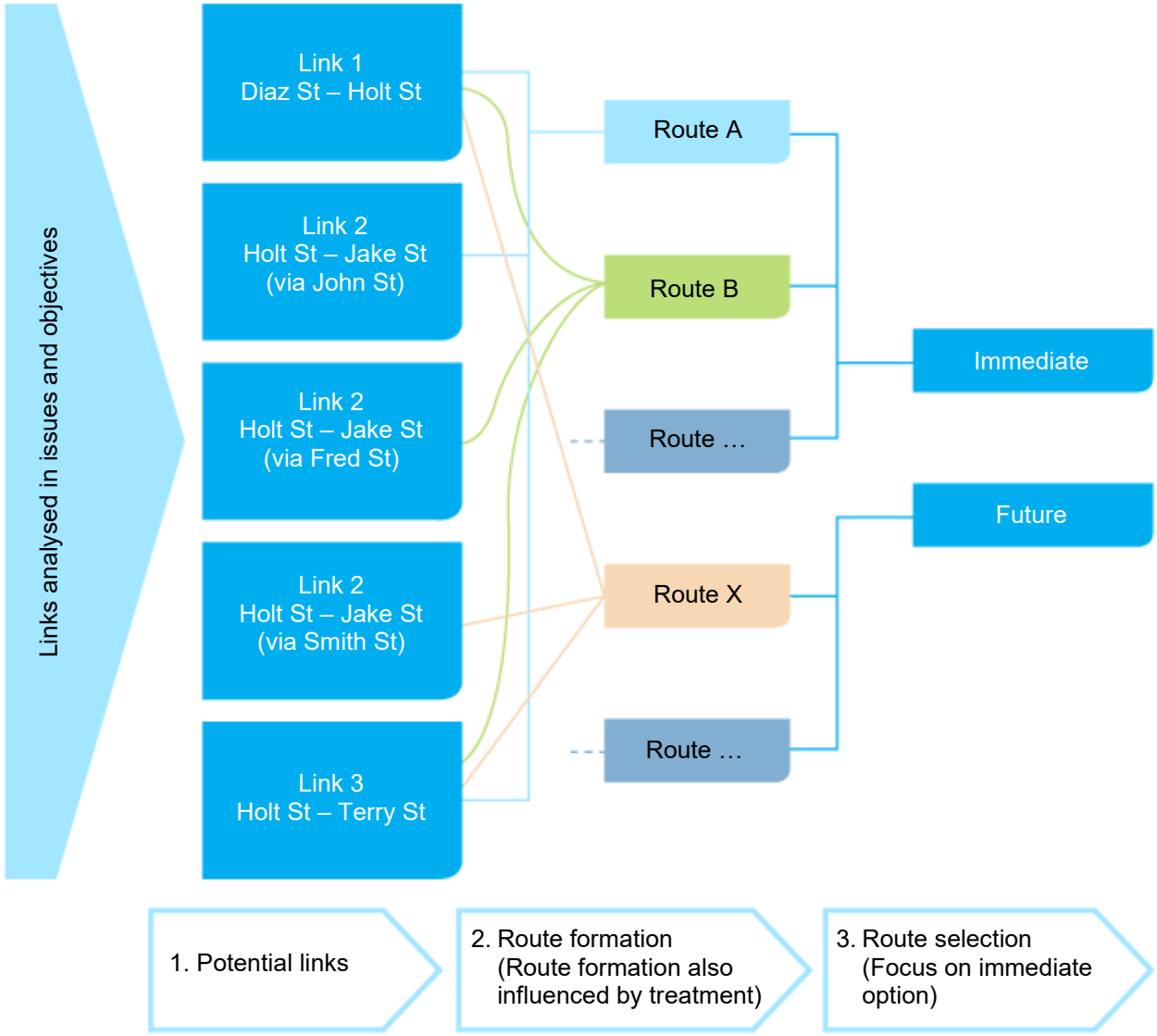

Figure 10 Route alignment filtering and selection process

For more complex projects it is essential to limit the number of alignment options so that the assessment task is manageable. Consider:

- Eliminating links early by considering whether they meet the route objectives.
- Ruling out links that are too indirect, unsafe, and involve unnecessary hills or stopping.

Route alignment options and selected routes should be mapped (preferably in GIS format) so they can be easily analysed and communicated with stakeholders.

Priority Cycle Route, Granard Road, Rocklea, Brisbane

TMR undertook an options analysis for a priority cycle route from Ipswich Motorway to Griffith University. The corridor was broken into two sections and a multi-criteria analysis was conducted on shortlisted options for each section.

The route is primarily for commuters, with an emphasis on providing for less confident bike riders.

Route alignment options were driven by:

- **Connectivity:** directness/minimise deviations.
- **Economic:** comparative cost.
- **Safety:** separation from other traffic, minimise conflict points, personal safety.
- **Network:** alignment with network and planning objectives; acceptability to stakeholders.
- **Social:** consideration of community impacts (property, parking, public transport); attractiveness to users.

Figure 11 illustrates a selection of route alignment options considered for the Granard Road section during the option development phase.

(Source: TMR. 2017. Ipswich Motorway to Griffith University Cycleway Options Analysis, Working Paper 2, July 2017.)

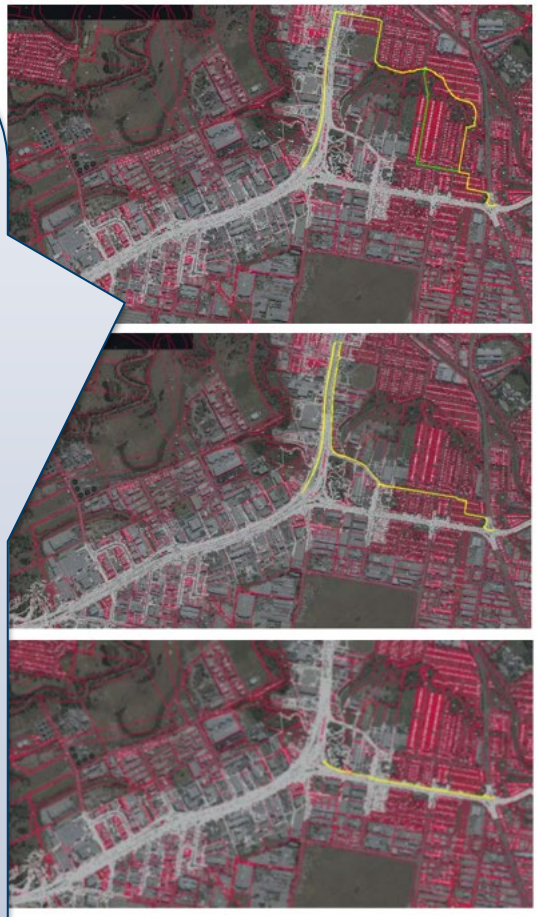

Figure 11 Granard Road, Route Alignment options

Appendix C3 – Case Study 9 provides details of an options analysis process for a bridge project in Mackay. It involved balancing considerations including hydraulics, afflux, access and integration of the desired level of service with cost effective design.

5.2 Route treatment options

Route treatment options describe the types of treatments used to provide for bike riders on specific sections of the route. They include mid-block and intersection treatments. Treatment options should:

- be appropriate to for the road function
- meet the needs of the target bike riders
- be feasible with respect to the site constraints
- achieve the route objectives within the framework of the three planning principles:
    1. **User needs -** what treatments best meet the needs of target users while also catering for other users?
    2. **Continuity** - how can a continuous level of service be provided?
    3. **Affordability** - can existing cycling infrastructure be enhanced, or innovative treatments be used to meet route objectives?

The primary sources of guidance about cycling treatments are:

- Austroads *Guide to Road Design Part 6A: Pedestrians and Cyclist Paths*[21]
- Austroads *Guide to Traffic Management* and *Guide to Road Design*
- Austroads *Cycling Aspects of Austroads Guides*[22]
- Austroads. (2014). *Assessment of the Effectiveness of On-road Bicycle Lanes at Roundabouts in Australia and New Zealand*
- TMR *Manual of Uniform Traffic Control Devices*
- TMR *Traffic and Road Use Management manual* (TRUM) [23]
- TMR Guideline *Selection and Design of Cycle Tracks* (2019)[24]
- TMR Technical Notes[25]
- TMR. (2014). *Technical Note 136: Providing for Cyclists at Roundabouts*[26].

