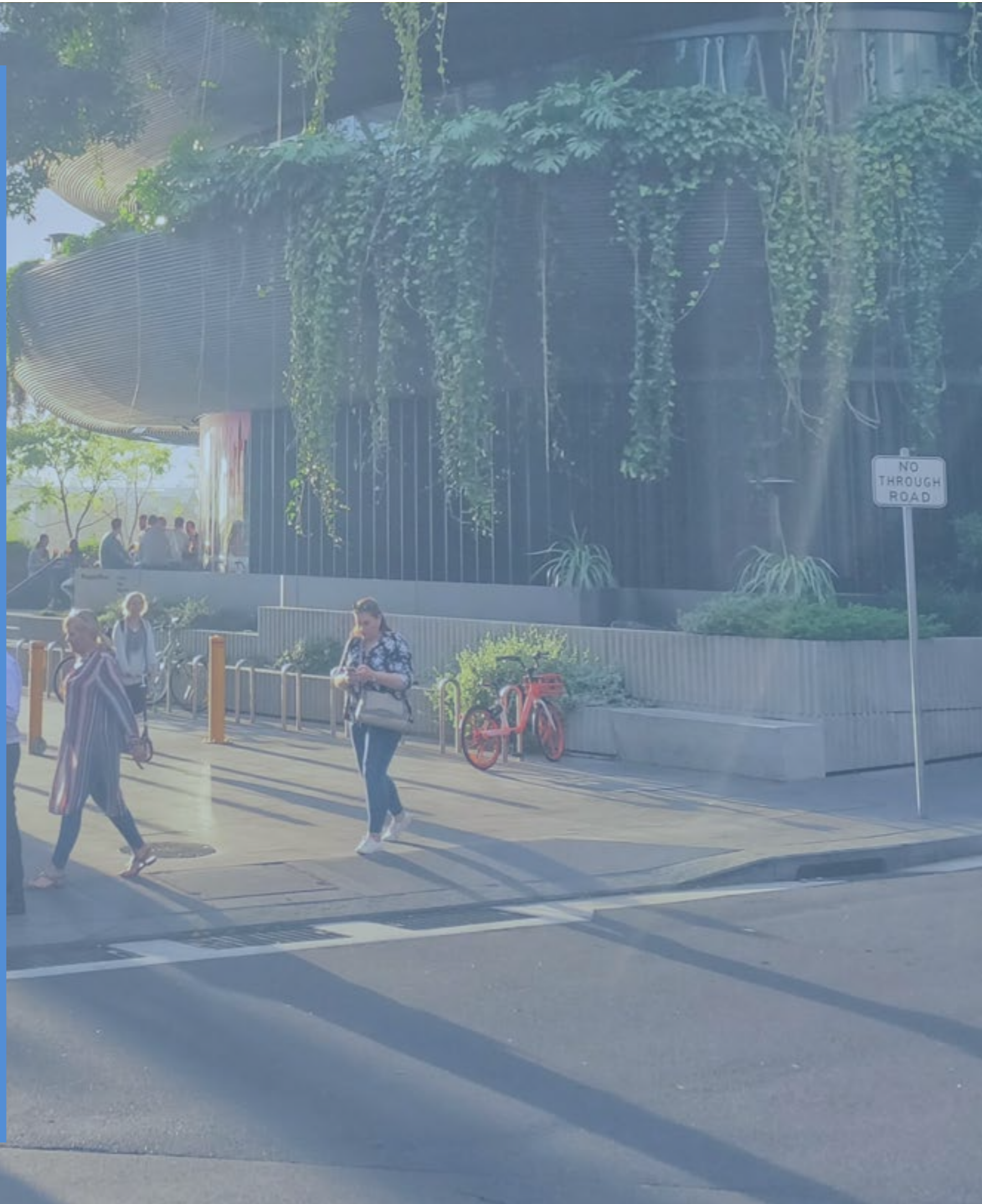


NSW Centre for Road Safety
May 2021

SAFE SYSTEM ASSESSMENT FRAMEWORK FOR MOVEMENT AND PLACE PRACTITIONERS

FINAL REPORT



Prepared for

NSW Centre for Road Safety

Prepared by

Arup

Arup Pty Limited

Level 5, 151 Clarence Street

Sydney, NSW 2000

Australia

Tel: +61 2 9320 9320

This document may contain confidential and legally privileged information, neither of which are intended to be waived, and must be used only for its intended purpose. Any unauthorised copying, dissemination or use in any form or by any means other than by the addressee, is strictly prohibited. If you have received this document in error or by any means other than as authorised addressee, please notify us immediately and we will arrange for its return to us.

DOCUMENT INFORMATION	
Report Title	Stage 4 - Final Report
Subtitle	Safe System Assessment Framework for Movement and Place Practitioners
Date	May 2021

REVISION	DATE	DETAILS
1.0	31/08/2020	Stage 4 first issue
2.0	30/10/2020	Stage 4 second issue
3.0	18/12/2020	Stage 4 final issue
4.0	8/04/2021	Stage 4 combined first issue
5.0	13/05/2021	Stage 4 combined final issue

REVISION DETAILS	
Prepared By	Philippa Ivens, Alexandra Satz and Emily Russo
Reviewed By	Mitch Lee, Kim Vandenberg and Callum Hooper
Approved By	Chris Schmid

CONTENTS

Introduction	6
The project	7
The stages	8
The workshops	9
Safe System Framework	10
NSW Movement and Place Framework	11
Literature Review	12
Literature Review: overview	13
Reviewed material	14
Treatment Information	16
Treatment information: overview	17
Assessing safety & place	18
Treatment matrix	19
Main Streets treatment summary	20
Civic Spaces treatment summary	22
Case Studies	24
Case studies: overview	25
Considerations of use	26
Safe System Assessment	27
Movement and Place assessment	28
Broadway, Chippendale	32
King Street, Newtown	36
Princes Highway, Milton	40
Crown Street, Wollongong	44
Pacific Highway, Coffs Harbour	48
Summer Street, Orange	52
Victoria Avenue, Chatswood	56
Bankstown City Plaza, Bankstown	60
The Levee, Maitland	64
Baylis Street, Wagga Wagga	68
Key Findings	72
Next Steps	74
References	76

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This document provides guidance on physical design and management treatments that can be used in combination to improve road safety for users of Main Streets and Civic Spaces.

Main Streets are typically characterised by:

- The dual function of a high place and high movement street
- Relatively high conflict points
- High competition for space

Civic Spaces are typically characterised by:

- Spaces where vulnerable road users need to be prioritised
- Management of vehicles is paramount

The primary objectives of this document are to:

- Merge the existing Safe System approach with the Movement and Place Framework
- Provide planning practitioners with direction on improving place outcomes, to achieve a safer road environment for all customers

The final output consists of a list of physical and management treatments (primary, supporting and enhancing) that have

improved safety and place outcomes for all users. Annotated case studies highlight how treatments can be used in combination in a street environment to show best practice. The case studies are intended to be representative of a range of typical Main Streets and Civic Spaces in NSW.

The project comprises four key stages. The project commenced with a Literature Review of existing and emerging guidance NSW for practitioners on street design, supplemented with research into international best practice design and treatments from the United Kingdom, the United States of America, New Zealand, Norway and Sweden. The Literature Review investigated their impact upon the safety and liveability of Main Streets and Civic Spaces. Informed by these findings, a table of physical management treatments for Main Streets and Civic Spaces was compiled, for both midblocks and intersections.

In Stage Two, the listed treatments were assessed for their effectiveness and evaluated against key place performance indicators and the Safe System Assessment methodology. Following this assessment, treatments were sorted into three categories; primary, supporting and enhancing, based upon their level of impact and effectiveness. This

process was informed by TfNSW stakeholders in a project workshop. Summaries of each treatment have been produced to advise on application.

In Stage Three, six Main Streets and four Civic Spaces case studies were identified as examples where treatments could be deployed to realise better road safety and place outcomes, for both midblocks and intersections. This included the production of plan and cross-section views of examples in metropolitan Sydney and across regional NSW. A review of the existing conditions and the key drivers for change for each case study has been completed to inform what the treatments should aim to resolve.

Stage Four is the compilation of all previous stages into this document for Main Streets and Civic Spaces. An evidence-based hierarchy of physical and management treatments to be applied in combination to contribute towards better place outcomes and the zero-trauma target was created. The combination of treatments is illustrated through a range of NSW case studies. This is supplemented with considerations of use to advise practitioners on suitable application. This document concludes with key findings and possible next steps.

INTRODUCTION

THE PROJECT

Context

Traditionally, road classifications have had high focus on limiting delay and increasing throughput of motor vehicles. However, places designed through the single lens of capacity, or road safety, often do not have good outcomes for the liveability and enjoyment of a road or street.

Purpose

The project seeks to develop guidance on physical design and management treatments to improve movement, place and safety outcomes by combining existing frameworks and approaches for place and safety respectively.

Objectives

The objective of this project is to:

- Merge the existing Safe System Framework with the NSW Movement and Place Framework
- Provide planning practitioners with direction on improving place outcomes, to achieve a safe road and street environment for all customers

Output

This report brings together the evidence gathered, reviews undertaken, evaluation of effectiveness and examples developed in Stages 1, 2 and 3.

The final output is this report, which provides guidance on best-practice for design and treatment application. This includes:

- A summary of information gathered from the Literature Review
- An interactive treatment dashboard which provides information on treatment impacts to safety and place, considerations for use and precedents
- Six Main Streets and four Civic Spaces case studies and layouts showing a plan and a section schematic drawing of each case study for a mid-block and intersection location. These drawings are annotated to highlight retained and additional treatments, and accompanied by a case study 'cover page' which describes context and key drivers, as well as the safety, movement and place assessments



THE STAGES

The project comprises of four key stages with two workshops at Stages 2 and 3.

Stage 1 Literature Review

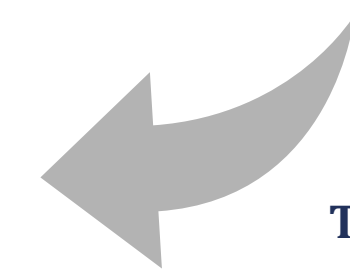
Stage 2 Treatment Information

Workshop 1

Stage 3 Case Studies

Workshop 2

Stage 4 Final Report



This report

1. Literature Review

The project commenced with a Literature Review of existing and emerging guidance for NSW practitioners on street design, supplemented with research into international best practice design and treatments (UK, USA, New Zealand, Norway, Sweden), and their impact upon the safety and liveability of Main Streets and Civic Spaces. Informed by these findings, a table of physical and management treatments for Main Streets and Civic Spaces was compiled for both mid-blocks and intersections.

2. Treatment Information

These listed treatments were then assessed for their effectiveness, evaluated against key place performance indicators and the Safe System Assessment methodology (exposure to risk, likelihood of a crash, and the likely severity in the event of a crash). From this assessment, treatments were sorted into three categories; primary, supporting and enhancing, based upon perceived impact on safety. Place performance is also indicated for each treatment, categorised as either; supporting, neutral or detracting. This process was informed by Transport for NSW stakeholders in a project workshop. One-page summaries of each treatment were produced to advise on application. This stage also included Workshop 1.

3. Case Studies

Suitable case studies were identified as examples of where treatments could be deployed to realise better road safety and place outcomes, for both midblocks and intersections. This includes the production of plan and cross-section views. These include examples in metropolitan Sydney and across regional NSW. A review of the existing conditions and the key drivers for change for each case study has been completed to inform what issues the treatments should aim to resolve. These studies are not proposals but rather a possible combination of treatments that bring the street closer to its assigned street type. This stage also included Workshop 2.

THE WORKSHOPS

The workshops presented an opportunity to share the work in progress as well as obtain feedback from a wide range professionals with focuses on place, land use, planning, safety, strategy/network and operations for a range of customer groups.

Workshop 1

This workshop presented progress during Stage 2 of the project. This involved outlining the processes undertaken to use the Literature Review to start to group and assess road safety treatments. The workshop described the metrics and frameworks adopted to assess safety and place of individual treatments.

A collaborative SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis was also discussed, with particular focus on what the challenges are to implementation.

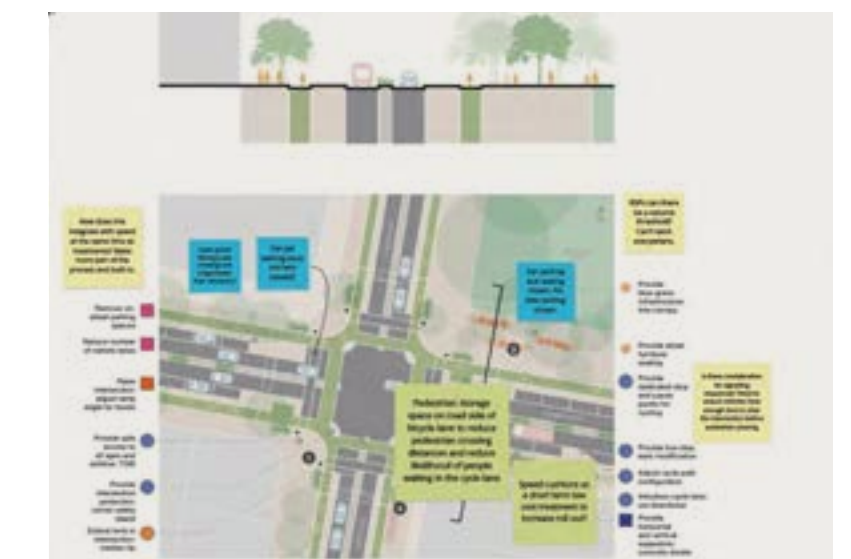
Additionally, the workshop also provided opportunity for professionals to contribute ideas on potential sites for case studies for Stage 3.

Workshop 2

This workshop was held during Stage 3. The workshop summarised work undertaken to date and presented three case studies for review (a metropolitan Main Street, a regional Main Street and a metropolitan Civic Space). Through rotating breakout groups, the application of the safety treatments were discussed in the context of best practice and place outcomes.



WORKSHOP 1: SWOT analysis using a collaboration tool, Miro



WORKSHOP 2: An annotated intersection

SAFE SYSTEM FRAMEWORK

The Safe System approach works towards achieving the ultimate goal of zero deaths and serious injuries on NSW roads.

“The four elements of the Safe System approach, first used in Scandinavia, are safer people, safer roads, safer speeds and safer vehicles. We need to improve the safety of all parts of the system, so that if one part fails, the other parts will protect people from being killed or seriously injured.

With all of these elements working together as a whole, the system is more forgiving of human or mechanical error and the impact of a mistake made on the road does not result in a fatality or serious injury.

This approach is underpinned by these principles:

- Road safety is a shared responsibility
- The human body can only withstand limited forces in a crash before this results in a fatality or serious injury
- Continuous improvements in vehicles, roads and behaviour will reduce fatalities and serious injuries.” *

* Extracted from 'Towards Zero - a Safe System approach', NSW Centre for Road Safety

As part of the NSW Road Safety Plan 2021, NSW has committed to deliver on a target of zero trauma on the transport system by 2056- the central principle of the Safe System approach. (see Future Transport, Transport for NSW, 2056)

For the NSW Government, this sets the mission of ensuring safety is at the forefront of all decisions that impact upon the planning, design, construction, operation and maintenance of our built environment.

The principles of Safe System are applied to the design of the road environment by considering three elements- exposure, likelihood and severity- that impact the risk of death or serious injury from a crash.

Each element and its key measure is defined below:

- Exposure- the number of road users that have the potential to be involved in the crash type (the number of users in relation to the length of road segment)
- Likelihood- the probability that an individual road user will be involved in a crash (physical treatments and design interventions)

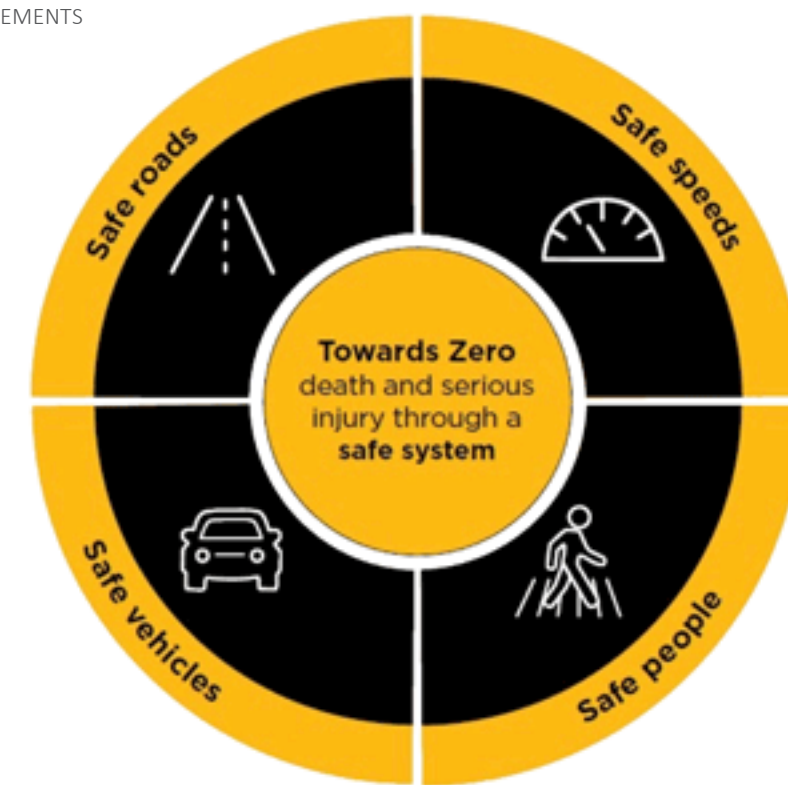
- Severity- the likely severity outcome in the event of a crash: minor, moderate, serious or fatal (vehicle speed)

The factors to be considered within each element have been identified by Austroads in the Safe System Assessment Framework for Infrastructure Projects. The purpose of the framework is to assess different major crash types (those identified as the predominant contributors to fatal and serious crash outcomes) against the exposure to that crash risk, the likelihood of it occurring and the severity of the crash should it occur.

KEY REFERENCE DOCUMENT:
[Safe System Assessment Framework, Austroads, 2016](#)



TOWARDS ZERO ELEMENTS



NSW MOVEMENT AND PLACE FRAMEWORK

Movement and Place is a “place-based” approach to the planning, design, delivery and operation of roads and streets, which takes the entire road corridor to the property line into consideration. The Framework also considers the land uses adjacent to the road corridor. It is a methodology and common language that can be used across government and practitioners. The NSW Movement and Place Framework organises transport links by their place and movement functions into road and street types. The Framework is also a method to plan and workshop desired future use and character of places and corridors to achieve safety, social and environmental outcomes.

Four broad road typologies are identified in the Practitioner’s Guide to Movement and Place:

- Main Roads- high movement, low place
- Main Streets- high movement, high place
- Local Streets- low movement, low place
- Civic Spaces- low movement, high place

Why Main Streets?

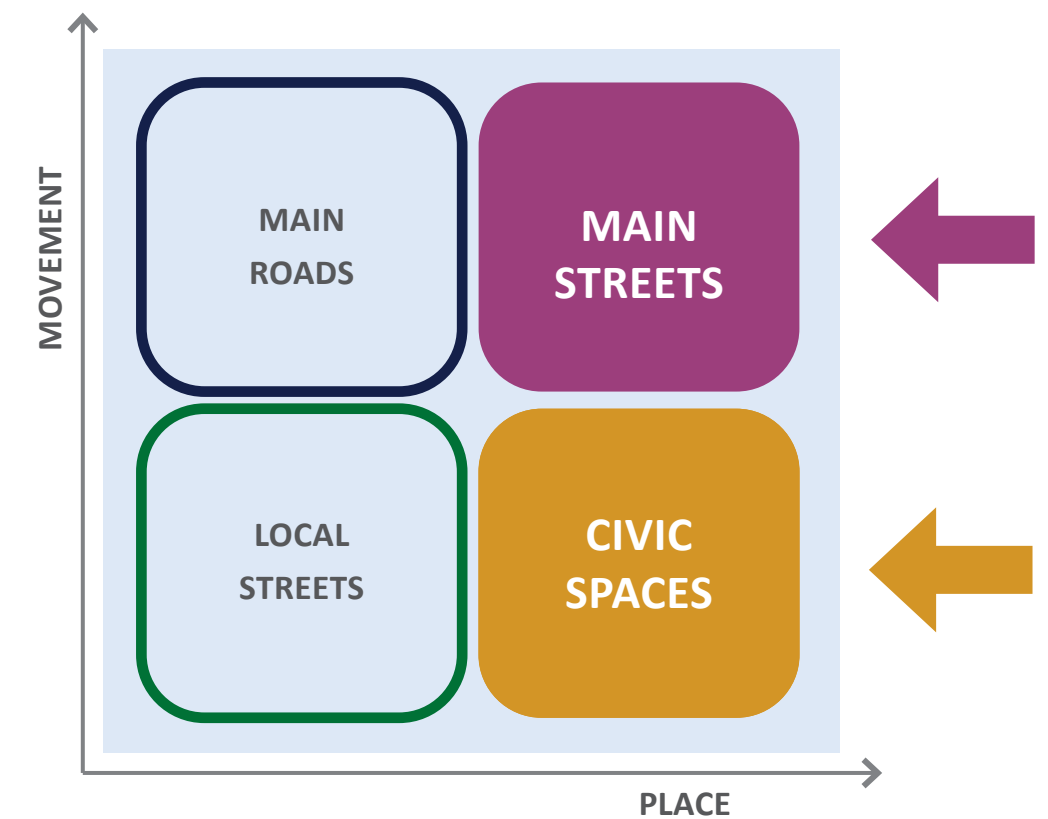
Some of the most difficult decisions faced in managing transport and place arise when trying to balance different users/customers of the road network. Considering this within the NSW Movement and Place Framework, Main Streets pose a great challenge with high competition for space in communities, towns and cities.

There is a complex need to balance high pedestrian activity and densities. Streets generate demand through significant commercial, employment, tourism, leisure and entertainment venues. They must also accommodate for the movement of growing numbers of people and goods. This is challenging for both local and State Government. As movements associated with this growth increase on Main Streets, so too does the road safety risk to some of the most vulnerable users.

Why Civic Spaces?

Some of the most difficult decisions faced in managing transport and place arise when trying to balance different users/customers of the road network. Considering this within the NSW Movement and Place Framework, Civic Spaces need to prioritise vulnerable road users while retaining their significant place value.

Converting a pre-existing road environment to a Civic Space can be particularly challenging especially if the road/area previously served as a movement corridor for motor vehicles. Special consideration is needed to ensure people walking and cycling are safe.



NSW MOVEMENT AND PLACE CLASSIFICATIONS:
 Main Streets are required to cater for high movement and high dwelling. Civic Spaces are required to protect vulnerable road users and maintain their significant place value



LITERATURE REVIEW

LITERATURE REVIEW: OVERVIEW

Purpose

Stage 1 identified physical and management treatments from a Literature Review of best practice in Australia and internationally. The research formed the evidence base upon which the treatments were developed.

Informed by the findings from local, national and international research, a table of treatments was compiled for both mid-block and intersections. The treatments were arranged into a hierarchy according to the risk element of the Safe System approach they were most likely to address. These comprise exposure to risk, likelihood of a crash, and the likely severity outcome in the event of a crash.