Table 15 identifies typical route treatment options that can be considered as part of a PCRIP.

[21]Austroads. (2017). *Guide to Road Design Part 6A: Pedestrians and Cyclist Paths*. Sydney, NSW: Austroads.

[22] Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads.

[23] TMR TRUM http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Traffic-and-Road-Use-Management-manual

[24] TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks* https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Cycling-guidelines

[25] TMR Technical Notes http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Technical-Notes

[26] TMR. (2014). Technical Note 136: Providing for Cyclists at Roundabouts. http://www.tmr.qld.gov.au/~/media/busind/techstdpubs/Technical%20notes/Traffic%20engineering/TN136.pdf .

Table 15 Typical route treatment options

Route Treatment Options	Road hierarchy applicable				
	Arterial roads	Collector roads	Local access roads	●Cost and ●Benefit	Guidance
1 Intersection treatments					
1.1 Signalised Intersections					
1.1.1 Protected intersection treatments with separated cycle tracks	✓	✓		●● ●●●	TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
1.1.2 Bicycle lanes through signalised intersections	✓	✓		● ●	'Section B.6: Cyclist facilities at signalised intersections' in Austroads. (2017). *Guide to Road Design Part 4: Intersections and Crossings*. Sydney, NSW: Austroads. '5.3.6 Hook Turn Storage Boxes and Hook Turn Restrictions', Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads.
1.1.3 Other treatments including: shared left turn lane, separation kerb, bypass.	✓	✓		● ●	'TC1769: Retrofit bicycle lane in a left turn lane' in TMR. (2014). *TC Signs: TC1751 – TC1799*. Queensland Government. TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
1.2 Roundabouts					
1.2.1 Improving multiple lane roundabouts on urban arterial roads	✓			●● ●●	Austroads. (2014). *Assessment of the Effectiveness of On-road Bicycle Lanes at Roundabouts in Australia and New Zealand*, Sydney, NSW: Austroads. TMR. (2014). *Technical Note 136: Providing for Cyclists at Roundabouts*. TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
1.2.2 Cycle tracks on single lane roundabouts	✓	✓		●● ●●●	
1.2.3 Low speed single lane roundabouts on low speed collector or local access roads		✓	✓	● ●●	
1.3 Minor Intersections					
1.3.1 Priority crossing at intersection with minor roads	✓	✓		●● ●●●	TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*

Route Treatment Options	Road hierarchy applicable				
	Arterial roads	**Collector roads**	**Local access roads**	**●Cost and ●Benefit**	**Guidance**
1.3.2 Conversion of stop-sign to give way	✓	✓	✓	● ●●●	'2.5 Control by Give Way and Stop Signs' in TMR. (2014). *Manual of Uniform Traffic Control Devices Part 2: Traffic Control Devices for General Use*. Queensland Government. 'Figure 2.2: Sight distance restrictions requiring use of stop signs' in TMR. (2014). *Manual of Uniform Traffic Control Devices Part 2: Traffic Control Devices for General Use*. Queensland Government.
1.3.3 Visibility improvements at minor intersections	✓	✓	✓	● ●●	'9.4 Pavement Surface Colour' in Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads.
1.3.4 Retrofit treatments at unsignalised intersections	✓	✓		● ●●	'TC1769: Retrofit bicycle lane in a left turn lane' in TMR. (2014). *TC Signs: TC1751 – TC1799*. Queensland Government.
1.3.5 Improve safety of minor crossing points	✓	✓		● ●●	'7.6.4 Unsignalised Bicycle Path Crossing' in Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads. TMR. (2014). *Manual of Uniform Traffic Control Devices Part 10: Pedestrian Control and Protection*. Queensland Government. Austroads. (2017). *Guide to Road Design Part 4*. Sydney, NSW: Austroads.
1.3.6 Reallocating priority on low traffic volume streets		✓	✓	● ●●●	
1.4 Grade separation					
1.4.1 Underpasses or overpasses at interchanges and intersections	✓	✓		●●● ●●●	TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
2 Mid-block treatments					
2.1 Underpasses and overpasses	✓	✓		●●● ●●●	Austroads. (2014). *Assessment of the Effectiveness of On-road Bicycle Lanes at Roundabouts in Australia and New Zealand*, Sydney, NSW: Austroads. TMR. (2014). Technical Note 136: Providing for Cyclists at Roundabouts. TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*

Route Treatment Options	Road hierarchy applicable				
	Arterial roads	Collector roads	Local access roads	●Cost and ●Benefit	Guidance
2.2 Cycle tracks	✓	✓		●●● ●●●	Austroads. (2020). *Guide to Road Design Part 3.* Sydney, NSW: Austroads. TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
2.3 Bicycle lanes		✓		●● ●●	Austroads. (2020). *Guide to Road Design Part 3.* Sydney, NSW: Austroads. TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
2.4 Bicycle advisory lanes		✓		● ●●	TMR Traffic & Road Use Management (TRUM), Volume 1, Part 8, Section 8.12.1-1 Advisory Bicycle Lanes and Cycle Streets
2.5 Cycle streets			✓	● ●●	TMR Traffic & Road Use Management (TRUM), Volume 1, Part 8, Section 8.12.1-1 Advisory Bicycle Lanes and Cycle Streets
2.6 Traffic calming		✓	✓	● ●●	'2.7 Type of Bicycle Facility Required' in Austroads. (2017). *Cycling Aspects of Austroads Guides*. Sydney, NSW: Austroads. Austroads. (2017). *Guide to Traffic Management Part 8: Local Area Traffic Management*. Sydney, NSW: Austroads.
2.7 Permit bicycle traffic in opposing direction on one-way streets	✓	✓	✓	● ●●●	Austroads. (2020). *Guide to Road Design Part 3.* Sydney, NSW: Austroads. TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
2.8 Convert service road to 'Cycle street' or 'Cycle track with limited vehicle access'	✓		✓	●● ●●●	TMR Traffic & Road Use Management (TRUM), Volume 1, Part 8, Section 8.12.1-1 Advisory Bicycle Lanes and Cycle Streets TMR. (2019). TMR Guideline *Selection and Design of Cycle Tracks*
2.9 Reallocation of lane space (road diet)	✓	✓		●● ●●●	Makwasha & Turner. (2016). Road Diet Safety: An Australian Viewpoint Nikiforos Stamatiadis. (2012). *Guidelines for Road Diet Conversions*. Transportation Research Board. Jennifer Rosales. (2006). *Road Diets Handbook: Setting Trends for Liveable Streets*. Portland, OR: Parsons Brinckerhoff.

Route Treatment Options	Road hierarchy applicable				
	Arterial roads	Collector roads	Local access roads	●Cost and ●Benefit	Guidance
3 Wayfinding and other signage					
3.1 Wayfinding	✓	✓	✓	● ●●●	TMR. (2009). *A guide to signing cycle networks*. Queensland Government. TMR. (2013). *Manual of Uniform Traffic Control Devices Part 9: Bicycle facilities.* Queensland Government.
3.2 Reduce/remove need to dismount	✓	✓	✓	● ●●	TMR (n.d.). *Fact Sheet: G9-58, Appropriate direction of cyclists* 'Section 2 (h) Cyclists dismount (G9-58)' in TMR. (2013). *Manual of Uniform Traffic Control Devices Part 9: Bicycle facilities.* Queensland Government
3.3 Bicycle warning signs: watch for bicycles, change lane to overtake, share the road	✓	✓		● ●	'TC 2003' in TMR. (2014). *TC Signs: TC2000 - TC2050*. Queensland Government. TMR. (2013). *Manual of Uniform Traffic Control Devices Part 9: Bicycle facilities.* Queensland Government.
3.4 Share the road signage	✓	✓		● ●	'TC 1878' in TMR. (2014). *TC Signs: TC1851 – TC1899*. Queensland Government. TMR. (2009). *A guide to signing cycle networks*. Queensland Government. '4.6.6-1' in TMR. (2015). *Traffic and Road Use Management Manual Vol. 1*. Queensland Government.
4 End of trip facilities					
4.1 Replace on-road vehicle parking with bicycle parking		✓	✓	● ●●●	Austroads. (2016). *Bicycle parking facilities: Guidelines for Design and Installation*. Sydney, NSW: Austroads. Austroads. (2016). *Bicycle parking facilities: Updating the Austroads Guide to Traffic Management*. Sydney, NSW: Austroads.
5 Changes to car parking					
5.1 Parking demand study	✓	✓	✓	● ●●	Jacobs SKM. (2014). *Bicycle lanes and car parking design review*. Brisbane, QLD: TMR. Austroads. (2017). *Guide to Traffic Management Part 11: Parking*. Sydney, NSW: Austroads.
5.2 Indented parking		✓		●● ●●●	Jacobs SKM. (2014). *Bicycle lanes and car parking design review*. Brisbane, QLD: TMR.

Route Treatment Options	Road hierarchy applicable				
	Arterial roads	Collector roads	Local access roads	●Cost and ●Benefit	Guidance
5.3 Reallocation of kerbside parking on one side	✓	✓	✓	● ●●	'Bicycle Advisory Lanes and Cycle Streets'. TMR supplement to the *Guide to Traffic Management, Part 8 Local Area Traffic Management*. Jacobs SKM. (2014). *Bicycle lanes and car parking design review*. Brisbane, QLD: TMR.
C6 Small scale and general amenity treatments					
C6.1 Transition ramp	✓	✓		● ●	TMR. (2014). *Technical Note 108: Mid-block bicycle lane termination treatments*. Queensland Government. TMR. (2009) *A guide to signing cycle networks*. Queensland Government. TMR (n.d.) *Fact Sheet: G9-58, Appropriate direction of cyclists*
C6.2 Intersection bypass treatments	✓	✓		●● ●●	
C6.3 Small scale, general amenity treatments	✓	✓	✓	● ●●●	

Cost and benefit scale key: ● Minimal ●● Moderate ●●● Major

Refer to guidance for details of the route treatments given above.

5.2.1 The need for innovation and compromise

In many cases a PCRIP is required because standard treatments are not viable in the short term. A significant challenge is deciding whether to implement treatments that do not meet minimum or best practice design guidance. Innovations may be opposed by decision makers or the public because they are too risky or are considered an unacceptable compromise.

The guiding principle is that as long as the treatment does not introduce new risks to the system, generally some form of cycle provision is better than nothing.

A decision tree process should be used where innovative or non-standard treatments are proposed. Figure 12 summarises the decision process.

In some instances, it may not be possible to deliver an effective or safe alternative route alignment or treatment within the 1-5 years. This highlights the need for a long-term, ultimate scenario option that may be delivered beyond the timeframe of the PCRIP.

- Is doing nothing better than elevating road user awareness of potential conflicts? Informing and guiding is usually better than "free-for-all".
- Are constraints real? Do safety issues outweigh some constraints?
- Does the treatment combine minimum values for multiple elements that could elevate risk?
- Could mitigating treatments be implemented that limit risk elevation?
- Are options available so bike riders could conveniently bypass a potentially risky environment?

If an affordable and effective non-standard treatment is not available, it may be appropriate to seek an alternative route alignment to bypass the issue.

The following TMR guidance may be helpful in planning and design stages for situations where treatments may not meet minimum or ideals specified in guidance:

- *Guidelines for Road Design on Brownfield Sites*[27]
- *Engineering Innovation in the Department of Transport and Main Roads*[28]

Meeting standards is an assessment criterion for the Active Transport Investment Program and other funding programs. If innovative treatments are being considered it is recommended that TMR be contacted for guidance as early as possible:

Contact details:

Engineering and Technology, TMR

Et.cnp_tech_assessment@tmr.qld.gov.au

[27] TMR. (2013). *Guidelines for Road Design on Brownfield Sites*. Queensland Government. https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Brownfields-guidelines.aspx

[28] TMR. (2014). *Engineering Innovation within the Department of Transport and Main Roads*. Queensland Government. https://www.tmr.qld.gov.au/business-industry/Business-with-us/Engineering-innovation.aspx

Decision tree for non-standard treatment options

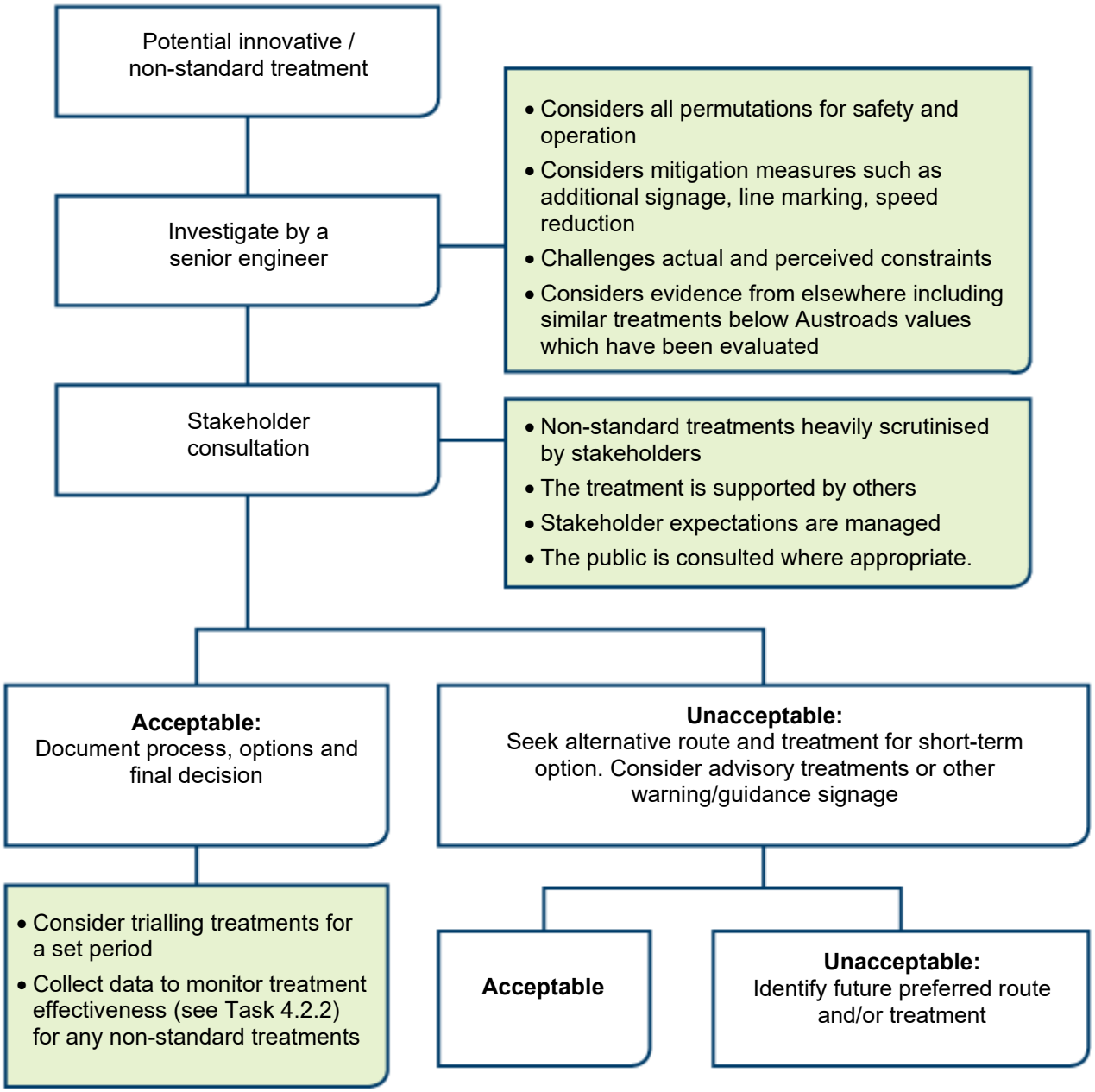

Figure 12 Non-standard treatment option decision tree

5.2.2 Trial route treatments

Trials of infrastructure may be considered where innovative or controversial treatments are proposed that do not have broad ranging support from all stakeholders. Trial treatments are typically:

- quick to implement
- cost effective
- easily reversible solutions that can be used to 'test' whether concerns of opponents are realised.