Process



Output

- A Literature Review identifying existing and emerging guidance that is being applied in NSW, supplemented with best practice design and treatments from the UK, USA, New Zealand, Norway and Sweden.
- A table of physical and management treatments for mid-block and intersection, sorted into a hierarchy based on their most likely Safe System risk element

REVIEWED MATERIAL

The Literature Review identified existing and emerging guidance both locally and globally. It sought to form an evidence base upon which treatment could be further grouped and explored.

There has been significant work to date on safety, movement and place, forming a large body of guidance documents, frameworks and policies.

A number of sources were reviewed and the following information was synthesised:

- Frameworks and approaches including objectives for design and management of streets
- Metrics and measures
- Treatments
- Impacts of treatments based on empirical studies and anecdotal evidence

REVIEWED MATERIAL: A suite of documents were explored for this Literature Review

NORWAY

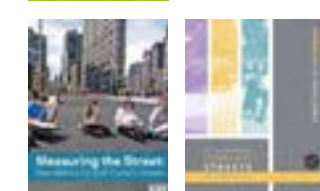


UNITED KINGDOM

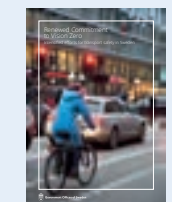
Creating better streets: Inclusive and accessible places



UNITED STATES OF AMERICA

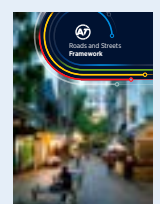


SWEDEN



AUSTRALIA

NEW ZEALAND





TREATMENT INFORMATION

TREATMENT INFORMATION: OVERVIEW

Purpose

To use the information from the Stage 1 Literature Review to sort and assess treatments.

Process

Sort the treatments

Identify treatments from the Stage 1 Literature Review and sort further into useful groupings for application (i.e. treatments that have very similar purposes and impacts)

Categorise the treatments

Group treatments according to their various applications:

- Street type suitability
- Mid-block, intersection or both
- 'NSW Road Planning Framework- Road Type Characteristics': typical speed limit, intersection treatments, clearways/ stopping zones, kerbside parking, walking activity, cycling provision, land use interface

Assess the treatments

Assess the individual treatment's impact and effectiveness for safety and place:

- Safety: Assess based on perceived impact on exposure, likelihood and severity to inform the treatment hierarchy (primary, supporting and enhancing)
- Place: Performance based on categories of supporting, neutral and detracting

Include a 'considerations of use' and local and global precedent images, along with the literature review references, to support the assessment.

Identify the case studies

A long list of case studies to be tested in Stage 3 were identified. A portion of Workshop 1 was dedicated to gathering a suite of potential sites to test.

Output

A compilation of treatment information presented in a 'dashboard' style. The treatments will be categorised according to risk elements and hierarchy (or impact). Information for treatments include:

- Key purpose and common contexts for use
- Considerations of use
- Literature Review reference
- Precedents: examples which show potential effectiveness of the treatment, what other treatments it is used in combination with and examples which show poor place outcomes as warning

ASSESSING SAFETY & PLACE

Assessing safety

Key reference: Safe System Assessment Framework, Austroads, 2016

Safety scores were based on the three risk elements identified in the Safe System Approach- Exposure, Likelihood and Severity. By re-framing the scoring, individual treatments and their relative impacts were given a score.

Exposure

- **Score = 0: Significantly reduces the number of users that have the potential to be involved in a crash, in particular reduces vehicle volumes**
- **Score = 4: Does not reduce the number of users that have the potential to be involved in a crash**

Likelihood:

- **Score = 0: Significantly reduces the probability that an individual user will be involved in a crash**
- **Score = 4: Does not reduce the probability that an individual user will be involved in a crash**

Severity:

- **Score = 0: Significantly reduces vehicle speed or mass, and/or improves impact angle**
- **Score = 4: Does not reduce vehicle speed or mass, and/or improve impact angle**

An outline of the scoring is defined as follows. The scoring for each individual risk element is multiplied to determine an overall score for the treatment. This informs the treatment hierarchy:

- Primary treatments: Score ~ 0-12
- Supporting treatments: Score ~12-32
- Enhancing treatments: Score ~32-48

Assessing place

Key reference: Practitioners Guide to Movement and Place- Implementing Movement and Place in NSW, Government Architect NSW, 2020

Place scores were adapted from the Practitioner's Guide to Movement and Place taking into account the project scope. Each treatment was identified as either having a supporting, neutral or detracting impact.

Note that the treatments with poor place outcomes for a Main Street or Civic Space context (identified in the Literature Review) were omitted from further progression (see Appendix 3).

Place scores were broadly as follows:

A treatment is assessed as **'supporting'** place if any one of these is addressed:

- Provides opportunity for blue-green infrastructure

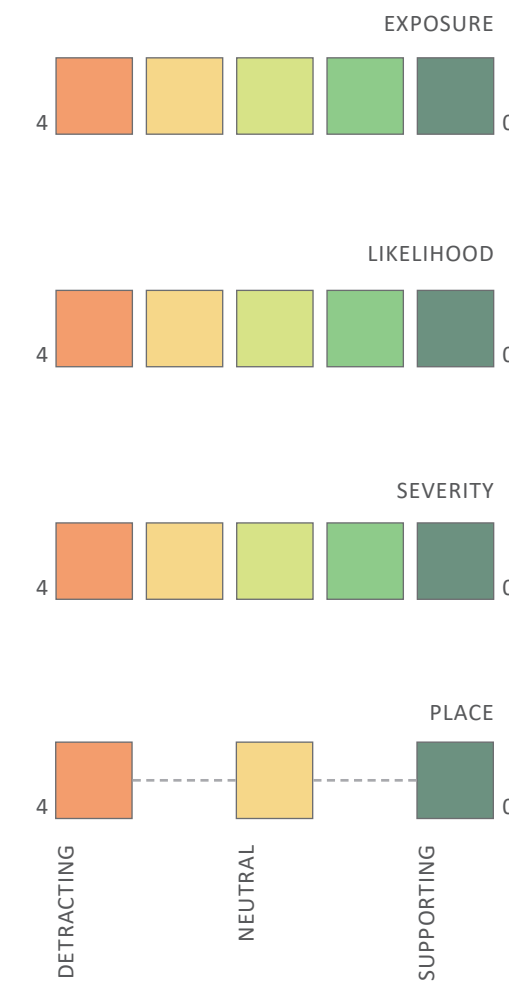
- Improves comfort and personal security
- Improves connectivity and access
- Improves activation / human-scale engagement
- Slows vehicles, caters to people walking and cycling movement

A **'neutral'** place assessment is assigned to treatments that have no ostensible place-supporting potential or are highly dependent on contextual factors and/or integration with other treatments.

A **'detracting'** place assessment is assigned if the treatment has significant potential to:

- Reduce opportunity for blue-green infrastructure
- Worsen comfort and personal security
- Worsen connectivity and access
- Worsen activation / human-scale engagement
- Increases vehicle speed and gives vehicles priority

ASSESSING SAFETY AND PLACE:
Measuring the potential impact of individual treatments



TREATMENT MATRIX

Once all the treatments were assessed in terms of their place and safety impacts, the treatments were grouped into a treatment matrix.

The treatment matrix serves as a guide in the selection process for a particular location. The matrix is a 3 x 3 structure which groups treatments according to the treatment hierarchy and risk elements that emerged from the individual scoring (on the previous page).

Using the matrix

Generally, the 'exposure' and 'primary' categories hold the most impactful treatments but nonetheless require other primary, supporting and enhancing elements across all risk elements to be effective.

Similar treatments (with similar place and safety impacts) are bundled together. For example, 'Restrict vehicle access' groups a number of treatment options together including: bollards, diverters, signals and signage, which all have the capacity to limit vehicle access.

The treatments were grouped in this way to provide flexibility and to avoid offering a definitive list of treatments.

It is a guide only

The matrix serves as a guide only, aiming to encourage combinations of treatments to be considered.

It should be noted that the categorisation of these treatments isn't rigid, rather treatments can shift categories depending on the context and the purpose they intend to serve.

This can be further explored in Appendix 2.1, Appendix 2.2 and Appendix 2.3, which highlight typical treatment uses, aspects to consider and precedents which typify either a supporting, neutral or detracting place outcome as a result of their use.

THE TREATMENT MATRIX: *The organisation of treatments relating to the treatment hierarchy and risk elements.*

	PRIMARY	SUPPORTING	ENHANCING
Exposure	Primary	Supporting	Enhancing
Likelihood	Primary	Supporting	Enhancing
Severity	Primary	Supporting	Enhancing

The table is a 3x3 matrix with a white arrow pointing from the top-left cell (Exposure/Primary) to the bottom-right cell (Severity/Enhancing). The cells are color-coded: Primary is pink, Supporting is light blue, and Enhancing is light orange.

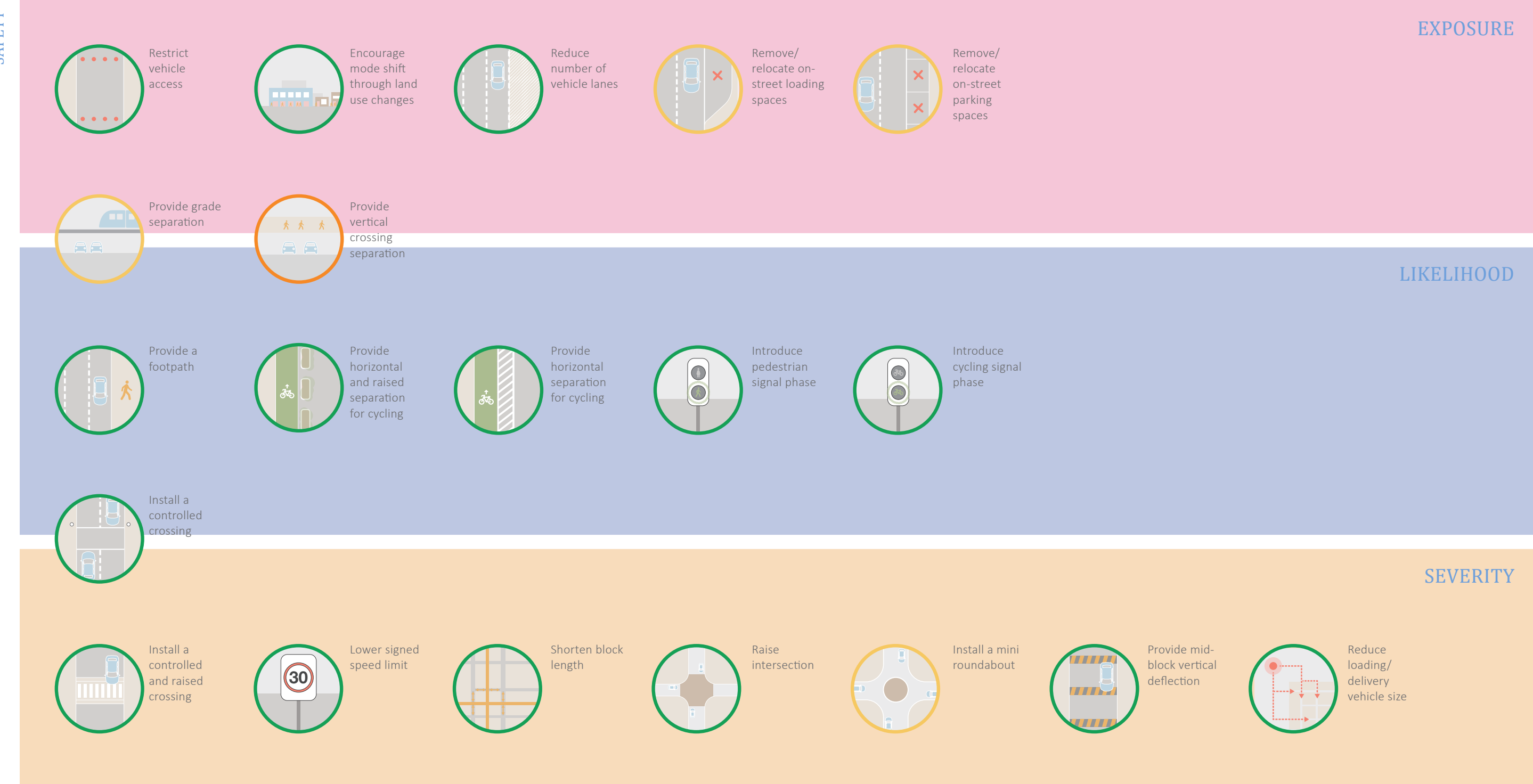
See Appendix 2.1 for Primary treatments

See Appendix 2.2 for Supporting treatments

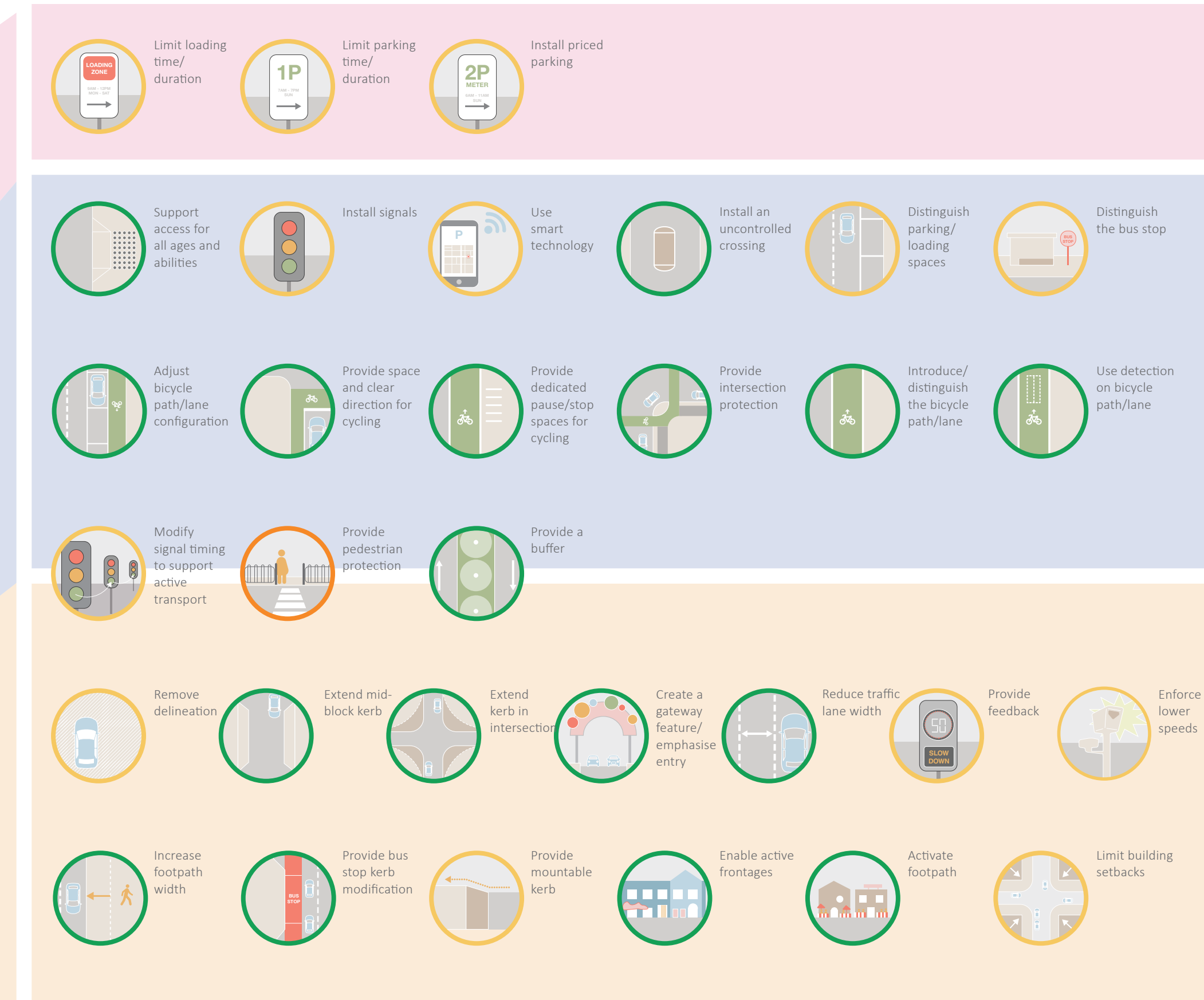
See Appendix 2.3 for Enhancing treatments

TREATMENT SUMMARY

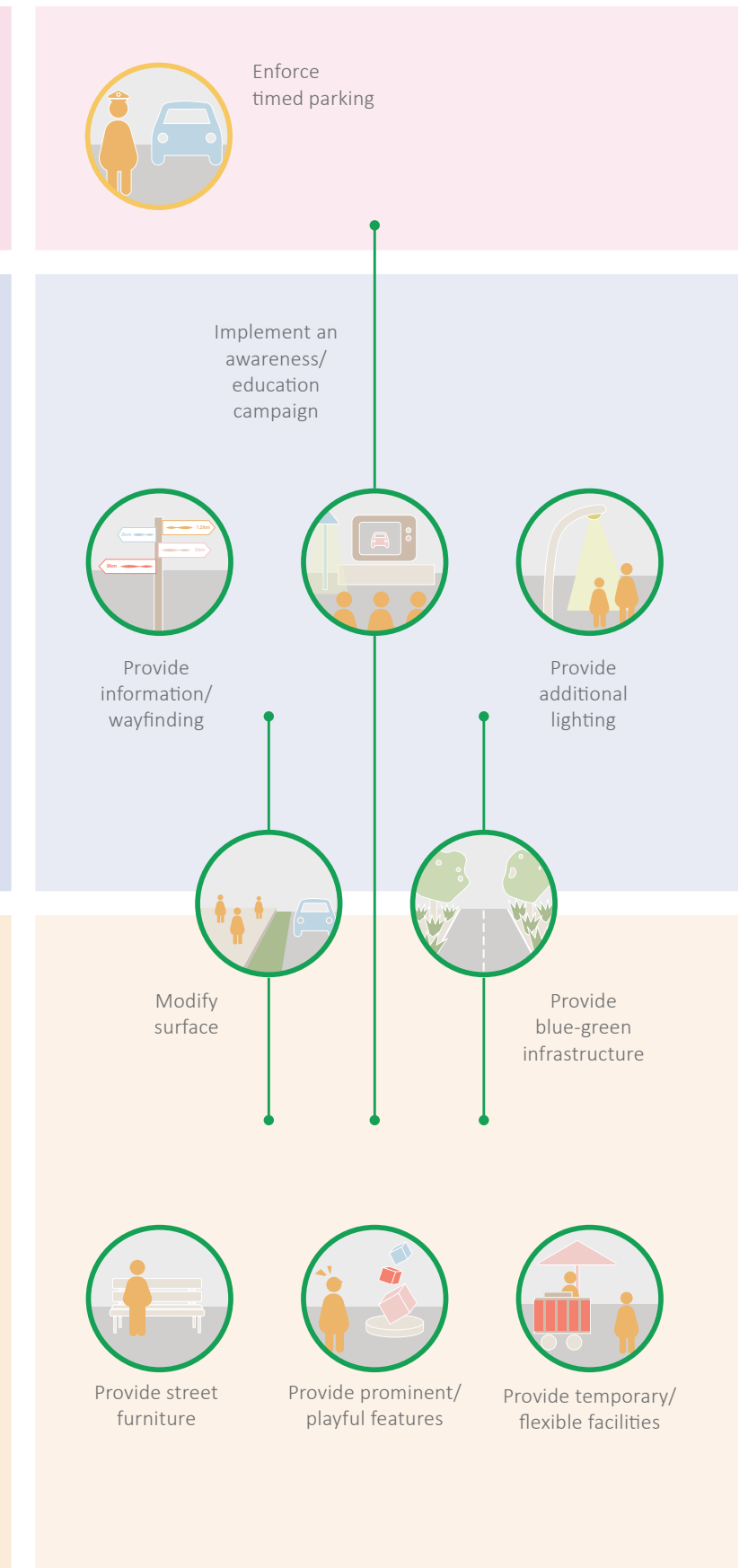
PRIMARY



SUPPORTING



ENHANCING



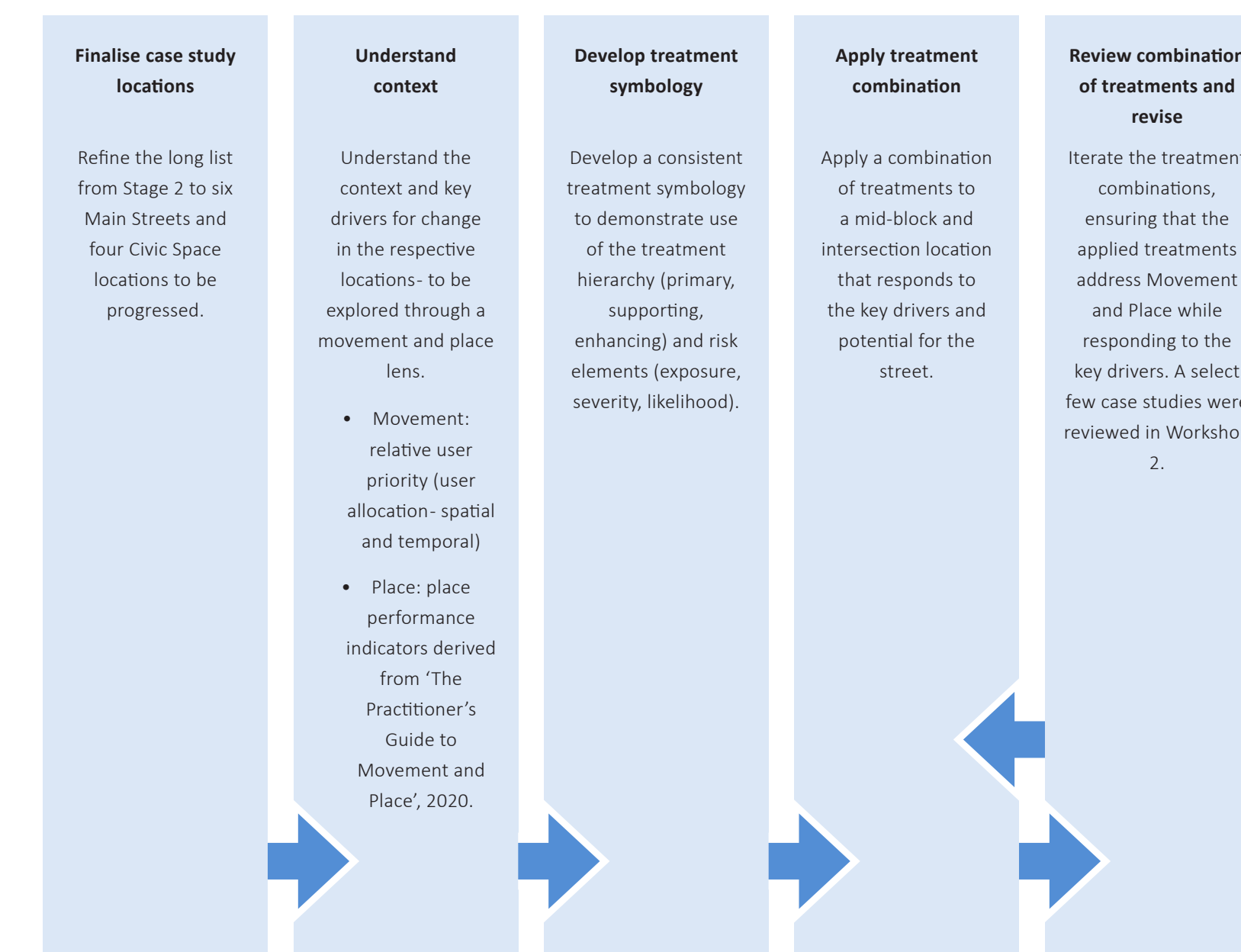
CASE STUDIES

CASE STUDIES: OVERVIEW

Purpose

To apply a suite of safety treatments to the selected case study locations, and to assess the impact of these on movement and place.