In some cases, trial treatments can be installed overnight with limited labour and disruption to traffic. Consider impacts to kerbside uses (parking, loading zones, public transport stops). Some trials will also require signage or a communications strategy to educate and engage with the public.

A monitoring and data collection strategy is required to evaluate the trial. TMR may provide support to road authorities wishing to trial innovative treatments.

If the trial is successful, the treatment can be implemented permanently.

New York, Vancouver and London have constructed physically separated cycle tracks with minimal cost. Physical separation was provided between cyclists and traffic with removable barriers made up of planters, boulders and plastic kerbing. Some treatments also beautify and enhance the street environment. Many Australian cities are now doing similar trials.

Figure 13 Innovative treatment – footpath widening and one-way protected cycle track, Broadway, New York City, NY

5.3 Alternative options analysis process that combines route and treatment options

On some projects, separating route options analysis from design treatment analysis may not be the most effective way to select the preferred option. This is most likely to be the case where:

- Stakeholders don't have a clear picture of what they are comparing when scoring route options.
- It is not obvious to stakeholders how route options are likely to be treated.
- It is not clear if risks can be effectively mitigated.
- Further investigations are required and to determine the feasibility of appropriate infrastructure on each route option.
- The preferred route is longer but is more likely to be attractive to riders when treatment options are considered.

In these situations, it may be more effective for the project team apply a different options analysis process. An alternative process could be conducted as follows:

1. Consult with stakeholders to identify all potential route options.
2. Project team develops high level concept drawings showing likely treatments on most promising routes, or on routes that vary significantly in appropriate treatment types.
3. Stakeholder evaluation of concept designs and input to optimise concept designs.

Figure 14 shows how route option and treatment option selection can be separated or combined.

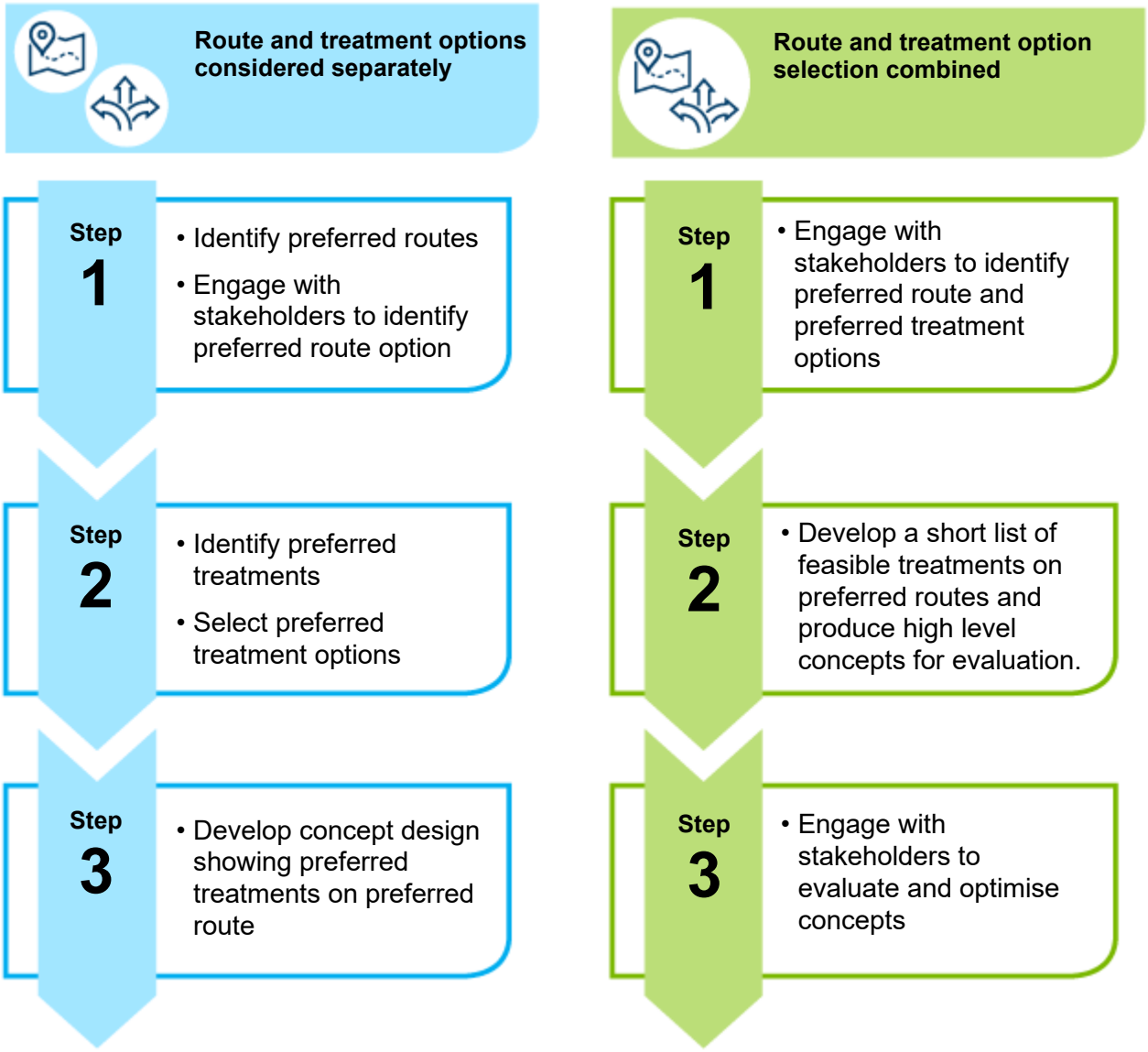

Figure 14 Alternative processes for option development

5.4 Option selection

Once a shortlist of viable route options should have been identified, the option selection task determines which route option to progress to design. The outputs of this task include:

- a set of ranked options against agreed technical objectives/criteria
- a map of the selected option, identifying and annotating the alignment, treatments and delivery stages.

Although this guideline does not offer a prescriptive method for option selection, it is recommended that the process consider the factors in Figure 15.

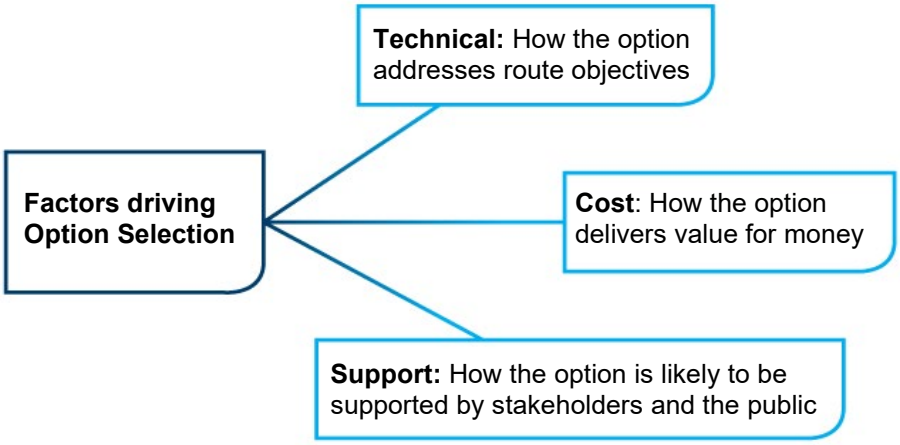

Figure 15 Primary factors driving option selection

The option selection process should be proportionate to the project scale and complexity. There are many methods to inform option selection. Common methods include:

- cost-benefit analysis (this may also be used to demonstrate eligibility for external funding opportunities)
- goals achievement matrix
- planning balance sheets and multi-criteria analysis
- if applying for external funding, aligning selection criteria with funding criteria, is one option.

An option selection framework is illustrated in Appendix A – Table A3. Appendix E outlines additional information on undertaking a multi-criteria analysis for a PCRIP.

5.5 Delivery approach

The delivery approach identifies where investment should be focussed in the short, medium and long term. If budget is limited, time frames for delivery may reflect the categories of issues identified in Task 3.4.