Process



Output

A cover page along with plans and sections of mid-block and intersection locations were produced for each case study. The case studies included Main Street and Civic Space metropolitan and regional locations:

Main Streets

Metropolitan:

- Broadway, Chippendale
- King Street, Newtown

Regional:

- Princes Highway, Milton
- Crown Street, Wollongong
- Pacific Highway, Coffs Harbour
- Summer Street, Orange

Civic Spaces

Metropolitan:

- Victoria Avenue, Chatswood
- Bankstown City Plaza Bankstown

Regional:

- The Levee, Maitland
- Baylis Street, Wagga Wagga

CONSIDERATIONS OF USE

The case studies are intended to illustrate best practice and do not form proposals or represent future changes to specific locations.

The following outlines the conditions of use regarding treatments and their application to varied contexts. It is important to note that the treatments should consider the following:

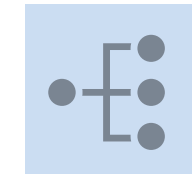
- land use
- flexibility and change over time
- strategic/network considerations
- operational conditions
- already established future strategic plans / masterplans
- future influential projects
- stakeholder impacts

Respond to context



Treatments must respond to the context of the place in which they are being applied. A blanket application of the following treatments is not the intention of this work. Time of day must be considered in context.

Consider a range of treatments



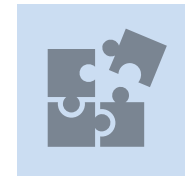
The combination of treatments demonstrated through the case studies does not represent a standard set of treatments to be applied on streets with similar contexts. A range of treatments should be considered in every location.

Equality of access



The identified treatments must consider a range of users to provide equality of access for all. The key users of each location need to be considered in the context of each treatment.

Use in combination



Treatments should not be used in isolation - they should be introduced in combination with policies and programs aimed at educating drivers and changing driver behaviour.

Use existing mechanisms



The ultimate application of these treatments needs to go through existing mechanisms e.g. Austroads Design Requirements. This will capture aspects such as infrastructure that needs to be upgraded (e.g. signal lanterns) and amending aspects that aren't to code (e.g. sight line obstructions).

Strive for best practice



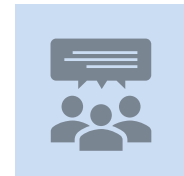
The treatments demonstrate the best practice outcomes that practitioners should strive towards. Under careful consideration, treatments may be adjusted to suit context, budget and space constraints.

Treatment suitability



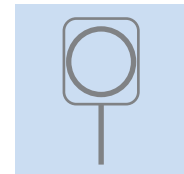
The application of some treatments may not be suitable in some locations.

Consider macro and micro networks



Any treatments that are selected need to consider the interface between macro and micro networks. This will require wider dialogue and engagement with other documents and/or organisations.

Treatment effectiveness



The effectiveness of treatments will be influenced by operating speeds, especially when considering outcomes for vulnerable road users in a place context.

SAFE SYSTEM ASSESSMENT

The Safe System approach involves different elements of the system working together to help eliminate death and serious injury. The framework assesses how closely road design and operation align with the Safe System objectives and clarifies which elements need to be modified to achieve closer alignment with Safe System objectives. An appraisal of the Safe System risk elements forms the basis of the Safe System Assessment. The risk elements are defined below:

- **Road user exposure** – refers to which road users, in what numbers and for how long are using the road and are thus exposed to a potential crash. The measure of exposure include: annual average daily traffic (AADT)*, side-road traffic volumes, number of motorcycles, people cycling and pedestrians crossing or walking along the road, length of the road, area and length of time.
- **Crash likelihood** – groups of factors affecting the probability of a crash occurring. They can be elements which moderate opportunity for conflict (e.g. the number of conflict points, offset to roadside hazards, separation between opposing traffic). They can also include

elements of road user behaviour and/or road environment. Typically, these are the elements which moderate road user error rates. This includes issues such as level of intersection control (e.g. priority/signals/movement ban), speed, sight distance, geometric alignment, driver guidance and warning and maintenance.

- **Crash severity** – groups of factors affecting the probability of severe injury outcomes should a crash occur. Typically, these factors are associated with the amount of kinetic energy and its transfer in the crash, e.g. impacts speeds and angles and the severity of roadside hazards.

A rapid Safe System Assessment was undertaken for each of the case studies which compared the existing conditions with the potential future conditions. The assessment focused on three crash types, as defined below:

- **Intersection** – crashes occurring at intersections, including side impacts involving vehicles from adjacent directions, collisions between right turning and opposing vehicles and rear-end crashes. Does not include pedestrian or cyclist crashes at intersections (these crash types

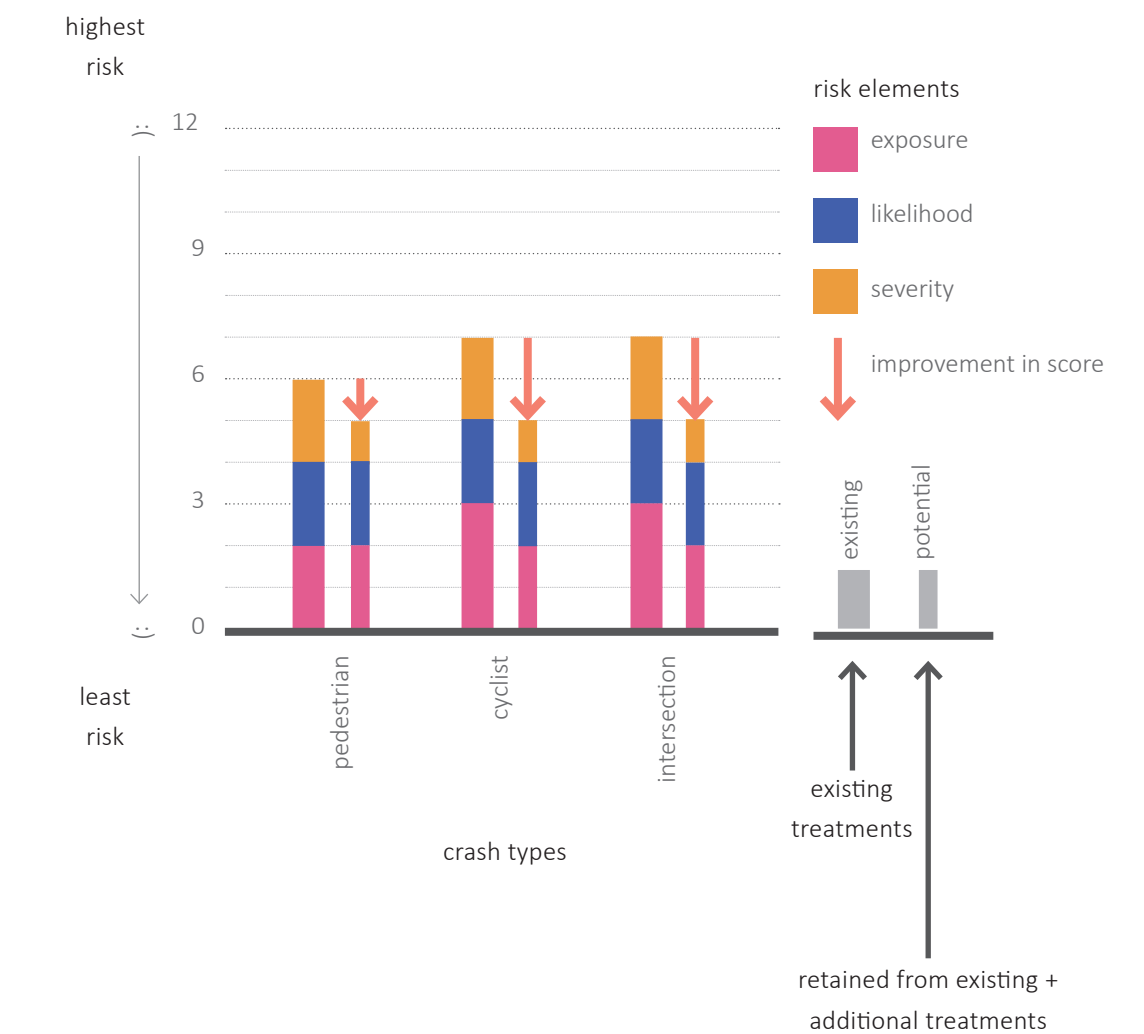
are considered separately);

- **People walking** – all crashes involving people walking, including persons boarding or alighting from a vehicle and anyone working on the road or roadside; and
- **People cycling** – all crashes involving people cycling.

A score of 0-4 was selected for each of the Safe System risk elements, where zero is the least risk and four is the highest risk. Each case study location was given a score out of 12 for both its current state and its potential future state. In most instances, the scores for the risk elements decreased as a result of the potential interventions. In some cases, the risk element score was maintained. This was particularly relevant in locations where significant interventions have already been implemented, with positive results.

** As AADT volumes were not available for the case studies, the assessment scoring focused on the potential reduction in volumes based upon potential interventions, such as a reduction in the number of vehicle lanes.*

RAPID SAFE SYSTEM ASSESSMENT: Scoring the street existing vs potential



MOVEMENT AND PLACE ASSESSMENT

It is important to consider the NSW Movement and Place measures that determine the street's existing performance relative to where we'd like it to be.

This ensures a more holistic approach for the street, rather than reacting solely based on crash history.

The combination of existing conditions and treatments collectively contribute to NSW Movement and Place measures.

Road user priorities

Each user group's relative priority can be determined by examining their spatial allocation (i.e. space dedicated to each user group) and temporal allocation (i.e. time allocated to each user group) within the streetscape.

The user groups comprise:

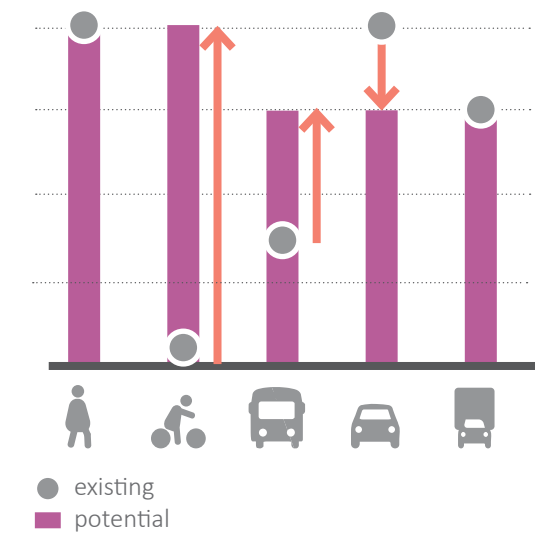
- People walking
- People on bicycles
- Buses
- Private vehicles
- Freight, loading and delivery

Evaluating movement and place performance

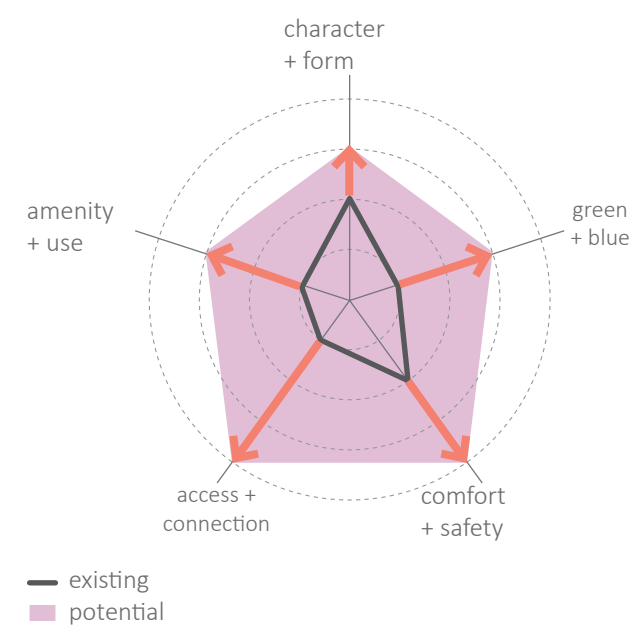
Place is often complex to measure since it is a combination of many factors that are difficult to measure. Place performance measures were derived from the Practitioner's Guide to Movement and Place, 2020, as follows:

- **Green + blue:** biodiversity, vegetation cover, waterways, on-site water management
- **Comfort + safety:** pedestrian crowding, community safety and security (Note: Safe System Assessment considered separately - in this context safety refers to personal and perceived safety)
- **Access + connection:** walking, cycling and public transport attractiveness, journey time reliability for freight and public transport
- **Amenity + use:** public space (local living, schools, end-of-trip facilities, places to stop and rest), mix of uses (population and housing density, local jobs, etc.)
- **Character + form:** walking and cycling permeability, building heights, street enclosure, dwellable street space, culture and heritage, land division, legibility, building density)

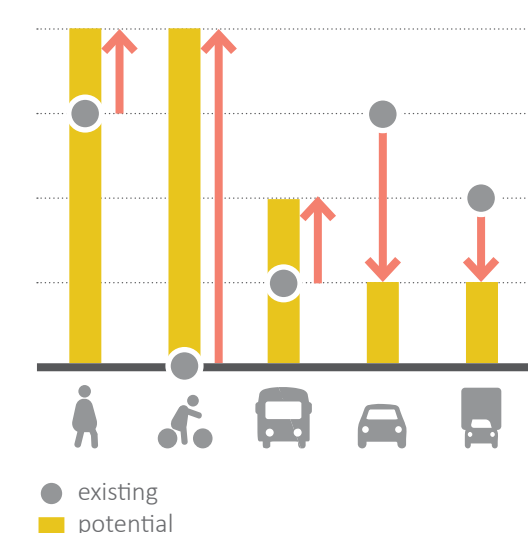
Main Streets road user priorities



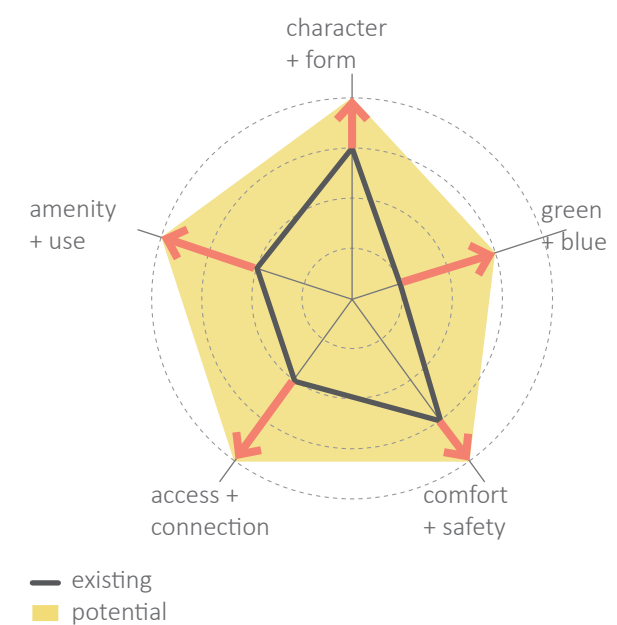
Evaluating movement and place performance for Main Streets



Civic Spaces road user priorities



Evaluating movement and place performance for Civic Spaces



ASSESSING MOVEMENT AND PLACE: By assessing where our street is at, compared to where we want it to be, we can immediately see the gaps and start to select treatments that specifically address these.

MAIN STREETS CASE STUDIES

Main Streets metropolitan case study



BROADWAY, CHIPPENDALE

Context

Broadway is a key east-west connection between the Western Suburbs and the Sydney CBD- eight lanes of traffic carry large numbers of vehicles throughout the day. Inbound and outbound AM and PM bus lanes support the key public transport function of the road. Several universities, small- and large-scale retail and hospitality as well as its proximity to Central Station means that Broadway has high volumes of people walking. The high number of road users passing along the street and wide crossing distances results in high exposure for people walking and the absence of segregation between some modes (cyclists and vehicles) means that the likelihood of a

crash is high.

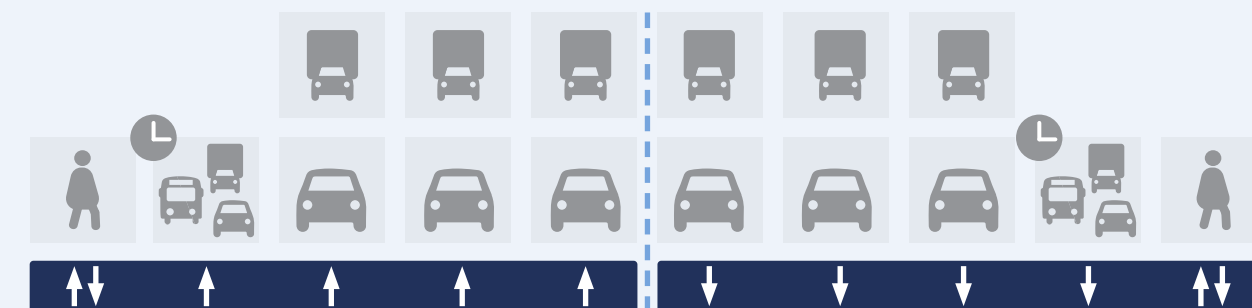
The posted speed limit is 50km/h, which will likely result in a higher severity of crash between a vehicle and a person walking than if the crash were to occur at 30km/h (90% chance of death at 50km/h vs 10% chance of death at 30km/h, NSW Centre for Road Safety, 2020). The intersection between City Road and Broadway is a known high-density crash area in Sydney. Pedestrian crossings are provided on three of the four arms of the intersection, meaning that some desire lines require people walking to cross three roads to travel between the north and south side of Broadway.

The intersection has multiple vehicle conflict points, including the movement to and from Bay Street. In the future, WestConnex is forecast to reduce the amount of traffic travelling along and Broadway.

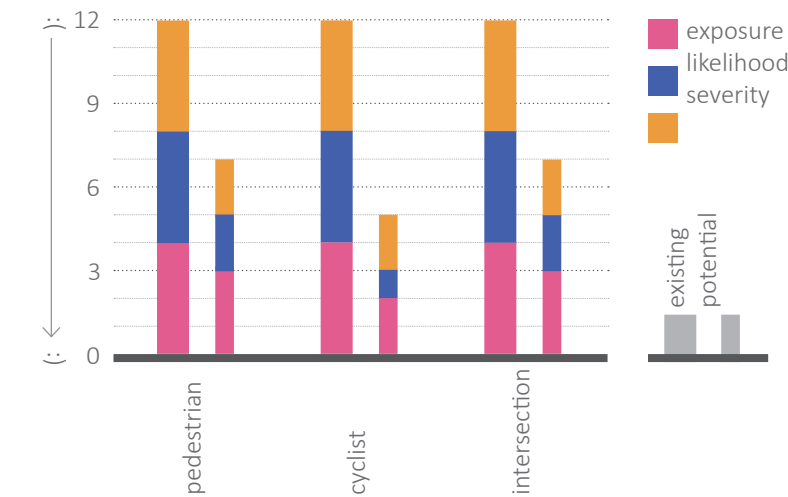
The key driver is to maintain Broadway's movement function by deprioritising private vehicles and creating a better balance between modes via provision of attractive and convenient infrastructure and facilities for people walking and cycling.

Existing user allocation

Broadway



Safety



Justification

Exposure

The allocation of road space between movement and place needs to be rebalanced along Broadway to increase priority for people walking and cycling and away from private vehicles. The additional interventions will look to capitalise upon lower traffic volumes as a result of WestConnex. Reducing the number of private vehicle traffic lanes will support Broadway's place function. The additional interventions will leverage off existing plans to close Bay Street to traffic, thereby reducing conflicting movements between people walking and vehicles and supporting large volumes of people walking.

Likelihood

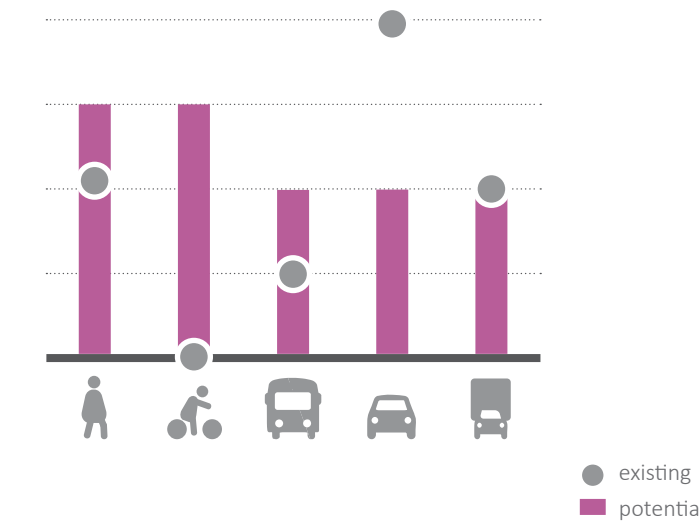
Improved bus priority and infrastructure will support Broadway's place function. Prioritising active modes of travel will help to further establish and strengthen the place function along Broadway. Conflicting movements between modes will be reduced, where possible, to increase safety.

Severity

The current speed limit of 50km/h is not conducive to a Main Street environment. Creating an attractive and inviting place along Broadway will be primarily supported by a reduction in the sign posted speed limit.

Movement and Place

Road user priorities



People walking

The footpath on the southern side of the road, adjacent to the park, has ample width. The footpath on the northern side of the road is relatively wide, however, has no buffer from the road. The intersection of Broadway, City Road and Bay Street is large and requires people walking to cross up to 9 lanes in one leg. Not all legs of the intersection have signalised crossings and pedestrian fencing prohibits any informal crossing.

People on bicycles

There is no formal bicycle infrastructure along Broadway.

Buses

Dedicated bus lanes operate in both directions during the peak periods in the flexible kerbside lane (6am-10am and 3pm-7pm in both directions). The bus stop on the southern side is easily distinguishable by two bus shelters with timetabling information and tactile ground surface indicators (TGSIs).