Consideration is also given to the PCRIP planning principles as follows:

- **User needs:** What improvements require immediate delivery to address safety, security or legibility issues and achieve route objectives for users.
- **Continuity:** Can the route be divided and delivered in sections? What are the most important sections to deliver first?
- **Affordability:** Can a combination of smaller scale/cost-effective treatments be packaged to create a significant section? What funding sources are available for different sections/ treatments? Are there opportunities to integrate works with other projects and save or share costs (see Section 4.4.1)?

5.5.1 Integration with other works

Cycling enhancements can be cost-effectively incorporated into other projects including:

- major transport projects such as intersection upgrades, road upgrades, rail projects, bridge projects
- minor transport works such as planned road maintenance, pavement resurfacing/ rehabilitation, line marking, local area traffic management, road safety audits, review of kerbside use projects
- open space rehabilitation, recreational infrastructure projects.

It is important to understand if and when these projects are happening, so they can be considered in the delivery.

Major works

Planned major transport projects achieve high quality, cost-effective improvements to improve cycle infrastructure.

As part of the *Cycling Infrastructure Policy*[29] TMR will provide for cycling in all TMR funded infrastructure projects. This includes explicit provisions if the project is on the PCN and implicit provisions in other areas. Explicit and implicit provisions are defined in the policy.

A PCRIP can inform the planning and design of a major project to ensure that it delivers on route objectives. For major projects the PCRIP can identify:

- what improvements are desirable and reasonable to include in the planned project
- interim improvements that may be required prior to the major project.

It is essential that the relevant authority for the project is engaged in the PCRIP option development phase. This increases the likelihood that the major project will deliver the improvements identified.

City of Yarra: Council resolution

The City of Yarra (an inner-city Melbourne council), adopted a council resolution in 1997 to provide bike lanes with all road resurfacing and line marking works. This allowed them to significantly expand the cycle network despite budget constraints. The City of Yarra has also built a cycle friendly environment at little additional capital cost by undertaking the following measures:

- ensuring local area traffic management works maintain cycle permeability.
- implementing a 40 km/h speed limit across all council roads
- prioritised bicycle movements at traffic signals
- targeted removal of parking to upgrade priority routes.

Minor works

Minor works undertaken by road authorities provide opportunities to implement improvements quickly and cost effectively. Examples of this include:

- line marking of bicycle lanes or intersection treatments to improve safety or legibility, undertaken as part of resurfacing or rehabilitation works
- upgrading of lighting as part of electrical maintenance works
- way-finding incorporated with signage replacement.

These works occur regularly across the PCN. To avoid fragmented/piecemeal improvements, consider how suitable transitions can be provided until the ultimate design/proposal is delivered.

5.5.2 Development

Cycling infrastructure may be delivered as part of new developments by incorporating conditions into:

- lot reconfiguration, structure planning and material change of use processes
- planning schemes.

This may require stronger integration of bike riding into statutory planning instruments. This should also include incentives for developers to cater for bike riding. For example:

- provision of active transport routes in and through the development
- incorporate Crime Prevention Through Environmental Design (CPTED) principles
- exclude bicycle facilities (e.g. showers and bicycle storage facilities) from negatively impacting a development's floor space ratio

[29] TMR. (2013). *Cycling Infrastructure Policy: Organisational Policy*. Queensland Government. https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Cyclists.aspx

- reducing car parking requirements if suitable bicycle parking is provided
- providing incentives and bonuses for appropriate bicycle facilities.

5.5.3 External funding

External funding may be available for local governments to deliver the priority cycle route. Potential sources include:

- TMR's Active Transport Investment Program - focuses on the delivery of the Principal Cycle Network
- regional economic development grants
- Transport Infrastructure Development Scheme (TIDS)
- tourism or sport and recreation grants
- road safety funding (e.g. Commonwealth Black Spot Program funding).

Sources of external funding and criteria can vary year to year.

6. Design

The PCRIP guidelines are not a replacement for existing design guidelines or other technical standards. Austroads *Guide to Road Design*, the Manual of Uniform Traffic Control Devices and TMR's technical notes remain the pre-eminent design standards and guidelines for cycling infrastructure projects in Queensland.

The guidance in this document is provided in order to:

- inform the preparation of the concept design for a preferred option of a PCRIP process
- ensure consideration is given to preferred design treatments
- prompt consideration of innovative treatment options.

The level of design and costing should be sufficient to demonstrate the benefits of the project, its viability and to obtain funding for subsequent stages.

Detailed design is not expected for the PCRIP. The content of the plan should inform the delivery of priority cycle routes to a high standard that helps encourage new, less confident riders and allow for future growth.

Austroads guides are typically used to design cycle infrastructure. Other Queensland, Australian and international guidelines are available that provide further guidance, especially in the area of innovative treatments.

Refer to Appendix F for references or visit TMR's website.

7. Monitoring and evaluation

Monitoring and evaluation pre and post-implementation is good practice and essential where innovative or trial treatments are installed. Monitoring can measure the benefit to riders and other users and demonstrate whether route objectives were achieved. The monitoring program will vary between projects. Consideration should be given to:

- Obtaining data before implementation to establish the base case scenario (Land Transport New Zealand provides useful information [30]).
- Monitoring changes in bike riding uptake. Bicycle counters are the preferred option. Annual surveys such as Super Tuesday and Sunday counts[31] may be suitable for smaller projects. Strava Metro can be used however data must be purchased and it does not capture all users.
- Collecting observational video analysis of non-standard treatments to understand in detail, how users are interacting around the treatment.
- Seeking public and stakeholder feedback using an attitudinal survey disseminated via website or intercept.
- Evaluating whether route objectives are met and identifying issues on the route.
- Identifying whether the route draws users away from undesirable routes.

A PCRIP's route objectives provide the ideal starting point to identifying metrics for evaluating the project.

Moreton Bay Regional Council evaluated the success of road diet (Is this correct? Road diet?) treatments on a highspeed roundabout (see Appendix C).

Consider an annual report that includes:

- Changes in level of bicycle and pedestrian use and reasons for shifts or anomalies.
- Safety trends - this could involve crash data or observational analysis of users.

The UK Department of Transport [32] outlines minimum monitoring requirements for cycle and walk projects. These are summarised in Table 12.

[30] Land Transport New Zealand. (2018). *Cycle Counting in New Zealand*. http://www.nzta.govt.nz/resources/sustainable-transport/cycle-counting-in-nz/cycle-counting/
[31] Bicycle Network About Super Counts https://www.bicyclenetwork.com.au/general/for-government-and-business/462/
[32] Department of Transport. (2018). *Active Mode Appraisal.* UK. https://www.gov.uk/guidance/transport-analysis-guidance-webtag#guidance-for-the-appraisal-practitioner

Table 16 Minimum monitoring requirements

	Data to be collected
Prior to scheme implementation	Number of bike riders per day/pedestrians per day Utility/leisure split Gender Journey time Origins and destinations
Scheme details	Length of scheme Environmental improvements (landscaping, vegetation etc.) Safety security improvements (lighting, CCTV) Links with other schemes (part of network, parking, resting places, crossings etc.) Information (signage)
Following scheme implementation	Number of bike riders per day/pedestrians per day Utility/leisure split Gender Mode shift (previous journey mode) Previous journey route (if transferred) Journey time Origins and destinations

(Source: Department of Transport, *TAG Unit A5.1, Active Mode Appraisal*, 2018.)

8. Communication and engagement

This section outlines communication and engagement methods for the public and stakeholders including:

- Identification of potential internal and external stakeholders, and organisations for engagement
- Engagement and communication methods in the PCRIP planning process
- Innovative engagement methods.

PCRIP projects often involve controversial decisions relating to contested road space. Projects should include an engagement strategy appropriate to the scale, complexity and space conflicts of the project.

Effectively involving stakeholders and the community in the decision-making process can increase the likelihood that treatments will be accepted. Cycling projects are often subject to a high degree of scrutiny and managing community and stakeholder expectations is important. The engagement strategy needs to ensure that the objectives and constraints along a route are fully understood to avoid creating expectations that cannot be met.

A core resource for planning and implementing stakeholder engagement processes is:

TMR. 2019. *Community and Stakeholder Engagement Guide: Active Transport Investment Program*. August 2019[33].