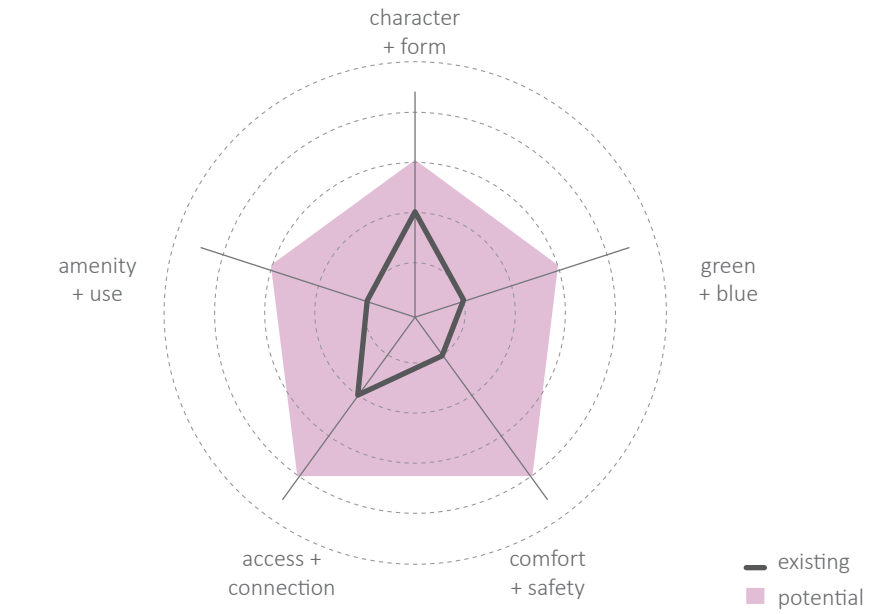
Private vehicles

Significant vehicular traffic, traveling at 50km/h, is carried on three lanes in each direction. Outside of peak periods the flexible kerbside lane becomes another traffic lane in each direction. The intersection of Broadway, City Road and Bay Street is busy with lots of different movements. Vehicles are currently prioritised over people walking at this intersection. The turning movement from Broadway into City Road is significant and currently requires a double right hand turn lane. Two slip lanes carry traffic westbound from City Road onto Broadway. Three right hand turn lanes carry large volumes of eastbound traffic from City Road onto Broadway.

Freight

There are no loading zones along Broadway, however, it is utilised for freight movements to service the surrounding land uses – in particular the Broadway Shopping Centre.

Evaluating movement and place performance



Green + blue

A mature tree canopy on the southern side of the road provides shade and amenity to people walking. The nearby Victoria Park is large with various community facilities including a pool and a lake. It is the main public open space in the area.

Comfort + safety

The footpath on the northern side requires pedestrians to walk next to high volumes of fast moving traffic with no buffer, which may reduce perceived and actual safety. The footpath capacity may struggle in areas of high pedestrian activity, particularly outside the Broadway Shopping Centre where crossing points are limited.

Access + connection

There are several bus routes that run in both directions along Broadway and Central Station is a short distance away. A limited number of crossings,

in conjunction with pedestrian fencing and high traffic volumes, reduces the pedestrian permeability. The footpath is fairly well-maintained with kerb ramps at all signalised intersections. There are no TGSIs at signalised intersections.

Amenity + use

There is little street furniture to stop and rest. This is at odds with the intensity of land uses which include: shopping mall with cinema and play area, retail, restaurants, cafes and park.

Character + form

The area is interesting and engaging thanks to active frontages and the park, although traffic volumes can detract from the sense of place. The road space allocation is skewed towards private vehicles, which severely detract from the human-scale. Only a relatively small amount of space is allocated to people walking along Broadway and none to people cycling or micro-mobility.

Existing conditions



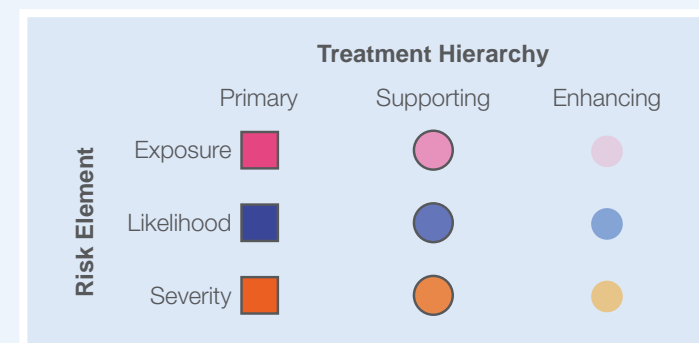
Retained treatments

Exposure

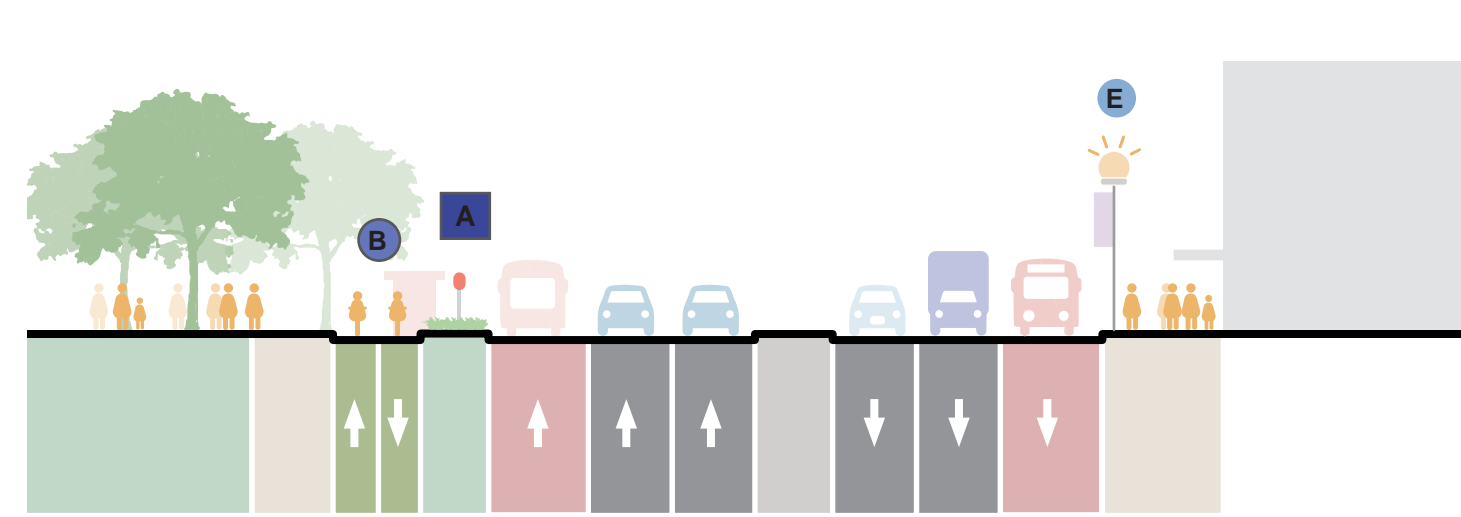
- 1 Fine-grain land use mix:** a variety of cafes, retail, community uses and recreational facilities

Likelihood/Severity

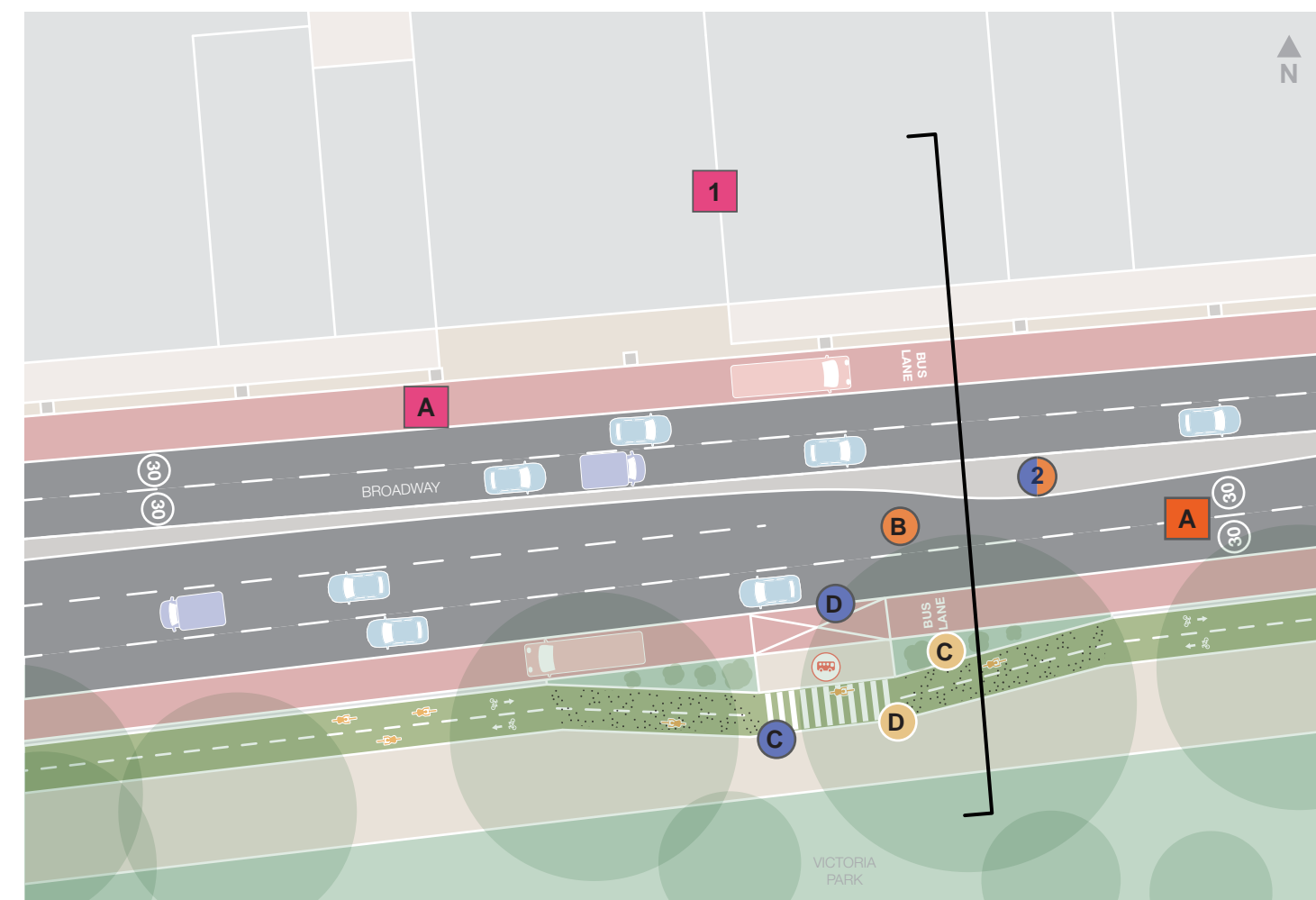
- 2 Buffer provided:** central raised buffer/median separating traffic flow



Broadway, Chippendale Mid-block



Desired user allocation



Additional treatments

Exposure

- A Reduce number of vehicle lanes:** add 24 hour bus only lanes

Likelihood

- A Provide horizontal and vertical separation for cycling:** concrete divider, planting provided near bus stop

- B Introduce bicycle path/lane:** two-way

- C Adjust bicycle path/lane configuration:** move lane behind bus stop

- D Distinguish the bus stop:** indicate stop location with pavement marking

- E Provide additional lighting**

Severity

- A Lower signed speed limit:** 30km/h

- B Reduce vehicle lane width**

- C Provide blue-green infrastructure:** low planting to narrow perception of lane for bus approach

- D Modify surface:** highlight conflict points for bus boarders/alighters and slow cycling on approach

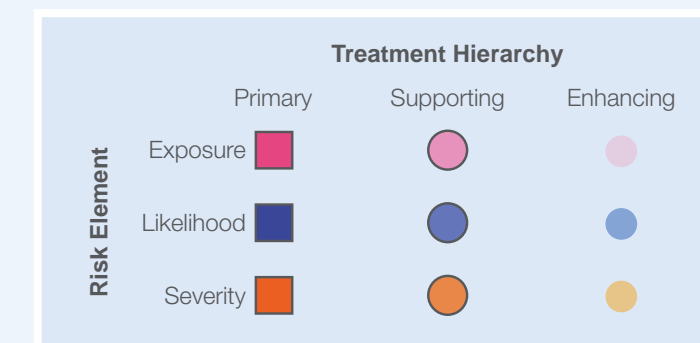
Existing conditions



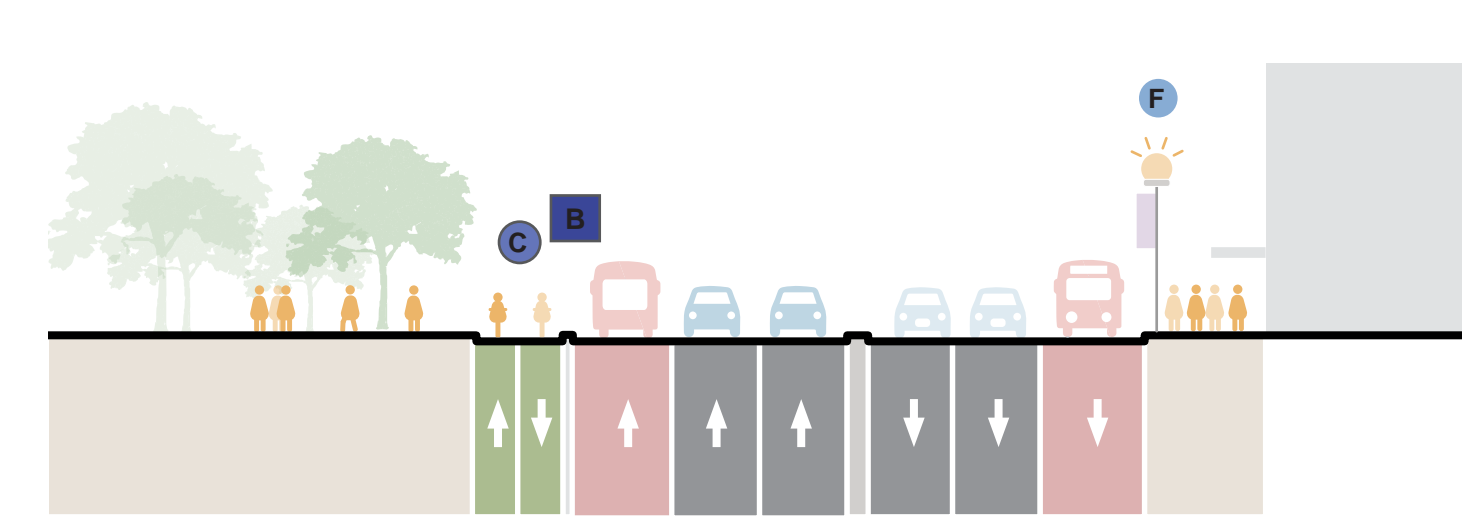
Retained treatments

Likelihood/Severity

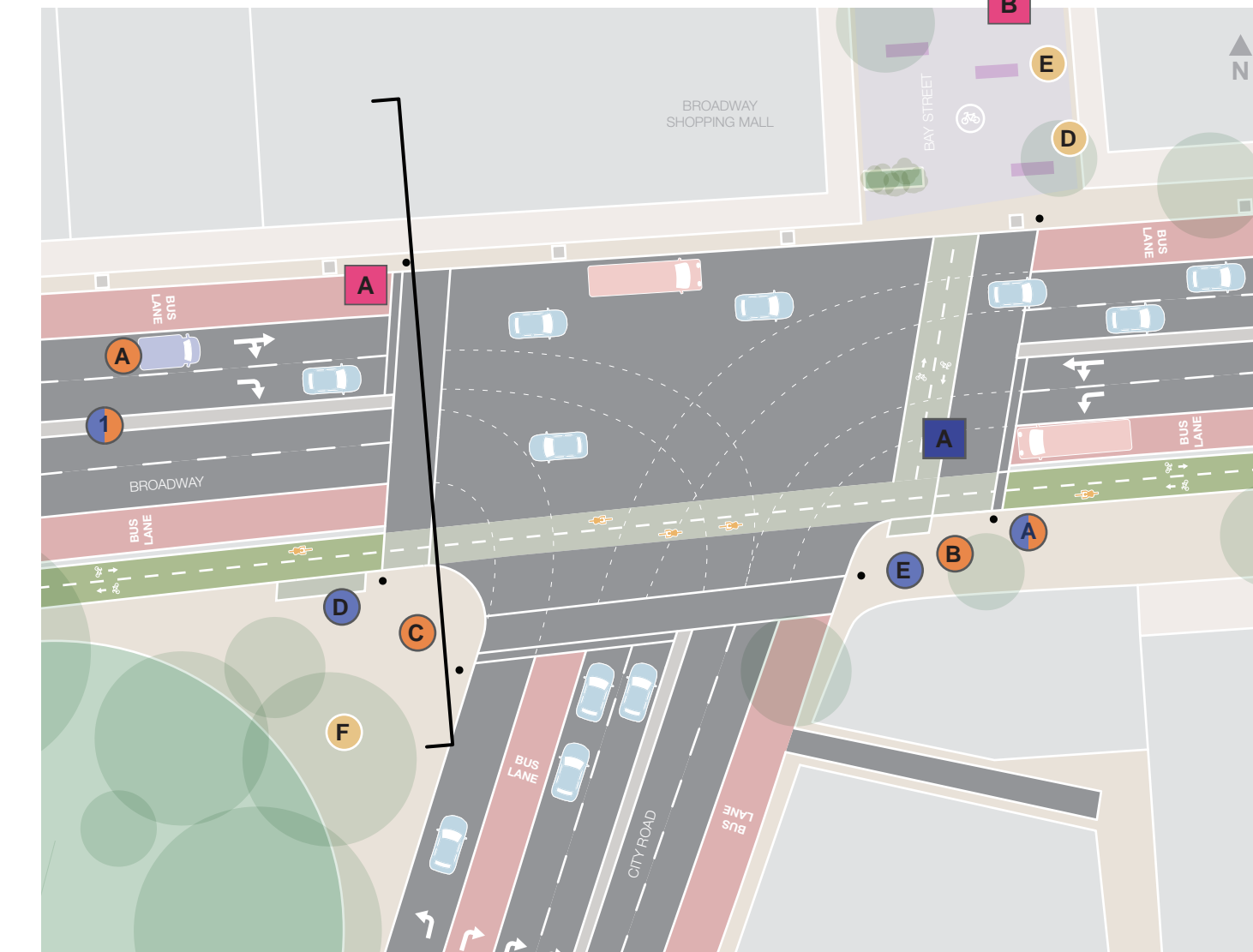
- 1 Buffer provided:** central raised buffer/median separating traffic flow



Broadway, Chippendale Intersection



Desired user allocation



Additional treatments

Exposure

- A Reduce number of vehicle lanes:** add 24 hour bus only lanes

- B Restrict vehicle access:** create public plaza by closing side road to vehicles, disguise bollards as seating and planting

Likelihood

- A Introduce pedestrian and cycling signal phases:** new crossings

- B Provide horizontal and vertical separation for cycling:** concrete divider

- C Introduce bicycle path/lane:** two-way

- D Provide dedicated stop and pause points for cycling**

- E Support safe access for all ages and abilities:** TGSi

- F Provide additional lighting**

Likelihood/Severity

- A Modify signal timing:** signalise left hand turn

Severity

- A Reduce vehicle lane width**

- B Extend kerb in intersection:** tighten kerb radius

- C Extend kerb in intersection:** remove slip lane

- D Provide blue-green infrastructure:** tree canopy

- E Modify surface**

- F Provide blue-green infrastructure:** trees to narrow intersection approach



KING STREET, NEWTOWN

Context

King Street is a heavily utilised east-west connection between the Princes Highway and City Road. There is little to no dedicated bus and cycling infrastructure, such as bus lanes and cycle lanes. There is dedicated cycling infrastructure along Wilson Street, making it a good parallel cycling alternative. Depending on the time of the day, the flexible kerb side lanes operate as a clearway, timed and ticketed parking, taxi zones and loading zones, which support a variety of land uses along the street. The walkable nature of Newtown,

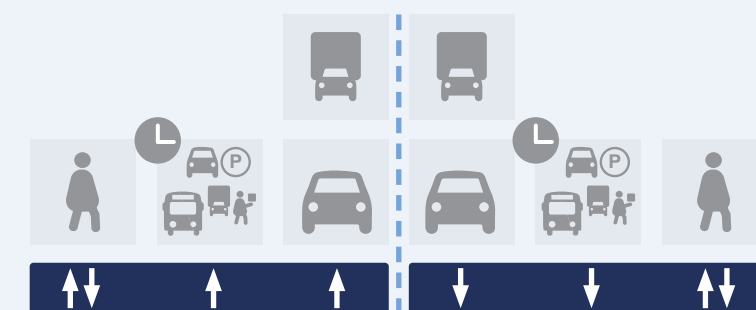
in combination with the attitudes and values of its residents, makes walking an attractive option for many people.

As a key destination for shopping and dining, high volumes of people walking accompany the high volumes of cars and buses. Exposure to crashes is high due to large crossing distances across four lanes of traffic at certain times of day. The footpath is next to the clearway lane, with no separation, which increases the likelihood of a crash. The

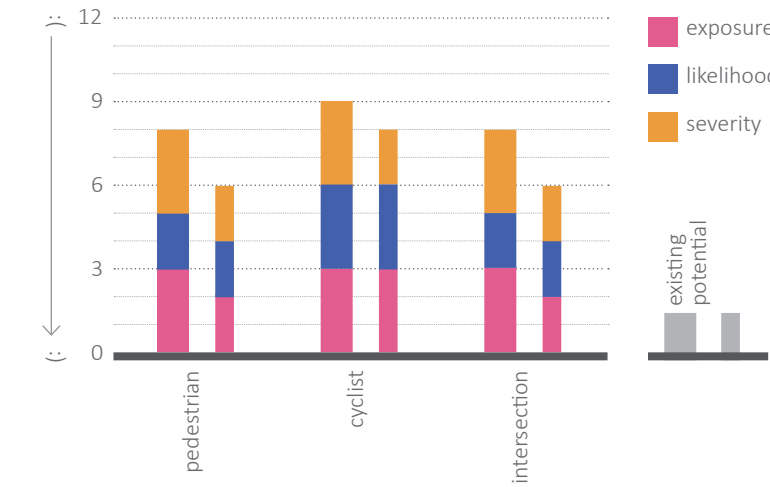
current signposted speed limit is 50km/h. Operational speeds are often much lower due to congestion. Outside of peak periods and during late evenings, there is a risk between higher speed vehicles (due to less congestion) and intoxicated pedestrians. In the future, WestConnex is forecast to reduce the amount of traffic traveling along King Street. There is potential to downgrade the function of King Street once traffic volumes have been reduced.

Existing user allocation

King Street



Safety



Justification

The additional interventions will build upon the existing strengths of a street with well-established movement and place functions.

Exposure

The additional interventions will capitalise upon reduced traffic volumes as a result of WestConnex by reducing the number of vehicle lanes and, consequently, the traffic throughput of King Street.

Likelihood

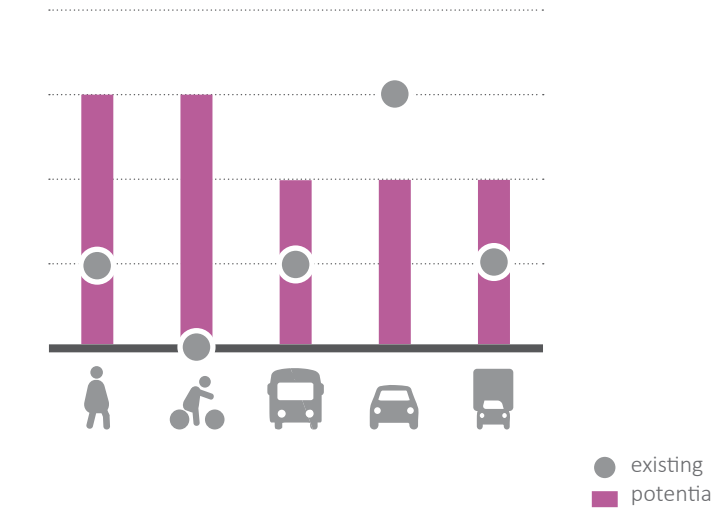
Conflicting movements between modes will be reduced, where possible, to increase safety.