8.1 Internal communication and engagement

Bringing internal stakeholders into the planning process is essential for PCRIP projects. Working closely with the following groups is important:

- **Elected representatives and/or senior management** to champion the project. Their involvement is critical particularly where treatments are contentious (e.g. impacting on car parking).
- **Communications and consultation staff** to facilitate community and stakeholder engagement.
- **Traffic operations, engineering and design services** to determine whether treatments are feasible, to identify options and opportunities, to synchronise works with other projects and identify design issues.
- **Urban planning** to incorporate elements of the route or supporting end of trip facilities into new developments.
- **Major projects** to incorporate elements into committed projects.
- **Parks and Recreation** to incorporate cycling facilities into parks and recreation projects.
- **Events, economic and tourism** for rural and regional councils where an economic development strategy includes measures to promote cycling tourism.
- **Asset management** to incorporate cycle facilities into road maintenance and upgrade projects such as line marking and resurfacing.

It is recommended that consideration be given to:

[33] TMR. 2019. *Community and Stakeholder Engagement Guide: Active Transport Investment Program*. August 2019 https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Research-and-resources/Participation-and-encouragement#cseg

- Obtaining internal input in developing the project scope and methodology.
- Inviting various stakeholders to serve on a project working group or attend key meetings.
- Involving consultants (if applicable) to meet with stakeholders individually or as part of an internal stakeholder meeting.

8.2 External communication and engagement

The communications strategy for external stakeholders should align with applicable road authority policies. The following external stakeholders should be considered in the strategy:

- local Bicycle User Groups (BUGs)
- Bicycle Queensland
- Queensland Walks
- local residents along the route
- local walking groups
- current bike and e-scooter riders using the route
- bicycle clubs and local bicycle shops
- elders from the local Traditional Owners
- local businesses served by the route
- primary and secondary schools, and large tertiary education institutions served by the route
- residential and commercial developers where the route passes through development areas
- Queensland Police Service
- other State Government departments (as applicable) - TMR/Local government.

Cycling projects can be very controversial and attract passionate enthusiasts or strong opponents. When undertaking external consultation, potential bias from stakeholders who 'shout the loudest' should be considered.

It is noted that broad community consultation can also be resource and time consuming. Consideration should be given to the appropriate choice of methods of engagement that provide the best value given the scope of the project.

8.3 Engagement methods

There are numerous ways to engage with the community and stakeholders. Input is particularly valuable in the early stages of a project, as knowledge of issues and opportunities informs decisions during later steps. Table 17 provides a summary of potential engagement methods.

Table 17 Engagement methods

Method	Potential use	Comments
External stakeholder workshop/ interviews/ meetings	Inform option development At key decision stages After design	Important to regularly engage with stakeholders that are directly impacted Separate from community workshop to allow focussed discussions Individual interviews with stakeholders, provides benefits but is time and cost intensive
Internal stakeholder workshops/ interviews/ meetings	During preparation At key decision stages including Basis for Design establishment, option development and selection.	Internal engagement less formal than external Internal stakeholders attend project meetings where appropriate
Internal informal lunchbox sessions	Inform route objectives, issues and opportunities Inform option development	Informal meetings with council or district staff members interested in the route as they cycle along it/know it well Useful if engagement with public is not allowed. Staff confidentiality requirements allows for broader input.
Meetings with elected representatives	During preparation During option development After design	Obtaining buy-in from elected representatives throughout the process greatly assists with endorsement and successful implementation, especially where innovative or non- standard treatments are proposed
Saddle survey	Inform route objectives, issues and opportunities	Cycle route to experience issues, opportunities, constraints Could include local BUG representative, elected member, internal stakeholders and/or other key stakeholders Effective for communicating issues to key stakeholders. Safety risks need to be managed carefully. Refer to Appendix C3 - Case study 1
Online surveys	Inform route objectives, issues and opportunities Inform option selection After design	Provides structured input from a broad cross- section of the public for relatively low cost Risk of bias from interest groups with a specific agenda Refer to Appendix C3 - Case study 7
Public submissions	Inform route objectives, issues and opportunities After design	Can be onerous as unrelated issues are often raised Risk of bias from interest groups with a specific agenda
Community workshops	Inform route objectives, issues and opportunities Inform option selection After design	Can be expensive and time consuming. Often have limited participation from public unless part of an interest group Risk of bias from interest groups with a specific agenda
Public displays	Inform route objectives, issues and opportunities Inform option selection After design	Inexpensive way to obtain input from existing users Display should be on existing route at a point where cyclists need to slow down or stop. Most effective in the evening peak period when cyclists tend to be more willing to stop and talk.
Crowd-sourced data	Inform route objectives, issues and opportunities After design	Several map-based consultation tools are available which enable the public to identify issues, preferences and problems along a route Removes the need for face-to-face time with staff Risk of sample bias, especially if process is advertised via an interest group (like a BUG) Should be managed by someone with appropriate communications and digital media experience
Social media	Inform route objectives, issues and opportunities Inform option selection After design	Risk of sample bias, especially if process is advertised via an interest group (like a BUG) Presents risks of trolling and web-related abuse Managed by person with communications and digital media experience to maximise benefits and mitigate risks.

Check your organisation's consultation policies and gain relevant approvals prior to undertaking consultation.

Appendix A – Sample PCRIP form

This form guides the Priority Cycle Route Improvement Plan (PCRIP) development. PCRIP information can also be used in grant funding applications. Relevant sections of TMR's Cycle Network Local Government Grants Program application are included. Contents are applicable to state and locally controlled corridors.

<table>
<tr><th>Priority Cycle Route Improvement Plan Content</th><th>Relevant section TMR grant application</th></tr>
<tr><td>Introduction</td><td></td></tr>
<tr><td>Provide a brief introduction about the route and area, and reasons for undertaking the route improvement plan.</td><td>Project Details</td></tr>
<tr><td>Preparation</td><td></td></tr>
<tr><td>Identify route objectives</td><td>Network enhancement
Safety</td></tr>
<tr><td>Funding sources</td><td>Project Costs</td></tr>
<tr><td>Issues and opportunities</td><td></td></tr>
<tr><td>Detail the process used to identify route issues and opportunities. Where possible use maps, tables and graphs to present findings. Include the following information:</td><td></td></tr>
<tr><td>Define the route</td><td>Project details
Network enhancement</td></tr>
<tr><td>Link environment review (findings summarised as per Table A1)</td><td>Demand
Network enhancement</td></tr>
<tr><td>Route issues (summarised in a map)</td><td></td></tr>
<tr><td>Current cycle users and route function</td><td>Connectivity, Demand</td></tr>
<tr><td>Crash/safety analysis (including perceived safety and comfort)</td><td>Safety</td></tr>
<tr><td>Desired future cycle users and route function</td><td>Demand</td></tr>
<tr><td>Prioritised route issues (findings summarised in a table as per Table A2)</td><td></td></tr>
<tr><td>The route should be segmented into links of similar characteristics.
Route characteristics should be described in maps and/or a summary table shown below.
Table A1: Route Environment Link Table
<table>
<tr><th>Link: ID</th><th>Link: Name</th><th>Road environment</th><th>Cycling facilities</th><th>Photo</th><th>Issues Opportunities</th><th></th></tr>
<tr><td>L1.0</td><td>Beta St to Lima St (via Omega St)</td><td>AADT: 9,200 vpd
Posted 60 km/h
777, 888 bus route
Loading zones</td><td>1.2 m painted cycle lane
No cycle priority at intersections
Identified on PCNP
Used as a commuter route</td><td>Summary photo typical of link</td><td>No cycle priority at intersections
Omega St roundabout is multi- lane and heavily trafficked
Parking and loading zones</td><td>Install cycle priority at intersections
Route bypass of Omega St
Target removal of kerbside parking</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>Project details
Network enhancement</td></tr>
</table>

Priority Cycle Route Improvement Plan Content	Relevant section TMR grant application
Depending on the type of project, determining issues and objectives may require additional situational analysis. This may include: Policy and planning framework Land use analysis Environmental constraints.	Strategic Connectivity Demand

Prioritised list of issues

The prioritised issues to be addressed should be presented in a form similar to Table A2 below. These may require refinement of the route objectives, which should relate to:

- **user needs** – which users are targeted in the route improvement (cyclists and other users)
- **continuity** – which elements require improved continuity along the whole route
- **affordability** – what affordability constraints impact on the PCRIP.