Severity

The sign posted speed limit will be reduced to increase safety, particularly in locations where different modes interact. A more pedestrian friendly and permeable place will be achieved by introducing pedestrian-oriented features, such as parklets and safe crossing facilities.

Movement and Place

Road user priorities



People walking

A well-maintained footpath is provided along both sides of the street. Signalised crossings on all four legs of the intersection allow for safe pedestrian crossing activity. With little buffer provided between traffic lanes and the footpath, it is a noisy environment for people walking.

People on bicycles

There is no formal infrastructure provided for cyclists who currently use the flexible kerbside lanes to travel. Dedicated bicycle lanes are in operation along Wilson Street, which provides a good alternative.

Buses

There are no dedicated bus lanes along King Street, however clearways operate during the peak in the flexible kerbside lane (6am-10am eastbound and 3pm-7pm westbound), facilitating bus movements. Bus stops are not easily distinguishable along the footpath.

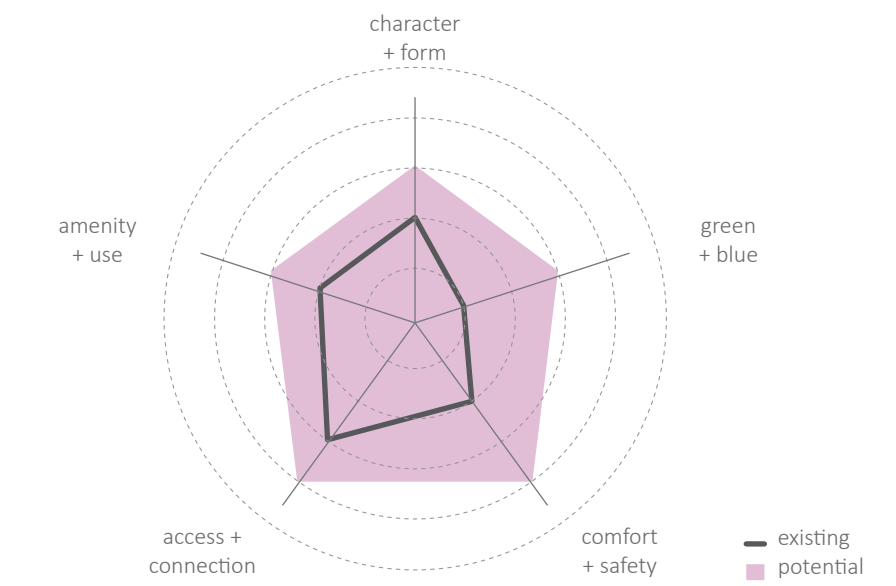
Private vehicles

One traffic lane in each direction operates at 50km/h. A second traffic lane operates during the peak period in the flexible kerbside lane (6am-10am and 3:30-5:30pm eastbound and 3pm-7pm westbound). A combination of ticketed 4 hour parking, loading zones and taxi zones operates during all other times in the flexible kerbside lane.

Freight

Timed loading zones operate during the off-peak period in the flexible kerbside lane (10am-3:30pm eastbound). Small to medium freight vehicles operate along King Street.

Evaluating movement and place performance



Green + blue

There are few links to nature along King Street – the streetscape is devoid of tree cover. Camperdown Memorial Rest Park is situated one block away, however, the proximity is not evident to a pedestrian walking along the street.

Comfort + safety

There is little to no buffer between the traffic lanes and the footpath during most of the day. At times, the flexible parking lanes accommodate parking, loading and taxi spaces, acting as a buffer and increasing the perceived safety of the area. Restaurants and shops are open late, generating pedestrian activity throughout most of the day. The footpath has an adequate width but can become crowded when shops place goods onto the footpath or where street furniture is placed, i.e. parking meters. Awnings are provided along most of the street.

Access + connection

Several bus routes operate along King Street, however, congestion can often affect their reliability. Newtown Train Station is located on King Street, providing greater public transport connectivity, choice and reliability. King Street has generally good walkability with kerb ramps provided at regular signalised crossings. The footpath is good-quality and maintains a flat grade along its length.

Amenity + use

There are a small number of places for people walking to stop and rest. This complements the restaurants, cafes and shops that line both sides of King Street.

Character + form

King Street has a unique character which makes it a distinct and interesting place to visit. Narrow, two-storey buildings make up the bulk of the built form, resulting in an area which is at the human-scale.

Existing conditions



Retained treatments

Exposure

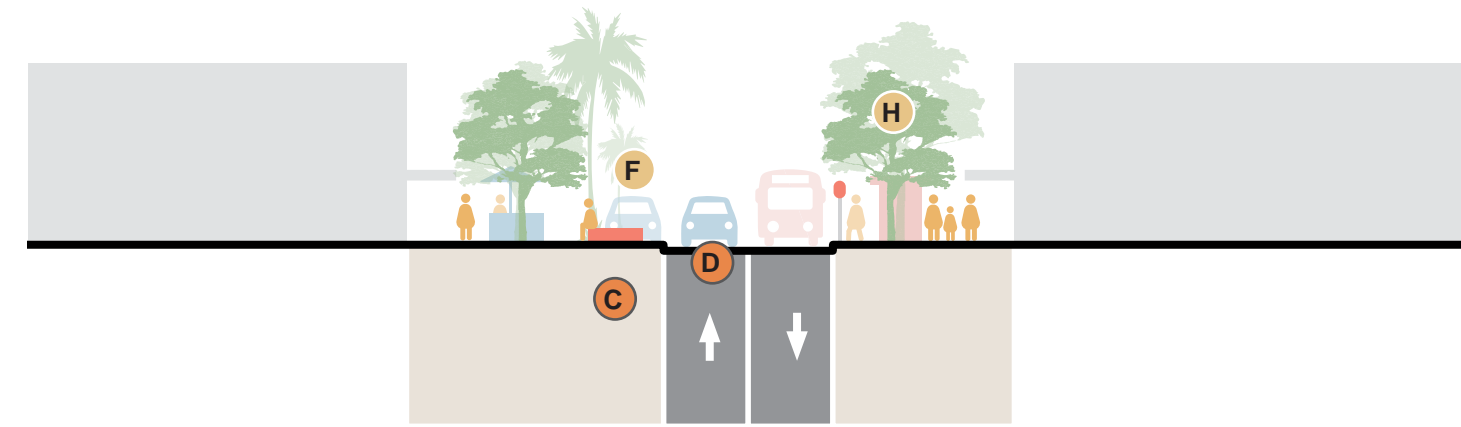
- 1 Fine-grain land use mix:** permeable urban structure and diverse land uses

Severity

- 2 Activated frontages:** visual variety of buildings and openings that engage with the street

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Risk Element			
Exposure	■	●	●
Likelihood	■	●	●
Severity	■	●	●

King Street, Newtown Mid-block



Desired user allocation



Additional treatments

Exposure

- A Reduce number of vehicle lanes**
- B Reduce on-street parking and loading spaces**

Likelihood

- A Distinguish parking spaces**
- B Distinguish the bus stop:** provide shelter and seating, and pavement marking at stop point

Severity

- A Lower signed speed limit:** 30km/h
- B Install controlled and raised crossing:** wombat
- C Increase footpath width:** through narrowing of carriageway
- D Reduce vehicle lane width:** accommodate bus width
- E Activate footpath:** outdoor dining furniture to bolster existing land uses

Provide portable/interim facilities: parklet

Provide blue-green infrastructure: planting

Provide blue-green infrastructure: tree canopy to narrow perceived street width

Existing conditions



Retained treatments

Exposure

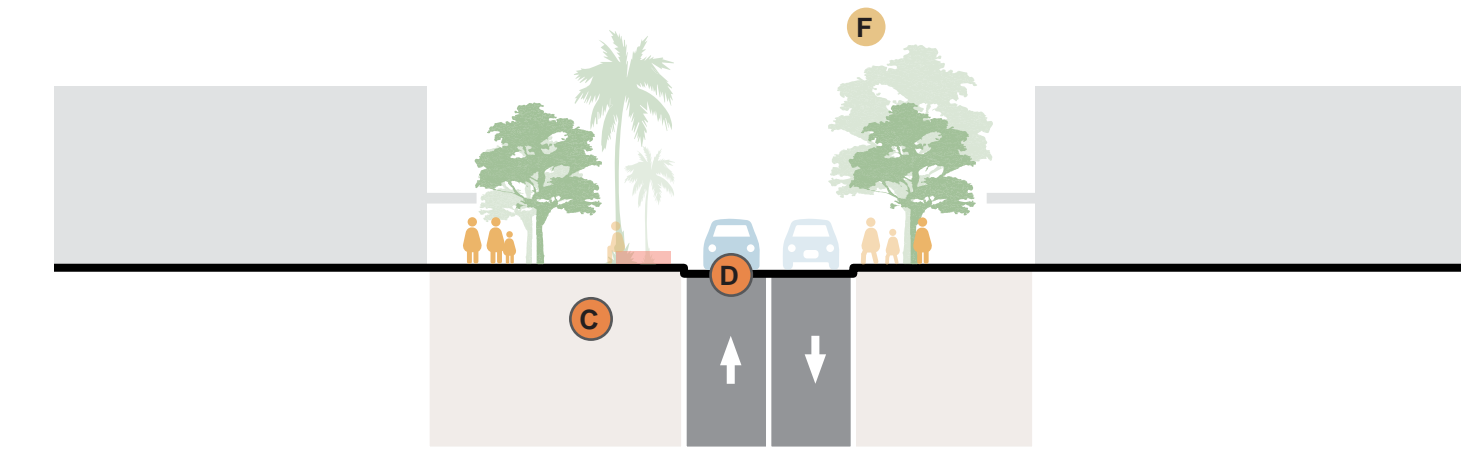
- 1 Restricted vehicle access:** one way traffic along Mary Street and Erskineville Road

Severity

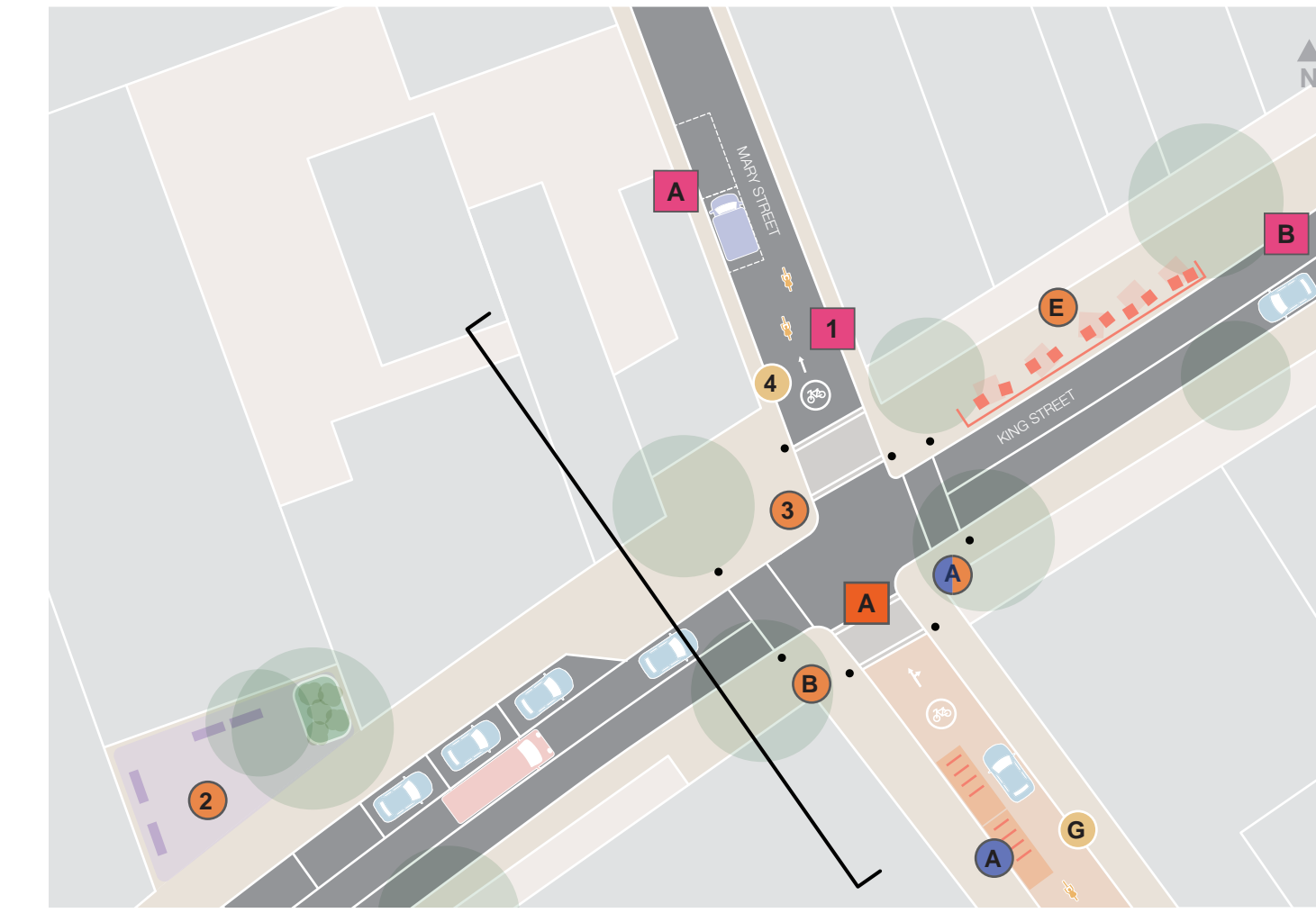
- 2 Activated footpaths:** small plaza provides seating, bins, bicycle storage and shade
- 3 Extended kerb into intersection:** tight kerb radii retained with footpath widening
- 4 Modified surface:** cycle symbol and directional arrow on pavement

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Risk Element			
Exposure	■	●	●
Likelihood	■	●	●
Severity	■	●	●

King Street, Newtown Intersection



Desired user allocation



Additional treatments

Exposure

- A Relocate on-street loading spaces:** move from main street to adjacent street
- B Reduce number of vehicle lanes**

Likelihood

- A Provide dedicated stop spaces for cycling:** cycle rack

Likelihood/Severity

- A Modify signal timing:** 60 second cycles

Severity

- A Raise intersection:** raised table on adjoining street interface
- B Extend kerb in intersection:** corner extension
- C Increase footpath width:** through narrowing of carriageway
- D Reduce vehicle lane width:** accommodate bus width
- E Activate footpath:** outdoor dining furniture
- F Provide blue-green infrastructure:** tree canopy to narrow perceived street width
- G Modify surface:** pavement material



PRINCES HIGHWAY, MILTON

Context

Milton is a regional town on the South Coast of NSW with a population of approximately 1,600. It is one of two main commercial centres in the Milton-Ulladulla region and a popular stopping location for travelers. The Princes Highway is the main road connection between Sydney and Melbourne via the South Coast. It forms the main street of Milton and carries large volumes of traffic, particularly during the school holidays. Recently, Milton

has experienced an influx of new residents and tourists, placing greater demands on the place function surrounding the road. Currently, there are large distances between controlled crossing points across Princes Highway. Formal uncontrolled crossings points are facilitated in some locations.

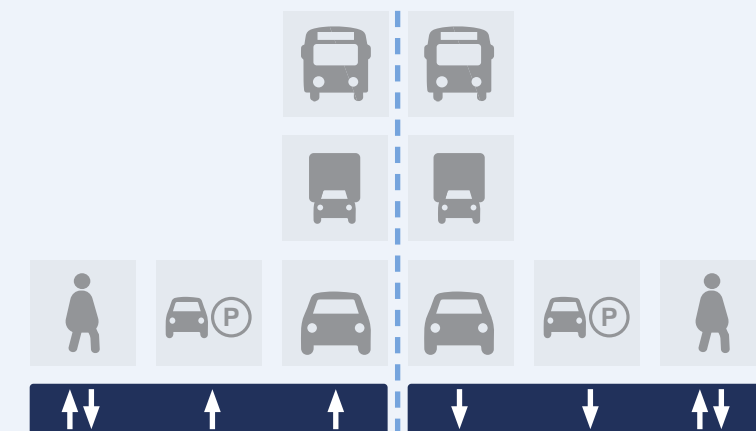
Transport for New South Wales have identified a corridor for the Milton-Ulladulla bypass as

part of the Princes Highway upgrade. Detailed planning has not yet begun, however, through traffic would be diverted around Milton.

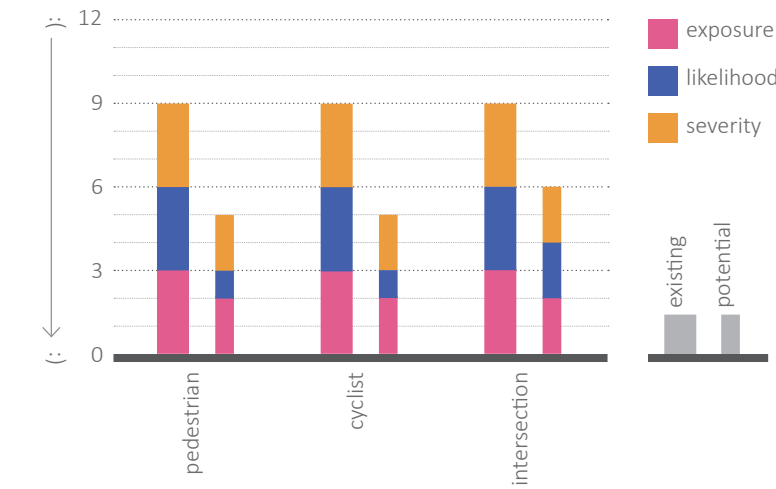
The posted speed is 50km/h, which will likely result in a higher severity of crash between a vehicle and a person walking than if the crash occurs at 30km/h (90% chance of death at 50km/h vs 10% chance of death at 30km/h, NSW Centre for Road Safety, 2020).

Existing user allocation

Princes Highway



Safety



Justification

The additional interventions will look to establish the burgeoning place function in Milton as it becomes a more popular tourist destination.

Exposure

The interventions will capitalise upon existing plans to bypass Milton, resulting in fewer vehicles travelling through the town and helping to reinforce the local function through the town centre.

Likelihood

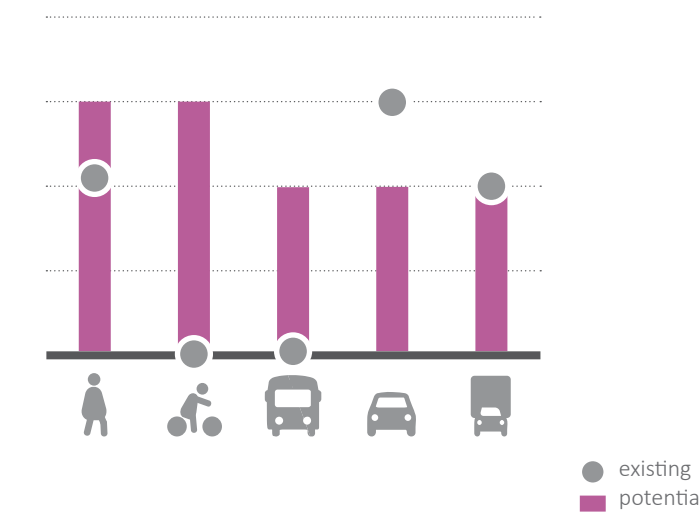
The majority of on-street parking will be retained as it is essential to supporting the local economy. Active transport, particularly cycling, will be encouraged under the proviso of the development of a wider network that connects key origins and destinations.

Severity

Fast moving through traffic is the primary barrier to creating a safer place. The interventions will capitalise upon existing plans to bypass Milton by reducing the speed limit to 30km/h and introducing a number of pedestrian crossing facilities.

Movement and Place

Road user priorities



People walking

A well-maintained footpath is provided along both sides of the street. A pedestrian crossing and kerb build outs facilitate pedestrian crossing points, however, these are some distance apart. Raised pedestrian crossings are in place at some intersections with the Princes Highway.

People on bicycles

There is no formal bicycle infrastructure.

Buses

A limited number of private bus services operate in Milton. All bus boardings and alightings are facilitated within the kerbside lanes. There is no formal bus infrastructure, such as bus lanes.

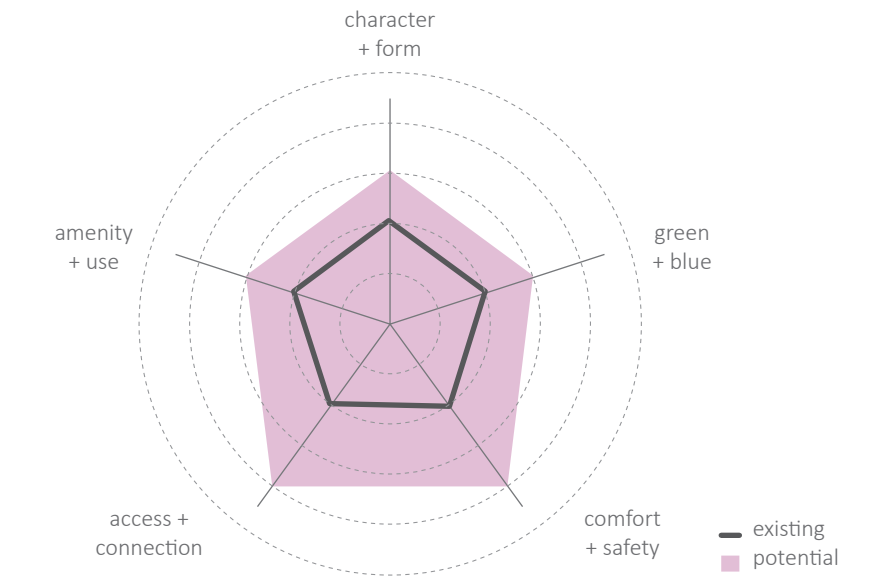
Private vehicles

One traffic lane in each direction operates at 50km/h. Timed parking occurs throughout the day in the kerbside lanes.

Freight

There are no designated loading zones. Loading operations must be accommodated within the kerbside parking lanes or in adjoining streets.

Evaluating movement and place performance



Green + blue

An inconsistent tree canopy provides some shade and amenity along parts of the road.

Comfort + safety

Kerbside parking lanes act as a buffer between the footpath and traffic. The posted speed and on-street parking contributes to the feel of a vehicle-dominated environment.

Access + connection

The area is dominated by private vehicle usage. Public transport provision is very low in Milton and its surrounds. The footpaths are wide and all crossing points have kerb ramps or raised platforms. There are no TGSIs.

Amenity + use

Active frontages consist of boutique retail, cafes and restaurants with plentiful outdoor dining. Some facilities are provided including: outdoor dining, seating and bins, and some bicycle racks. The predominant land uses include civic places (including a theatre and a library), as well as retail and dining.