The issues should respond to the confirmed route objectives, guiding principles and criteria for bicycle planning (refer to Austroads) and should differentiate between those issues that are essential to address and those that are desirable to address. This will inform the assessment of route options and selection of route treatments.

Table A2 Prioritised issues to be addressed

Route objective	Issues addressed	Essential or Desired, Priority	

Option development and appraisal

Document the process undertaken to develop, assess and select the route alignment, route treatments and delivery priority/approach.

Present the options in a map format to improve understanding.

The evaluation of route options against the route objectives can be presented in a format similar to Table A3 below.

Network enhancement
Cost effectiveness
Strategic

Table A3 Assessment of options

Link; or Route; or Treatment; or Staging	Essential		Desired				Cost		
	Objective 1	Objective 2	Objective…	Objective…	Objective …	Objective…			
Option 1									
Option 2									
Option 3									
Option …									

The preferred route alignment, treatments and delivery priority must be shown on a map. A hypothetical example is shown in the figure below.

Priority Cycle Route Improvement Plan Content	Relevant section TMR grant application
	
Design	
Briefly describe the concept design proposal and cost estimate of the preferred route option. High-level concept design drawings of the preferred option included as an appendix.	Project Costs Project Milestones
Monitoring and evaluation	
Detail monitoring and evaluation strategies for pre- and post-implementation of treatments. This is compulsory for non-standard or extended design domain treatments and may be a requirement for grant funding.	
Communication and engagement	
Detail the consultation (both internal and external) undertaken as part of the PCRIP. Indicate the level of support (or otherwise) for the proposed route improvements.	Connectivity Demand

Appendix B – Information sources

Information Source	Examples	Considerations
ABS Census data	Demographic (e.g. age, income and car ownership) Journey to work	Some organisations provide summaries of Census data Demographic data offers more value if linked to travel behaviour
Aerial photography	Queensland Globe Google Earth	Queensland Globe is an interactive mapping tool implemented inside Google Earth
Asset management systems	Local and state government asset databases	Your local government may have GIS/CAD inventories or asset management systems which may provide data on cycling and other related infrastructure
Crash data	Crash data is available through the Queensland Government Dataset[34] or WebCrash[35] TMR crash prediction model (currently under development) Crowd sourced issues Hospitals, insurance companies Traffic management centres Risk and liability claim databases	Cycling crashes are often under-reported. Sources other than traditional TMR/QPS could be used
Crowd-sourced cycle counts	Volunteer cycling organisations, such as Bicycle Network Super Tuesday commuter count and Super Sunday recreational count [36]	Details such as gender and bicycle type are also recorded Volunteer counts do not occur frequently Data may be of poor quality or wilfully inaccurate due to vested interest of participants It is important not only to count bike riders, but also understand trip purpose, bicycle and rider type, origin and destination, trip length and bike rider demographics
Crowd-sourced cycle data	Route data (e.g. Strava, RiderLog, MapMyRide) Crowd-sourced issues mapping	Data may have sample bias due to the use of application by sports cyclists on training rides Supplements existing traffic surveys, but does not replace them
Cycle counts	Permanent counter sites Cycle counts undertaken for other projects Usage data for end-of-trip facilities (e.g. RFID log history) Commission your own cycle counts (e.g. visual, tube, video)	It is important not only to count bike riders, but also understand trip purpose, bicycle and rider type, origin and destination, trip length and bike rider demographics

[34] https://data.qld.gov.au/dataset/crash-data-from-queensland-roads
[35] https://www.webcrash.transport.qld.gov.au/webcrash2
[36] https://www.bicyclenetwork.com.au/general/for-government-and-business/462/

Information Source	Examples	Considerations
GIS databases	GIS land use data GIS tenure and property boundary data GIS terrain/gradient information Environmental layers	Easements, transport, power, utility and other linear corridors may be suitable for bicycle routes or a barrier for bicycle routes Required if terrain/gradient is an issue on the route
Models	Traffic or population models	Models are typically not designed for cycle planning, but could still be used to understand future patterns of demand or traffic volumes along roads Generally only data for current usage is available. Larger metropolitan and regional areas may have population or traffic forecast models
Planning schemes	Planning Schemes and other land use planning documents	Can be used to identify current and future trip generators/attractors (e.g. schools, public transport hubs, development areas, employment/activity centres, open space, recreation)
Policies	Cycling and transport policies Health and community wellbeing policies Tourism and economic policies	Tourism and economic plans may be more relevant to rural and regional areas which aim to have cycling playing a role in building their economy
Route complaints	Public and stakeholder consultation Existing local government complaint registers/databases	Consider potential biases of topical issues and passionate enthusiasts
Site inspection	Saddle survey	A saddle survey involves ridng the existing and proposed routes to audit and ground-truth
Traffic counts	Existing traffic counts Traffic counts undertaken for other projects Inferred traffic volume ranges based on road hierarchy	
Travel Surveys	Existing travel surveys (e.g. SEQ household travel survey) Commission your own travel survey Community consultation	
Video survey	High quality, compact video cameras mounted to a vehicle, bicycle or person (e.g. GoPro)	Some cameras include GPS tracking allowing data to be geographically referenced

Appendix C – Case studies

C1 Low cost interventions

Provides a series of case studies that highlight the success of low-cost interventions in helping increase bike riding participation. It acknowledges the usefulness of demonstrating what can be achieved within smaller budgets.

For example, Case Study 4 “Cycle-friendly Street Treatments” outlines the improvement to a regional cycleway route in Stanmore, NSW to provide a safer mixed-traffic environment for bike riders. This was achieved through installing a “one-way driver-way link” intervention that narrows the street to a one-way single lane for motor vehicle traffic, while providing bypasses for riders from both directions.

Austroads. (2014). *Low Cost Intervention to Encourage Cycling: Selected Case Studies*. Sydney, NSW: Austroads.

C2 Cycling Infrastructure – Selected Case Studies

This Austroads publication provides a series of case studies covering various types of cycling infrastructure. Of relevance to this guideline is the show casing of innovative / non-standard treatments which can be referred to when addressing similar situations while preparing a PCRIP.

Austroads. (2014). *Cycling Infrastructure: Selected Case Studies*. Sydney, NSW: Austroads.

C3 List of PCRIP Project case studies

Eight case studies have been prepared to highlight the application of parts of the PCRIP guidelines.

They are published as a separate document. Topics are:

1 The importance of saddle surveys in early concept planning

2 Setting route objectives

3 Cycle route inspections: capturing outputs

4 Road diet at a high-speed roundabout

5 Before and after of a major intersection

6 Improving intersections on a Priority Cycle Route

7 Using consultation effectively at early concept stage

8 Basis of design – How to conduct a workshop

9 Bikeway bridge project

Appendix D – Multi-criteria analysis advice and sample criteria

TMR's *Cost Benefit Analysis Manual (2011)* describes multi-criteria analysis (MCA) as "a method used to evaluate a project against a number of criteria." It is a decision-making that provides the framework for assessing options based upon their performance against agreed criteria such as social, environmental, cost (capital and ongoing), distance to key attractors/generators, and land resumption.

The evaluation methodology allows for assessment based upon a quantitative and qualitative analysis. This approach enables consideration of those impacts that can be accounted for in monetary terms and those that are more challenging to quantify such as environmental, social, community, and health benefits/effects.

A multi-criteria analysis allows decision makers to include a full range of measurable criteria.

The following offer key considerations for a multi-criteria analysis:

- Identify criteria for the assessment that address the goals and route objectives being targeted (see Table E1).
- Organise criteria under high-level and low-level objectives (where relevant).
- Select a suitable number of criteria for the assessment. The more criteria, the likely greater the effort to undertake the assessment and resultant higher risk of double counting.
- Select criteria carefully to avoid double counting/duplication. Double counted effects may give more weight in the overall decision than is deserved for that criteria (e.g. capturing the cost associated with land resumption once).
- Clearly define and quantify criteria where possible to promote transparency, provide an audit trail, ease of use, consistent with the issue being considered and to minimise subjectivity.
- Set up a consistent numerical scale for assessing the performance level of each criteria (scoring thresholds, interval scales). Where quantifiable elements cannot be determined for a criterion, elicit the decision makers' judgment/ reasoning to justify the score (e.g. very weak, moderate, strong, etc. see Table E2).
- Carefully consider the inclusion of a cost criterion particularly where options being considered are highly variable (see Table E3). It may be preferable to assess the financial component in the decision-making process separately to the multi-criteria analysis to appropriately judge an options intrinsic 'value for money' (e.g. cost benefit analysis or other form of economic analysis). Where cost is to be included, consider 'value for money' principles as follows:
    - *Whether the proposal is cost effective – does the project deliver outcomes proportionate to the scale of the cost?*
    - *Ensure that the scale (large or small) of the projects does not excessively impact on the project prioritisation.*
    - *The opportunity cost of the proposal. The opportunity cost relates to the forgone benefits associated with the next best use of the project money.*
    - *Project costs should consider both the upfront (capital) and ongoing (maintenance and operation) costs.*
- Identify and assign weights for each criterion that reflect the relative importance to the decision-making process. Typically, this may be agreed through a consultation process with key stakeholders with reference to the overall goals/objectives and local area context.
- Undertake an assessment of differing goals and objectives through modifying/varying the weighting applied to criteria (sensitivity analysis). This can enable the assessment to consider a higher weighting towards areas such as economic, environmental, social or/and a weighted average score. It may also help to understand the sensitivity of the cost criteria to the outcome/final score.

- Consider the context of the district or local government and availability of data for the assessment.

Table D1 presents a summary of criteria and sub-criteria appropriate for the assessment of cycle route projects. This was developed with reference to the former Australian Bicycle Council and the federal Department of Infrastructure, Transport, Regional Development and Local Government publication *Prioritisation of Bicycle Infrastructure Proposals*[37] . Prioritisation criteria for the TMR Active Transport Investment Program (ATIP) can be found at https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Cycling-grants .

Table D1 Summary of Core Criteria for Assessment

Criteria	Sub-criteria	Example Metrics/Measures
Strategic Importance	Completion of state strategic network	Extent it aligns with PCNP
	Closure of gaps/ missing links in network	Extent to which the project / route is supported by state or local planning policy framework and context
	Project identified in other local planning	Extent to which the project will have the most impact on the PCNP
Connectivity	Schools (Primary, Secondary)	Improve cycle network connectivity to trip attractors
	Tertiary education institutions	Within five kilometres of key centres
	Employment centre	Within three kilometres of an educational facility
	Activity centre	Located up to five kilometres of a Public Transport node supported by end of trip facilities
	Public open space or recreational	Extent of future population served by route (assuming appropriate catchment area)
	Tourist attractions	Number of jobs served by route
	Railway stations or public transport key interchanges /nodes	Serves a diverse mix of cyclist user types
	Greenfield development sites	
	Urban renewal areas	
Economic	Mode shift	Potential future bike riders and type of mode shift
	Impact on private vehicles	Change in road environment (e.g. parking provision, lane width, traffic operation)
	Economic impacts	Qualitative impact of facility on surrounding business and /or tourism e.g. 'better business viability' derived from the cycling infrastructure
Safety	Cycling safety	Crash statistics
		% heavy vehicles
	Pedestrian safety issues	Reduced conflicts with other users
		CPTED, Lighting, Signage
People and communities	Level of service	Level of service calculations
		Bikeability Assessment
	Townscape/urban planning	Integration / fit land use intent
Cost	Value for money	Capital cost Whole of life costs

- [37] Australian Bicycle Council. (n.d). *Prioritisation of Bicycle Infrastructure Proposals*.

Table D2 illustrates a qualitative assessment method for technical objectives as outlined in Section 4.3.

Table D2 Qualitative method for assessing technical objectives and support

Assessment method: For technical objectives and support		
●	Good	Overall strong positive impact
●	Positive	Overall positive impact
●	Neutral	Overall neutral impact
●	Negative	Overall negative impact
N/A	Not applicable	

The assessment method for cost as shown in Table D3 is aimed at high level costing based upon the three cost tiers of treatment: minimum, moderate, major, but if quantitative costs are known, these could also be substituted.

Table D3 Three tier method for assessing cost

Assessment method: Cost		
$	Minimum	As per Table 11 .
$$	Moderate	
$$$	Major	
N/A	Not applicable	

Appendix E – References

E1 Reference documents

E2.1 Policy and strategy documents

- Department of Transport and Main Roads. (2017). *Queensland Cycling Strategy 2017-2027.* https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Cycling-strategies
- Department of Transport and Main Roads. (2017). *Cycling Infrastructure Policy.* http://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Cyclists.aspx

E2.2 Standards and technical guidance

- Austroads. (2015). *Bicycle Wayfinding*. (Publication AP-R492-15). Sydney, NSW: Austroads.
- Austroads. (2017). *Guide to Road Design Part 6A– Pedestrian and Cyclist Paths.* (Publication AGRD06A/17). Sydney, NSW: Austroads.
- Austroads. (2017). *Cycling Aspects of Austroads Guides.* (Publication No AP-G88-17). Sydney, NSW: Austroads.
- Austroads. (2001). *Forecasting Demand for Bicycle Facilities*. (Publication No. AP-R194/01). Sydney, NSW: Austroads.
- Austroads. (2006). *Pedestrian–Cyclist Conflict Minimisation on Shared Paths and Footpaths*. (Publication No. AP-R287/06). Sydney, NSW: Austroads.
- Department of Transport and Main Roads. (2013). *Engineering Innovation within the Department of Transport and Main Roads.* Brisbane, QLD: Queensland Government. https://www.tmr.qld.gov.au/business-industry/Business-with-us/Engineering-innovation.aspx
- Department of Transport and Main Roads. (2017). *Manual of Uniform Traffic Control Devices (MUTCD).* Brisbane, QLD: Queensland Government. https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Manual-of-uniform-traffic-control-devices
- Department of Transport and Main Roads. (2013). *Road Planning and Design Manual (Second edition)*. Brisbane, QLD: Queensland Government. http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Road-planning-and-design-manual-2nd-edition.aspx
- Department of Transport and Main Roads (n.d.), *Road Planning and Design Manual (First edition).* Brisbane, QLD: Queensland Government. http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Road-planning-and-design-manual.aspx
- Department of Transport and Main Roads. (2006). *Pedestrian Safety and Accessibility Audit Tools.* Brisbane, QLD: Queensland Government.
- Department of Transport and Main Roads. (2013). *Technical Information for Cycling*. Brisbane, QLD: Queensland Government. https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Research-and-resources/Technical-notes-for-planners-and-engineers

E2.3 Multi- criteria assessment and monitoring

- Land Transport New Zealand. (2018). *Cycle Counting in New Zealand*. NZ: Land Transport New Zealand. http://www.nzta.govt.nz/resources/sustainable-transport/cycle-counting-in-nz/cycle-counting/
- Department of Transport and Main Roads. (2011). *Cost-benefit Analysis Manual Road Projects* http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Cost-Benefit-Analysis-Manual.aspx

- Department of Transport and Main Roads. (n.d.). *Active transport economic appraisal tool* https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/Cycling-investment-in-Queensland

E2.4 Other resources and key references

- Bicycle Council. (2013). *TMR Level of Service Model for Bicycle Riders.* Brisbane, QLD: ARRB. http://cdmresearch.com.au/TMR/0027%20TMR%20Level%20of%20Service%20Model%20(Final-2).pdf
- PedBikeTrans www.pedbiketrans.com
- New Zealand Transport Agency (n.d.), *Cycling Network Guidance.* NZ: New Zealand Transport Agency. https://www.nzta.govt.nz/walking-cycling-and-public-transport/cycling/cycling-network-guidance
- Strava Metro http://metro.strava.com/
- Transport and Infrastructure Council. (2016). *Australian Transport Assessment and Planning Guidelines, Mode Specific Guidance, M4-Active Travel.* https://www.atap.gov.au/mode-specific-guidance/index