Character + form

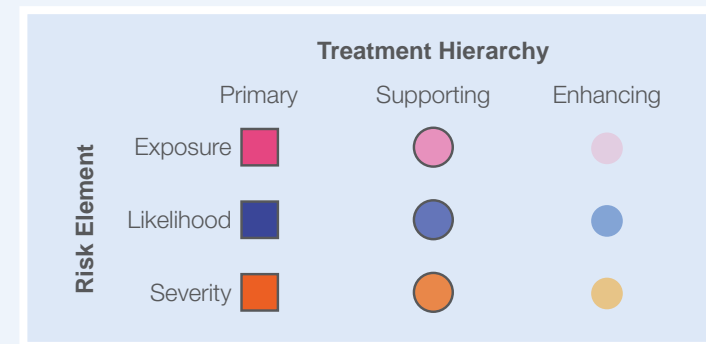
One to two-storey buildings with active frontages means the area is welcoming and addresses the human-scale. Variation in facade also provides some visual interest.

Existing conditions

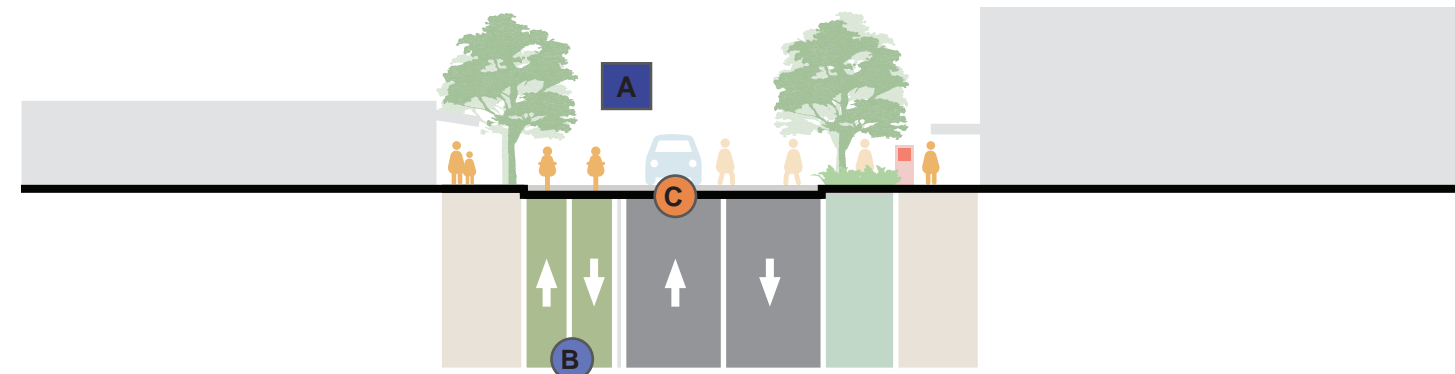


Retained treatments

- Likelihood
- 1 Distinguished parking spaces:** clear delineation between through traffic and parking spaces
- Severity
- 2 Temporary facilities:** Available space for flexible pedestrian activities



Princes Highway, Milton Mid-block



Desired user allocation



Additional treatments

- Exposure
- A Remove on-street parking spaces**
- Likelihood
- A Provide horizontal separation:** at-grade marked buffer
 - B Introduce bicycle path/lane:** two-way
 - C Provide dedicated stop space for cycling:** cycle rack
 - D Provide information:** wayfinding totem

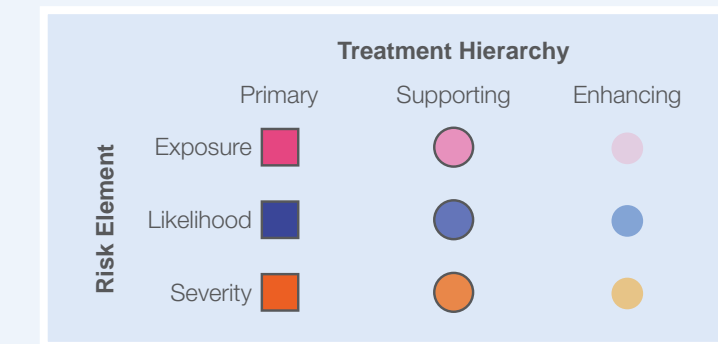
- Severity
- A Lower signed speed limit:** 30km/h
 - B Install controlled and raised crossing:** wombat
 - C Reduce vehicle lane width**
 - D Extend mid-block kerb:** planted bulb-out
 - E Provide blue-green infrastructure:** low planting and tree canopy to narrow perceived street width
 - F Modify surface:** to encourage further use

Existing conditions

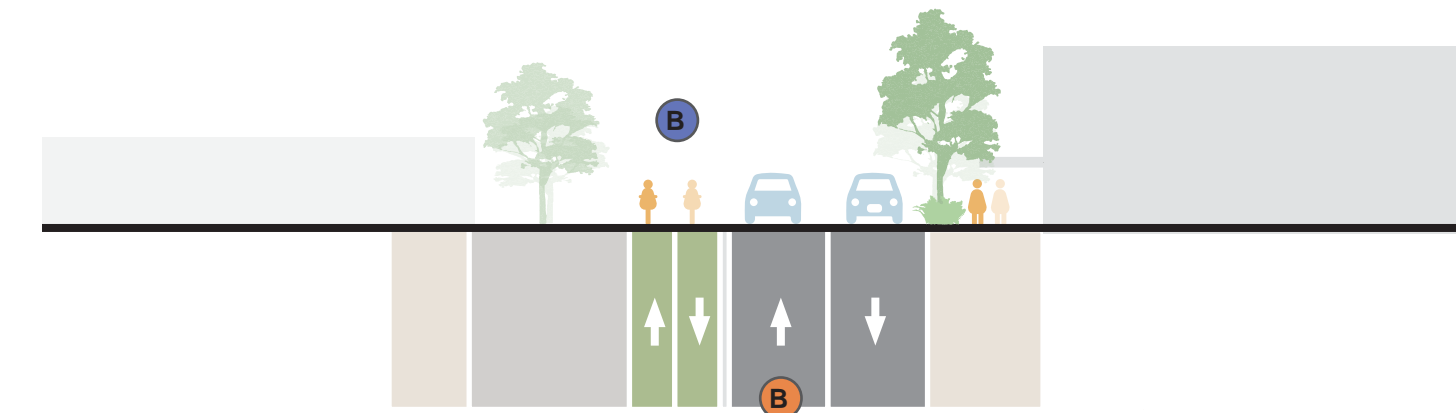


Retained treatments

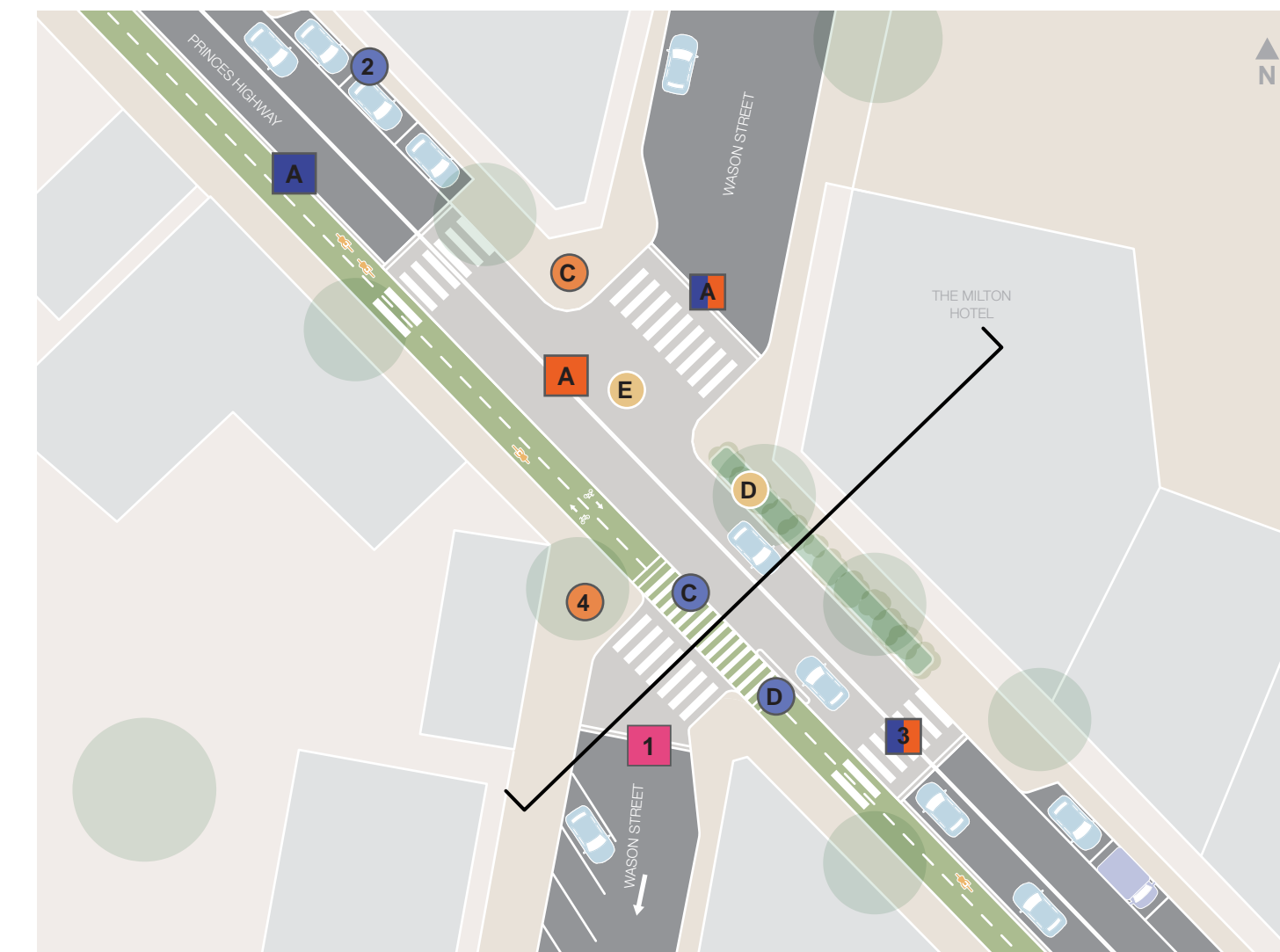
- Exposure
- 1 Restricted vehicle access:** Wason Street south is one-way
- Likelihood
- 2 Distinguished parking spaces**
- Likelihood/Severity
- 3 Controlled crossing:** zebra
- Severity
- 4 Extended kerb in intersection:** tight kerb radii with a modified surface treatment, bollards along the edges are removed



Princes Highway, Milton Intersection



Desired user allocation

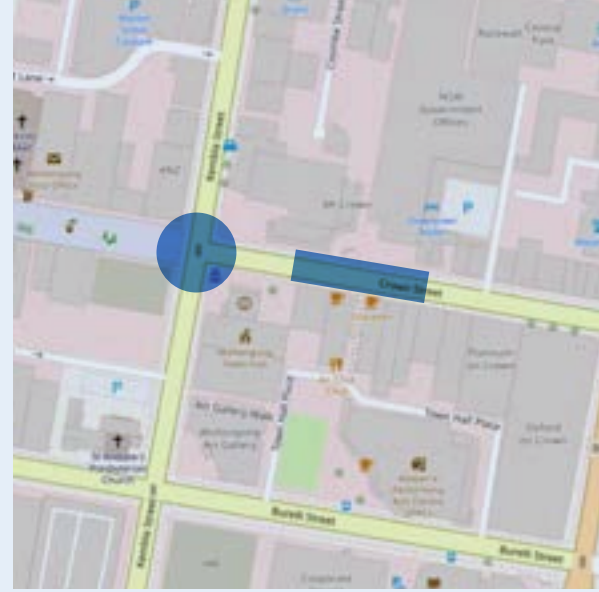


Additional treatments

- Likelihood
- A Provide horizontal separation for cycling:** at-grade marked buffer
 - B Introduce bicycle path/lane:** two-way
 - C Distinguish bicycle path/lane:** raise surface slightly at conflict point
 - D Provide intersection protection:** corner safety island for cycling

- Likelihood/Severity
- A Install controlled crossing:** zebra

- Severity
- A Raise intersection:** level with footpath
 - B Reduce vehicle lane width**
 - C Extend kerb in intersection**
 - D Provide blue-green infrastructure:** tree canopy and planting to narrow perceived lane width
 - E Modify surface:** pavement material that is new/unfamiliar to help slow down drivers



CROWN STREET, WOLLONGONG

Context

Crown Street is the main street of Wollongong and forms the main arterial road from Wollongong's southern suburbs to the north east. Part of Crown Street was converted to a pedestrian mall in the 1980s and is now the centre of a major shopping district.

The section of Crown Street allowing vehicle access accommodates two lanes of traffic with parking lanes indented along parts of the street. Where parking is not present, the

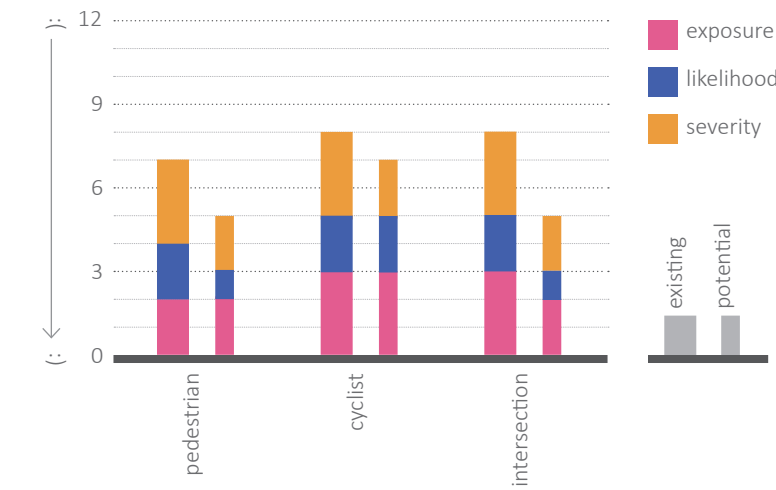
footpath is wider which allows for greater pedestrian flow and activity. Wider footpaths make for good informal crossing points as people walking only have to cross two lanes of traffic and their view is not impeded by parked cars. A mature tree canopy shades most of the street. Many treatments have already been applied and although this road is classified as a Main Street it could be considered a Civic Space in the future if further adjustments to the road environment are made. The existing

land use comprises a mix of cafes, restaurants, retail stores, civic/community destinations and office/commercial spaces.

The posted speed limit is 40km/h, which will likely result in a higher severity of crash between a vehicle and a person walking than if the crash occurs at 30km/h (40% chance of death at 40km/h vs 10% chance of death at 30km/h, NSW Centre for Road Safety, 2020).

Existing user allocation

Crown Street



Justification

The environment along Crown Street is already considered a successful Main Street, where both movement and place functions have equal importance. The additional interventions build upon already established place elements as the street transitions towards a Civic Space in the future.

Exposure

Alternative parallel routes allow through traffic to be carried on other roads, leaving Crown Street to perform a more local traffic function.

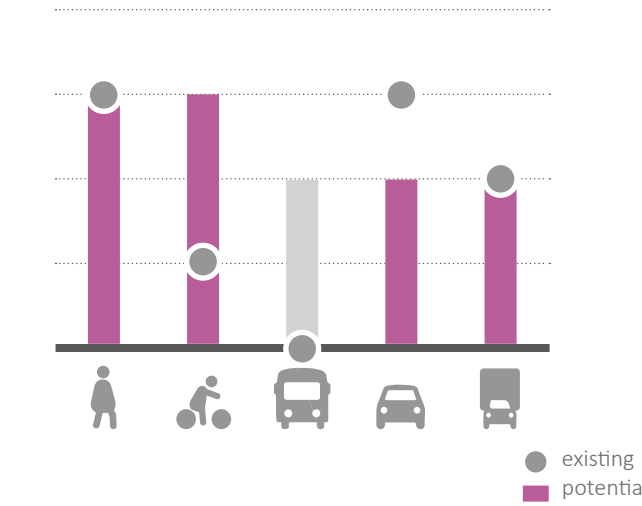
Likelihood

Crown Street forms a continuation of a pedestrianised mall. The interface between the mall and trafficked street is of utmost importance as it is the location where modal priorities shift. Traffic calming measures at this intersection are critical to signify a change in environment to both people walking and drivers.

Severity

A sense of high place value is reinforced along the street with slow vehicle speeds, wide footpaths and ample crossing opportunities.

Road user priorities



People walking

Generous and well-maintained footpaths facilitate pedestrian activity in the area. Outdoor dining can create pinchpoints along the footpath in some locations. A mature tree canopy shades the majority of the footpath.

People on bicycles

There are no bicycle paths/lanes on Crown Street, however, some cyclists may feel comfortable riding on the road due to the slow traffic environment.

Buses

No bus services operate along Crown Street.

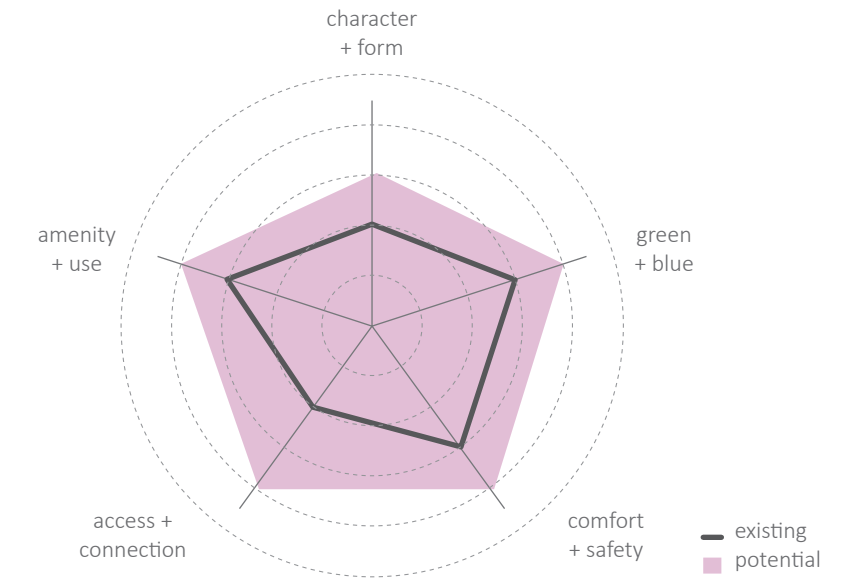
Private vehicles

One traffic lane in each direction operates at 40km/h. Timed and metered parking during the day is present along much of the street (8:30am-6:00pm) eastbound and (8:30am-4:30pm) westbound.

Freight

Designated loading zones operate throughout the day (8:30am-6:00pm).

Evaluating movement and place performance



Green + blue

A mature tree canopy shades most of the footpath. In some locations, the tree canopy also shades the carriageway.

Comfort + safety

Several cafes, restaurants and bars are open throughout the day and into the evening and provide a level of activity on the street. Awnings along most of the street provide protection from the weather.

Access + connection

The street is dominated by private vehicle usage with no public transport provision along Crown Street. The intersection with Kembla Street is built out and has kerb ramps, making it a safe and accessible crossing for all users. There are no mid-block crossing points, however, various kerb build outs facilitate informal crossing.

Amenity + use

There are high levels of amenity along Crown Street where a wide footpath provides appropriate capacity for people moving through the area, supporting areas to stop and rest. The combination of capacity and facilities help bolster the adjacent office, civic, dining and retail land uses.

Character + form

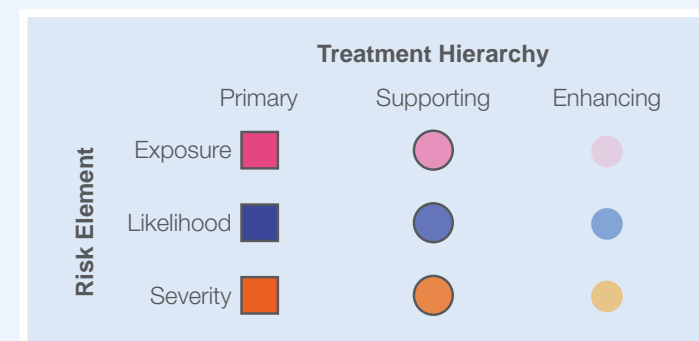
Active frontages which remain open into the evening make Crown Street an engaging and interesting place to visit throughout the day and into the evening. Its proximity to the pedestrian mall as well as slow moving traffic, human-scale buildings and pedestrian amenity combine to create a street where people walking can feel welcome.

Existing conditions

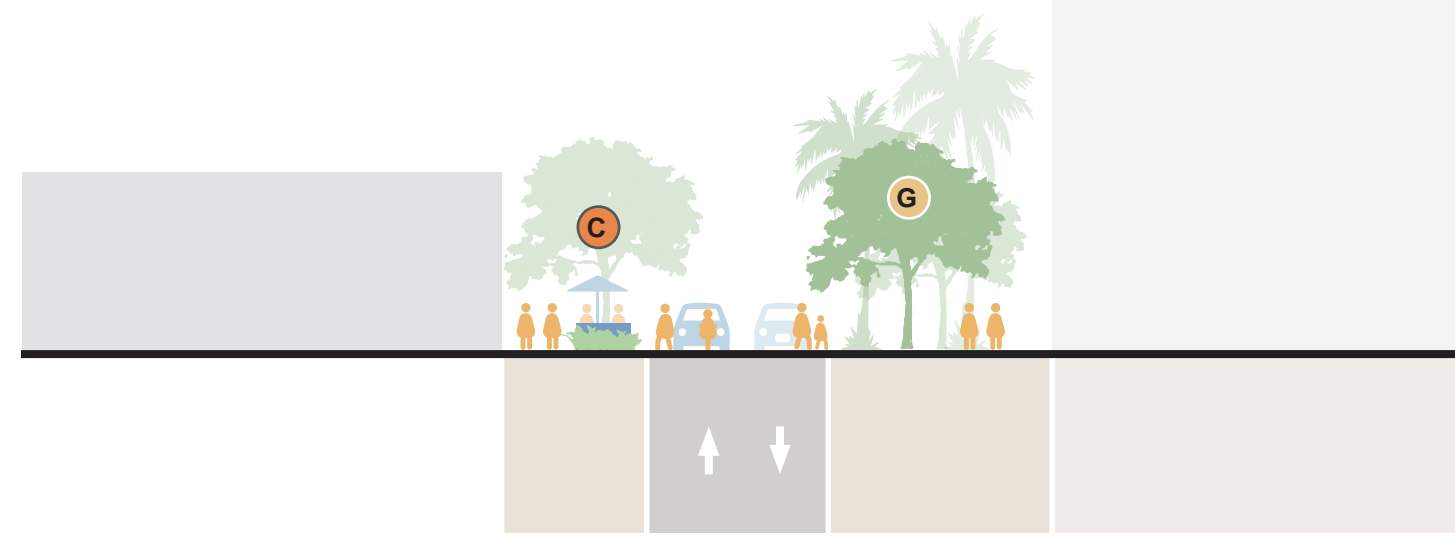


Retained treatments

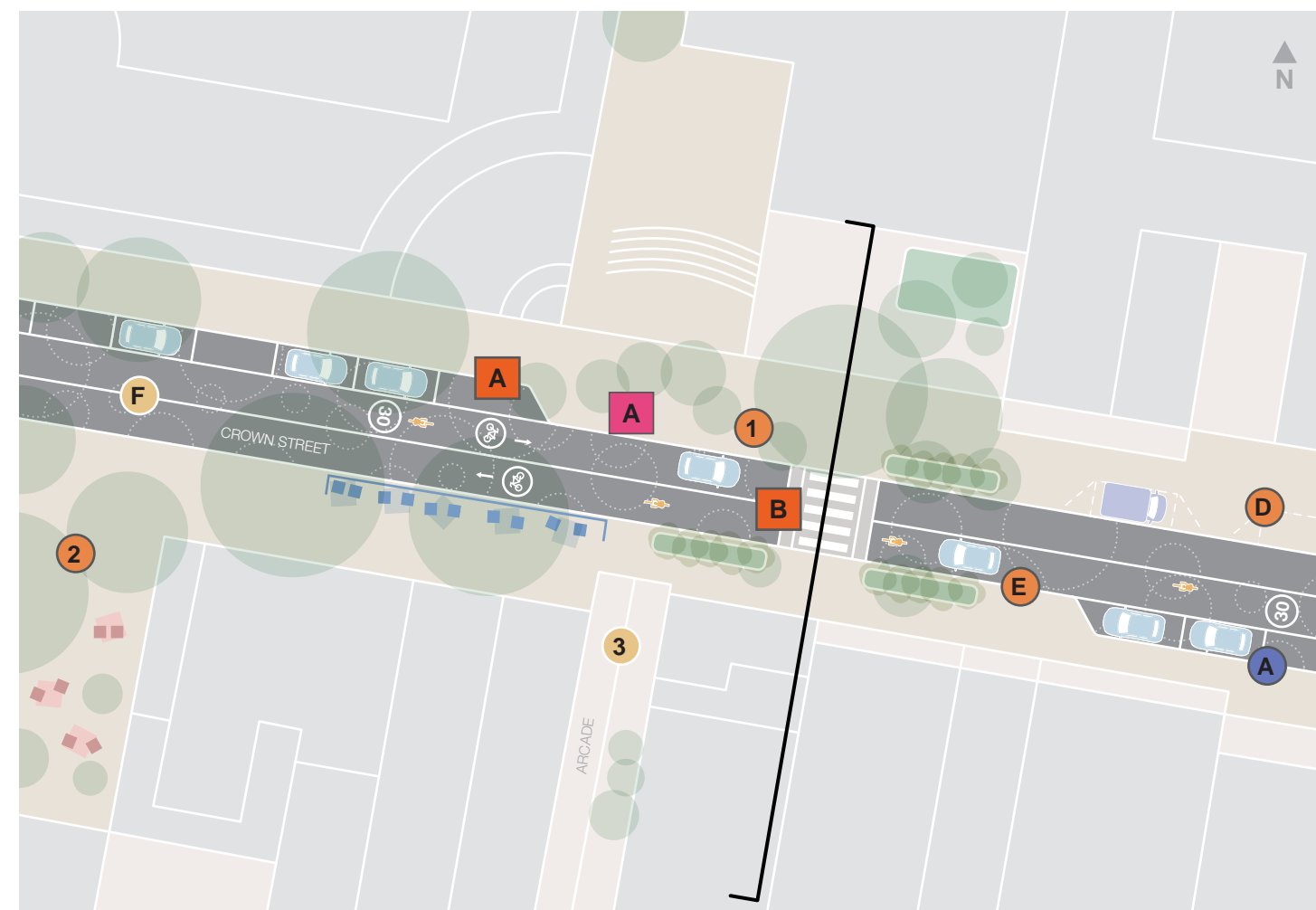
- Severity
- 1 **Extended mid-block kerb:** with substantial tree canopy and tree variety
 - 2 **Activated footpath:** existing outdoor dining setback from street
 - 3 **Street furniture:** shade, bins and seating



Crown Street, Wollongong Mid-block



Desired user allocation



Additional treatments

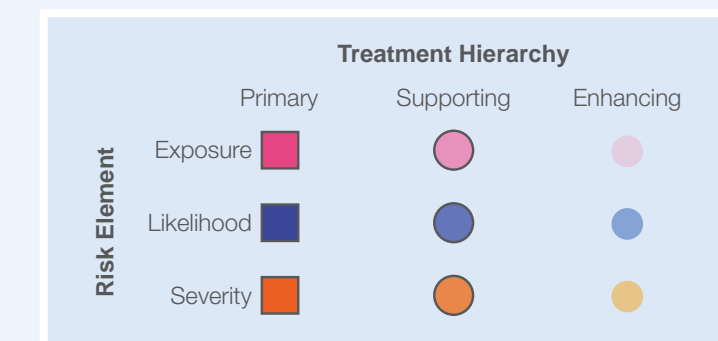
- Exposure
- A **Remove on-street parking spaces**
- Likelihood
- A **Distinguish parking spaces**
- Severity
- A **Lower signed speed limit:** 30km/h
 - B **Install controlled and raised crossing:** wombat
 - C **Activate footpath:** outdoor dining furniture
 - D **Utilise footpath for freight vehicles:** mountable kerb
 - E **Extend mid-block kerb:** pinchpoint
 - F **Modify surface:** pavement marking including direction and symbol for cycling
 - G **Provide blue-green infrastructure:** planting to narrow perception of street width

Existing conditions

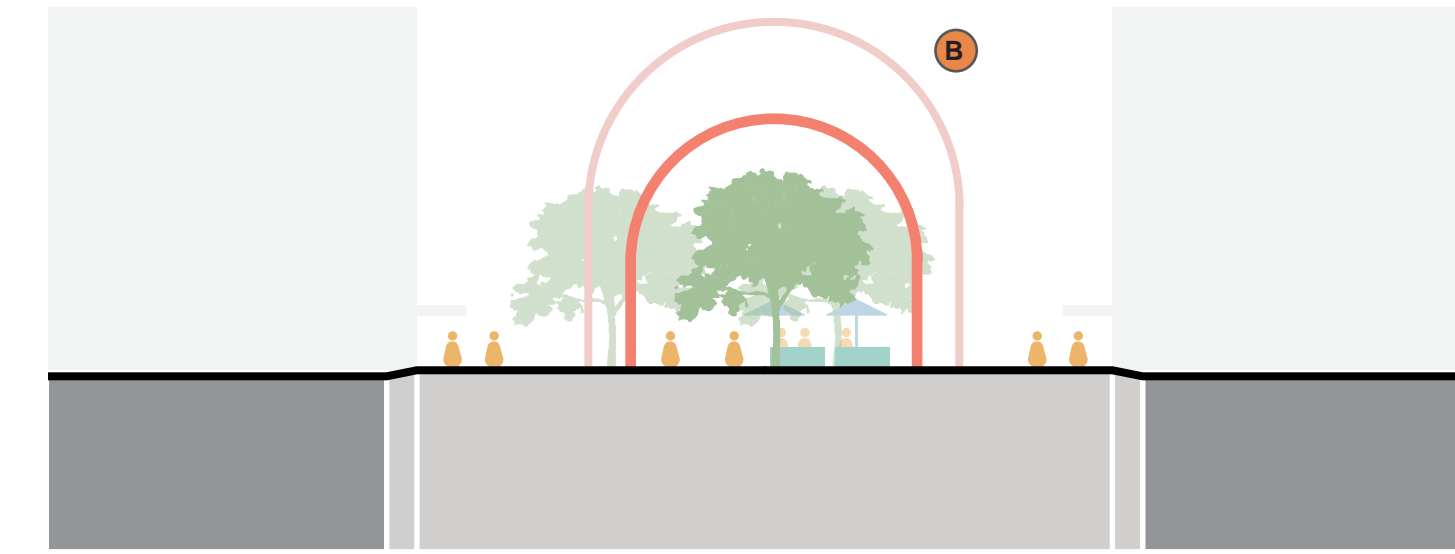


Retained treatments

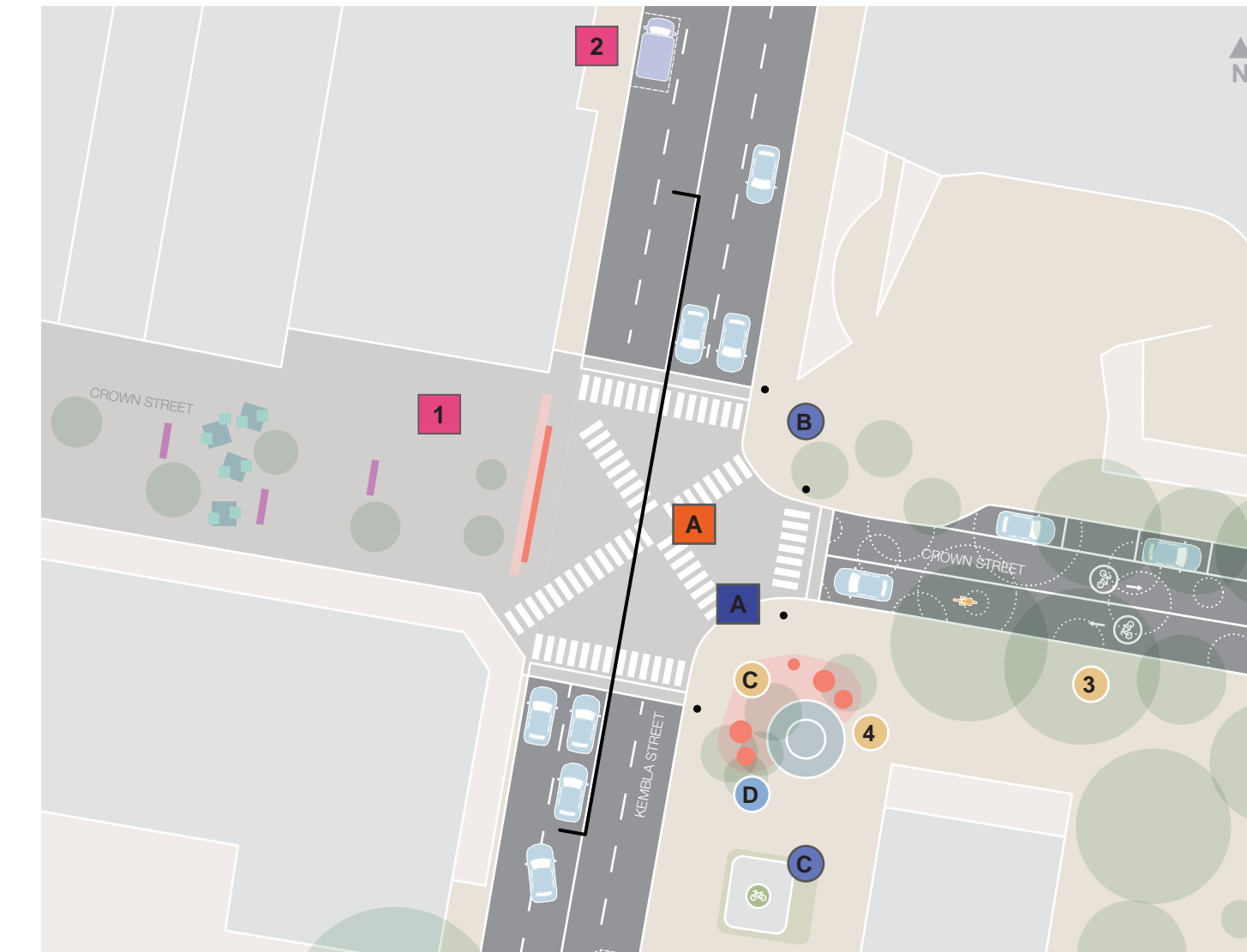
- Exposure
- 1 **Restricted vehicle access:** public plaza
 - 2 **Reduced number of delivery/loading spaces:** loading and delivery offset onto Kembla Street
- Severity
- 3 **Blue-green infrastructure:** substantial tree canopy, narrowing the perception of the street
 - 4 **Prominent feature:** stand-alone water feature, pedestrian scale features to alert drivers of presence of people



Crown Street, Wollongong Intersection

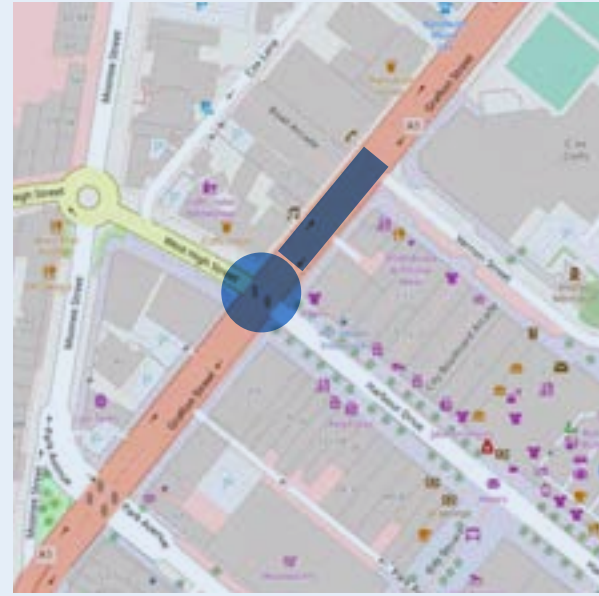


Desired user allocation



Additional treatments

- Likelihood
- A **Introduce pedestrian signal phase:** scramble
 - B **Support safe access for all ages and abilities:** TGS1
 - C **Provide dedicated stop space for cycling:** end of trip facility
 - D **Provide information:** wayfinding
- Severity
- A **Raise intersection:** level with footpath
 - B **Create a gateway:** art feature
 - C **Provide street furniture:** seating, enhance existing features with pedestrian facilities signaling to driver presence of other users



PACIFIC HIGHWAY, COFFS HARBOUR

Context

Coffs Harbour is a regional city on NSW's north coast, midway between Newcastle and Brisbane with a population of approximately 71,000. The Pacific Highway is a major interstate vehicle and freight route that runs north-south between Sydney and Brisbane. The posted speed limit is 110km/h in non-urban areas and drivers must slow down to 60km/h through the centre of Coffs Harbour. Planning is currently underway to bypass Coffs Harbour as part of the Pacific Highway Upgrade project. The bypass would remove approximately 12,000 vehicles from the Coffs Harbour CBD every day and improve safety

along the existing highway. The bypass would mean that through traffic will avoid the CBD and encourage a more equitable balance between the movement and place functions of the existing highway. The current road space allocation is skewed towards movement, with approximately twenty-two metres of road space allocated to vehicles and approximately two metres allocated to people walking.

Due to high vehicle volumes, the exposure to a crash is high, compounded by large crossing widths for people walking, with few crossings provided. The absence of segregation between

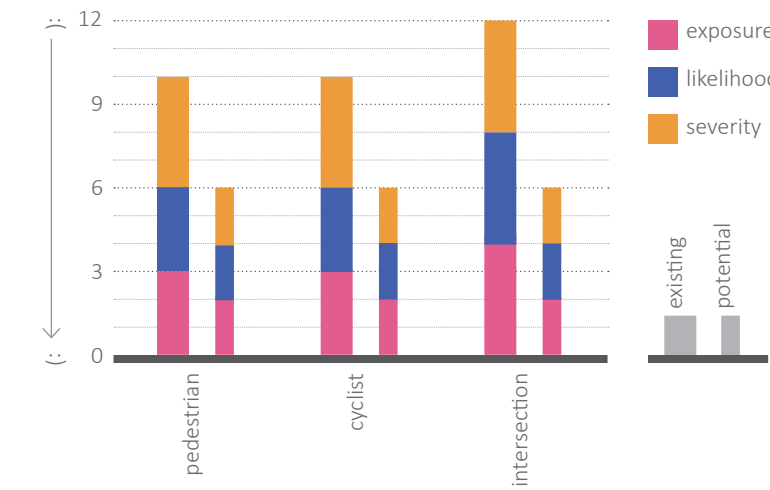
some modes (cyclists and vehicles) means that the likelihood of a crash is high. The posted speed limit is 60km/h, which will likely result in a higher severity of crash between a vehicle and a person walking than if the crash occurs at 30km/h (95% chance of death at 60km/h vs 10% chance of death at 30km/h, Auckland Transport, 2018).

Existing user allocation

Pacific Highway



Safety



Justification

The Coffs Harbour bypass is a major catalyst to rebalance the movement and place functions along Pacific Highway through the reallocation of road space from private vehicles to other modes.

Exposure

A significant reduction in traffic lanes will encourage through traffic to use the bypass and establish a more local function through the city centre.

Likelihood

Extensive bicycle infrastructure and wide footpaths will encourage active transport in a tourist-friendly destination.

Severity

A significant reduction in the sign posted speed limit will increase safety and further encourage use of the bypass. The additional interventions respond to the local context – low planting and a tree canopy provide shelter from the tropical climate.

Movement and Place

Road user priorities



People walking

A range of factors make walking along Pacific Highway an unattractive option. These include a lack of landscaping along the sides of the road, poor-quality and unattractive footpaths, high shop vacancies, sparse crossing opportunities (up to 260 metres distances), a fenced median which is unattractive and precludes informal crossing, and high volumes of fast-moving traffic.

People on bicycles

There is no cycling infrastructure along Pacific Highway.

Buses

Two bus routes operate a small number of services along Pacific Highway. No bus stops are located in the study area.

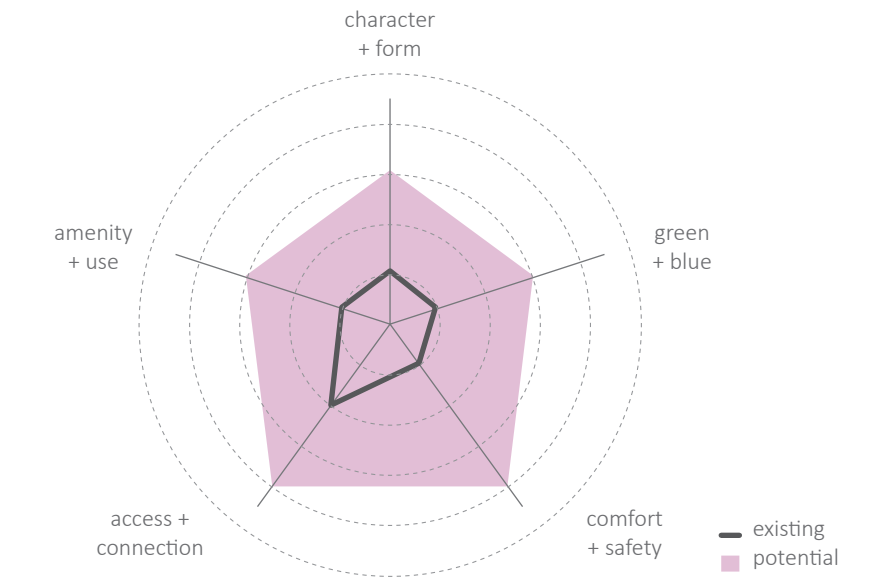
Private vehicles

Private vehicle usage dominates the area. Two traffic lanes in each directions travel at 60km/h. Left and right turn lanes operate on the approach to the intersection, resulting in five and six traffic lanes in some areas. The kerbside lanes facilitate timed parking (1P 8:30am – 6pm / 2P 8am-9pm northbound and 1/2P 8am-6pm / 1P 8am-6pm southbound). Timed parking in the kerb side lanes acts as an informal buffer between people walking and four traffic lanes.

Freight

Pacific Highway is a key freight route which accommodates a high number of large vehicles. There is a small loading zone along Pacific Highway which allows loading access to the surrounding land uses.

Evaluating movement and place performance



Green + blue

There are few links to nature along Pacific Highway. Sparse tree planting in the median and along the footpath provide very limited shade to people walking along one side of the street.

Comfort + safety

There is very little pedestrian amenity or comfort when walking along Pacific Highway. The footpath is narrow with no places to stop and rest. There are four lanes of fast moving traffic in close proximity to the footpath, which is noisy and unpleasant for people walking despite the buffer of parked cars in the kerbside lanes.

Access + connection

The area is dominated by private vehicles. Two bus routes operate along Pacific Highway, however, there are no

bus stops within the study area. Kerb ramps and TGSi are present on all four legs of the signalised intersection which facilitates a safe crossing for all users over five / six traffic lanes.

Amenity + use

This section of Pacific Highway comprises a mix of uses including: retail, cafes, restaurants and visitor accommodation. A minimum amount of facilities are provided for stopping and resting. Benches and bins are mainly provided on the intersecting streets.

Character + form

High shop vacancies and a number of buildings that do not actively interface with the street results in an area that is not activated, engaging or welcoming for people walking.

Existing conditions



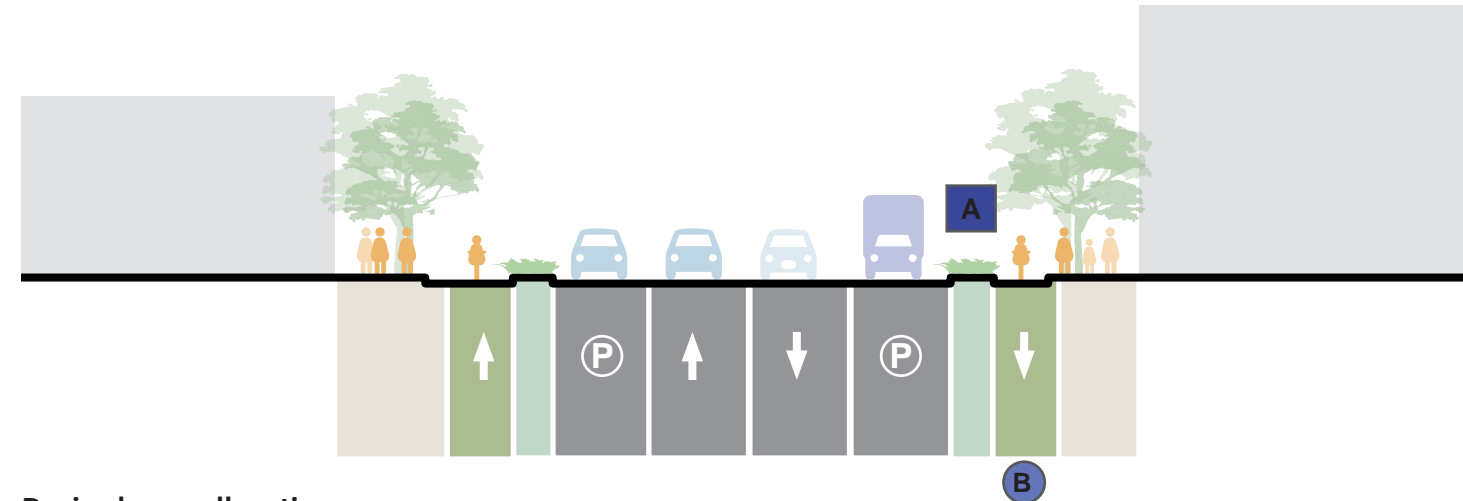
Retained treatments

Severity

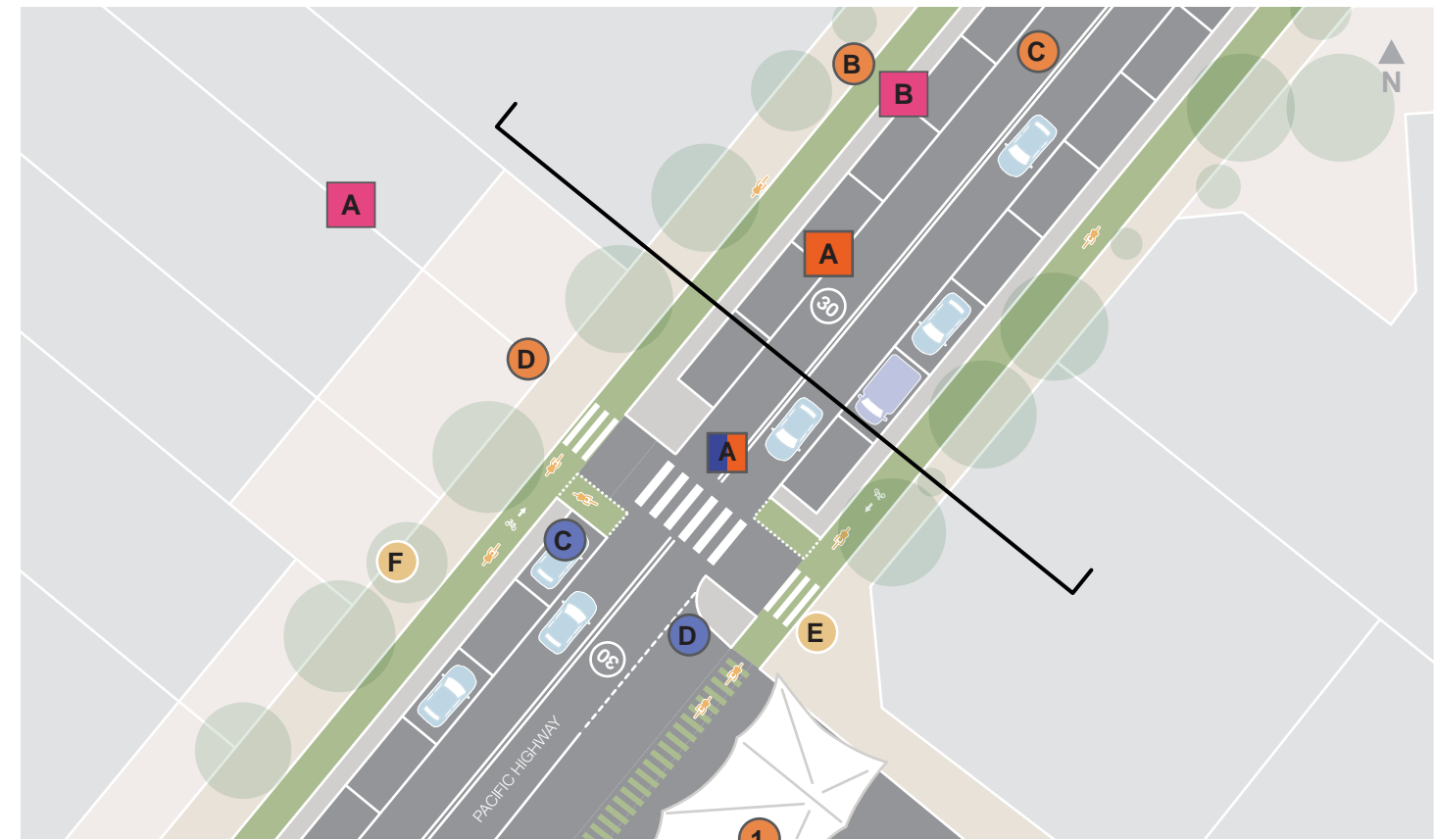
- 1 **Emphasised entry:** using a distinguishable feature for entry into adjacent streets

Risk Element	Treatment Hierarchy		
	Primary	Supporting	Enhancing
Exposure	Red square	Pink circle	Light pink circle
Likelihood	Dark blue square	Dark blue circle	Light blue circle
Severity	Orange square	Orange circle	Yellow circle

Pacific Highway, Coffs Harbour
Mid-block



Desired user allocation



Additional treatments

Exposure

- A Provide fine-grain land use mix
- B Reduce number of vehicle lanes

Likelihood

- A Provide horizontal and vertical separation for cycling: concrete divider
- B Introduce bicycle path/lane: uni-directional
- C Provide dedicated stop and pause spaces for cycling
- D Provide intersection protection: corner safety island

Likelihood/Severity

- A Install controlled crossing: zebra

Severity

- A Lower signed speed limit: 30km/h
- B Increase footpath width: through narrowing of carriageway
- C Reduce vehicle lane width: remove median and accommodate bus width
- D Enable active frontages
- D Modify surface: highlight conflict points for pedestrians and people on bikes
- E Provide blue-green infrastructure: tree canopy to narrow perception of the street
- F Provide blue-green infrastructure: tree canopy to narrow perception of the street

Existing conditions



Retained treatments

Exposure

- 1 **Restricted access:** right turn bans onto Pacific Highway from Harbour Drive

Likelihood/Severity

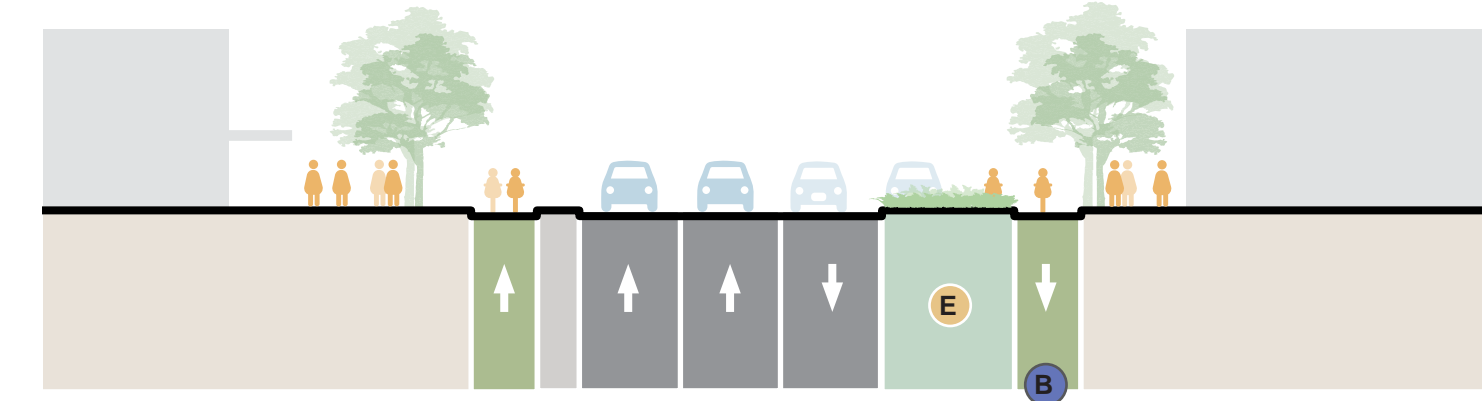
- 2 **Buffer provided:** central raised median separating traffic flow and narrowing lane width

Severity

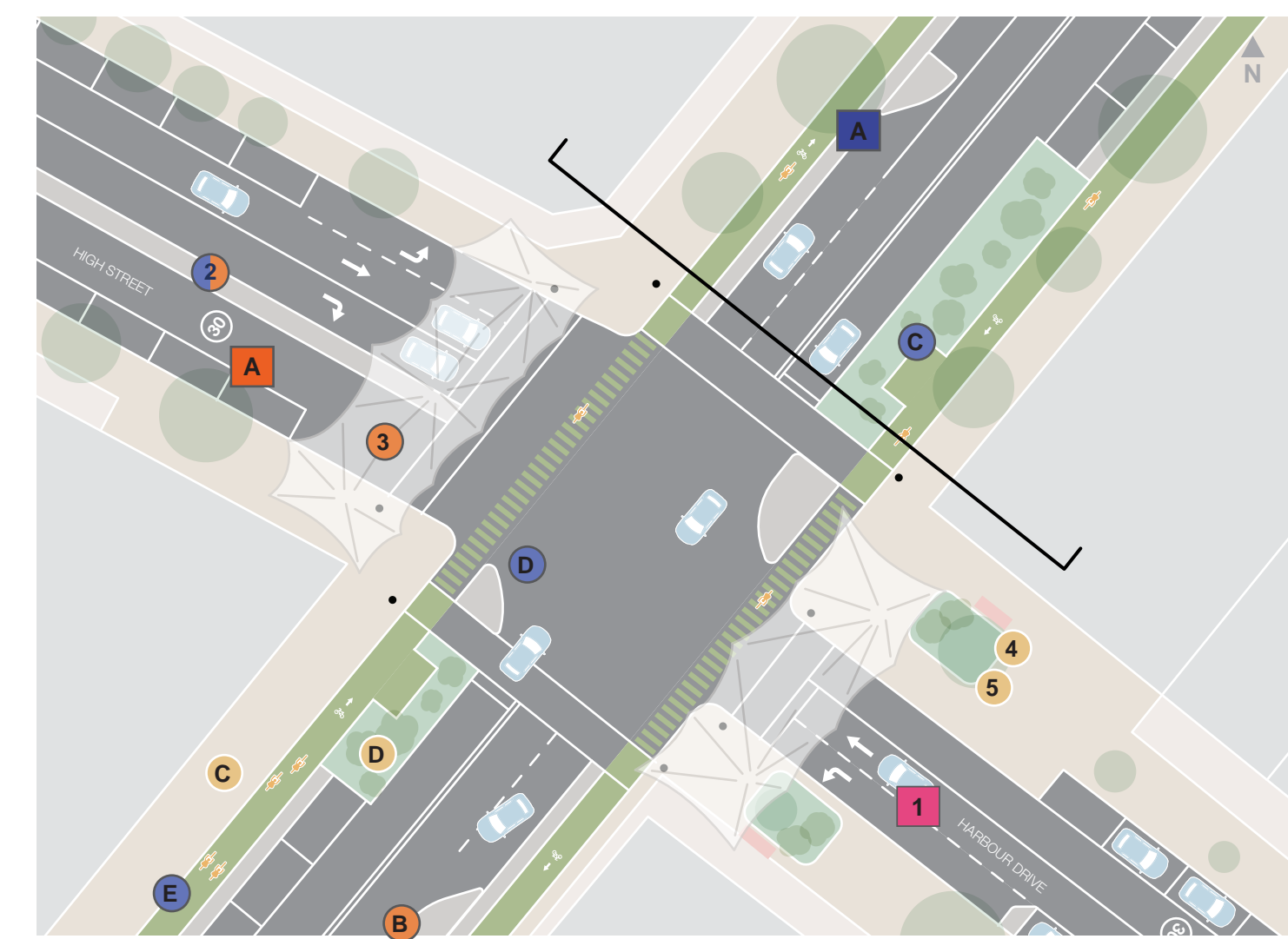
- 3 **Emphasised entry:** using a distinguishable feature
- 4 **Street furniture:** including bins and seating
- 5 **Information provided:** wayfinding

Risk Element	Treatment Hierarchy		
	Primary	Supporting	Enhancing
Exposure	Red square	Pink circle	Light pink circle
Likelihood	Dark blue square	Dark blue circle	Light blue circle
Severity	Orange square	Orange circle	Yellow circle

Pacific Highway, Coffs Harbour
Intersection



Desired user allocation



Additional treatments

Likelihood

- A Provide horizontal and vertical separation for cycling: concrete divider
- B Introduce bicycle path/lane: uni-directional
- C Provide dedicated stop and pause spaces for cycling
- D Provide intersection protection: corner safety island
- E Use detection on bicycle path/lane: sensors

Severity

- A Lower signed speed limit: 30km/h
- B Extend mid-block kerb: kerb blister
- C Modify surface: pavement material
- D Provide blue-green infrastructure: tree canopy and low planting, narrow perception of street
- E Provide blue-green infrastructure: swale, narrow perception of approach lane



SUMMER STREET, ORANGE

Context

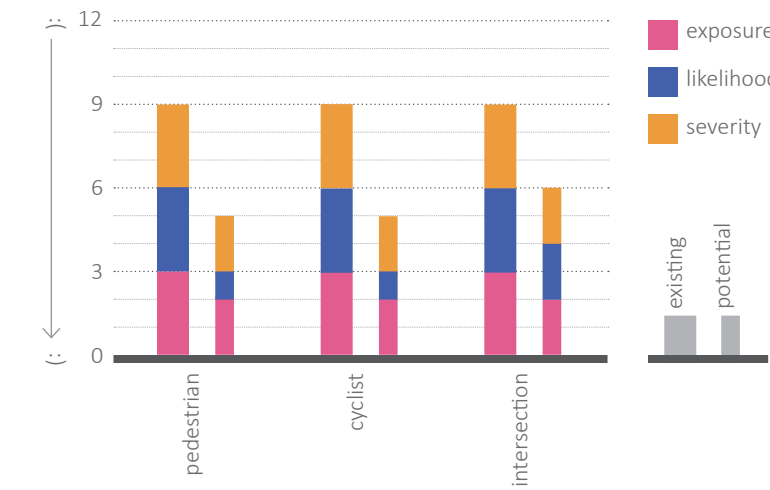
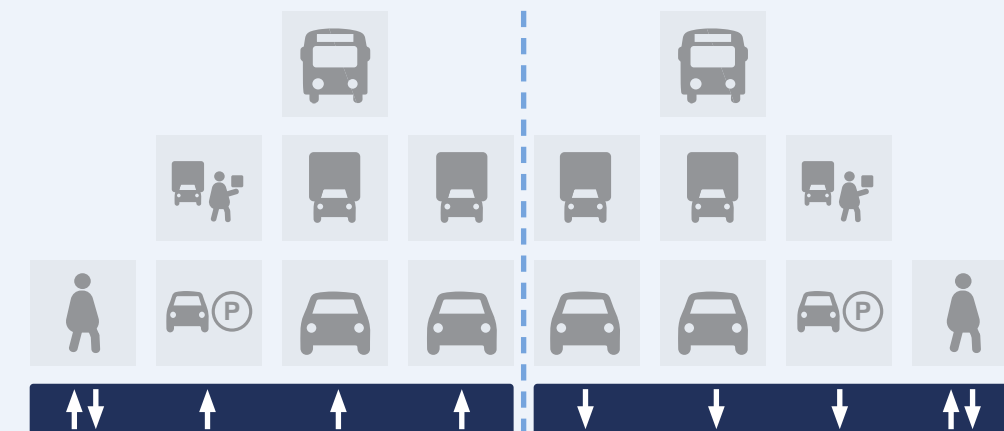
Orange is a significant regional city in the Central Tablelands of NSW, 250 kilometres west of Sydney with a population of approximately 40,000. Summer Street forms part of the Mitchell Highway which runs north-south between Bathurst and south western Queensland. Orange was bypassed via the Northern Distributor Road in 2013, however vehicles may still travel through the centre of Orange as the travel times are relatively comparative.

Timed parking in the kerb side lanes acts as a buffer between the four traffic lanes and people walking. It also encourages a high turnover of visitors to the town centre / local shops. A narrow, vegetated median facilitates informal crossing. Kerb build outs at signalised intersections reduce the width people walking are required to cross. A mature tree canopy shades the street on both sides.

The posted speed is 50km/h, which will likely result in a higher severity of crash between a vehicle and a person walking than if the crash occurs at 30km/h (90% chance of death 50km/h vs 10% chance of death at 30km/h, NSW Centre for Road Safety, 2020).

Existing user allocation

Summer Street



Justification

The main street of Orange is typical of other rural and regional centres throughout NSW. It plays an important movement function for to, from and through traffic and a vital place function for residents and visitors.

Exposure

The additional interventions aim to encourage through traffic to use the Northern Distributor Road by reducing the number of traffic lanes through the town centre to one in each direction. Parking will be maintained as it is critical to supporting the local economy in a regional location.

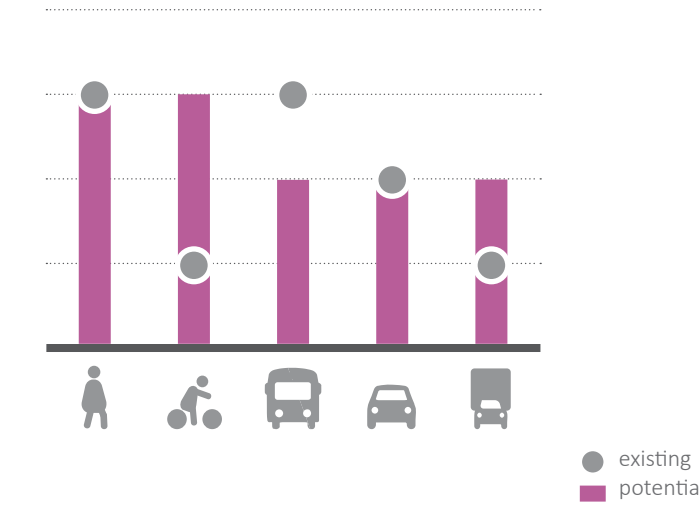
Likelihood

The use of public transport will be encouraged by improving facilities. Significant bicycle infrastructure will be introduced under the proviso of the development of a wider network connecting key origins and destinations. Informal crossing is prevalent and will be formalised in specific locations while maintaining pedestrian priority.

Severity

The sign posted speed limit will be reduced through the town centre in conjunction with the introduction of a number of crossing points to increase safety for pedestrians.

Road user priorities



People walking

A well-maintained and wide footpath is provided along both sides of the street. Signalised crossings on all four legs of the intersection with Lords Place allow for safe pedestrian crossing activity. The kerbside parking lanes act as a buffer between traffic and people walking.

People on bicycles

There are no bicycle paths/lanes along Summer Street. Formal bicycle parking is available for those who cycle to the area in the form of cycle racks. Signage and painting prohibits cycling on the footpath.

Buses

Several local bus routes operate along Summer Street. A bus zone operates on both sides of the road between 6:30am and 7:30pm.

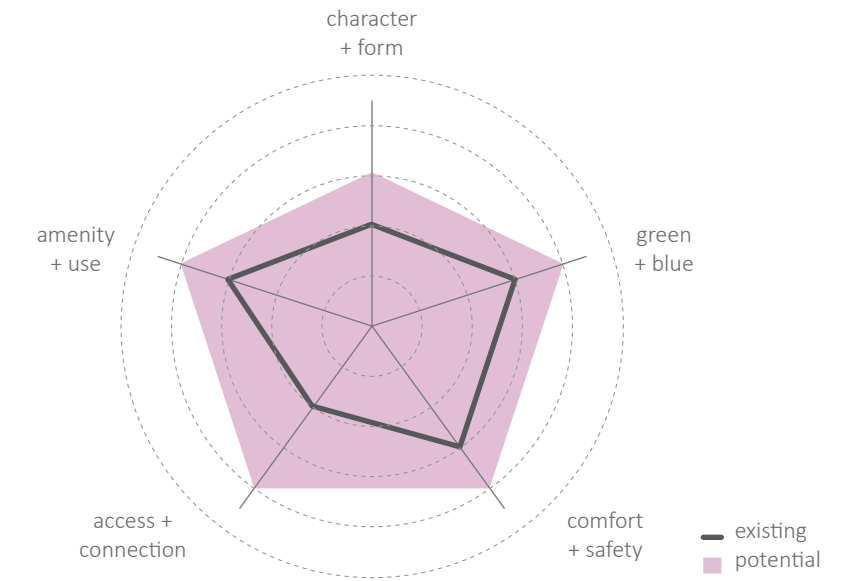
Private vehicles

Two traffic lanes in both directions operate at 50km/h. 1/2P between 8:30am and 6pm facilitates a high turnover within the town centre and helps to reduce vehicle speed by creating friction.

Freight

A small number of loading zone spaces are provided along Summer Street which allows direct loading access to the adjacent land uses. It operates between 6:30am and 6pm.

Evaluating movement and place performance



Green + blue

A mature tree canopy, planted median and vegetated kerb build outs provide pedestrian amenity to the area.

Comfort + safety

Cafes, restaurants and local shops are open throughout the day and into the evening and provide a level of activity on the street. There is adequate lighting throughout the evening to ensure people walking feel safe. Awnings along most of the street provide protection from the weather.

Access + connection

Several local bus routes provide an alternative to car usage with frequent services to nearby towns and civic anchors. Kerb ramps and build outs at all four arms of the signalised intersection facilitate a safe crossing

point. There are no TGSIs. There is one signalised mid-block crossing but no other formal crossing points across Summer Street.

Amenity + use

There is a high level of amenity along Summer Street where a wide footpath provides appropriate capacity for people moving through the area as well as areas for pedestrians to stop and rest. These facilities help support the mix of retail and dining.

Character + form

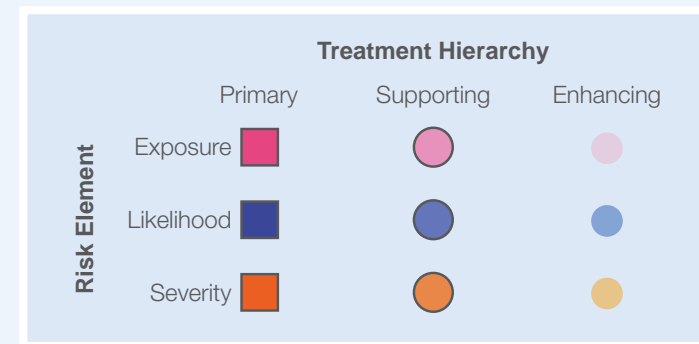
Active frontages, outdoor dining and various heritage buildings make Summer Street an interesting and inviting place for pedestrians to visit. Two to three-storey buildings and wide footpaths mean the area is at an appropriate human-scale.

Existing conditions



Retained treatments

- Likelihood/Severity
- 1 **Buffer provided:** central raised median separating traffic flow with low planting
 - 2 **Active frontages:** human-scale buildings that engage with the street and provide visual interest
 - 3 **Blue-green infrastructure:** mature tree canopy
 - 4 **Modified surface:** footpath is a brick patterned surface



Summer Street, Orange Mid-block



Desired user allocation



Additional treatments

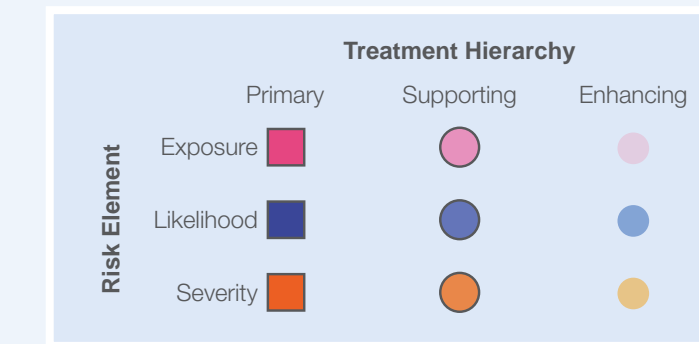
- Exposure
- A Reduce number of vehicle lanes
 - B Remove on-street parking spaces
- Likelihood
- A Provide horizontal and vertical separation for cycling: concrete divider
 - B Introduce bicycle path/lane: uni-directional
 - C Adjust bicycle path/lane configuration
 - D Provide bus stop kerb modifications
- Severity
- A Lower signed speed limit: 30km/h
 - B Install controlled and raised crossing: wombat
 - C Extend mid-block kerb: pinchpoint
 - D Modify surface: highlight conflict points for bus boarders/alighters and slow cycling upon approach
 - E Provide blue-green infrastructure: low planting to narrow perception of lane

Existing conditions

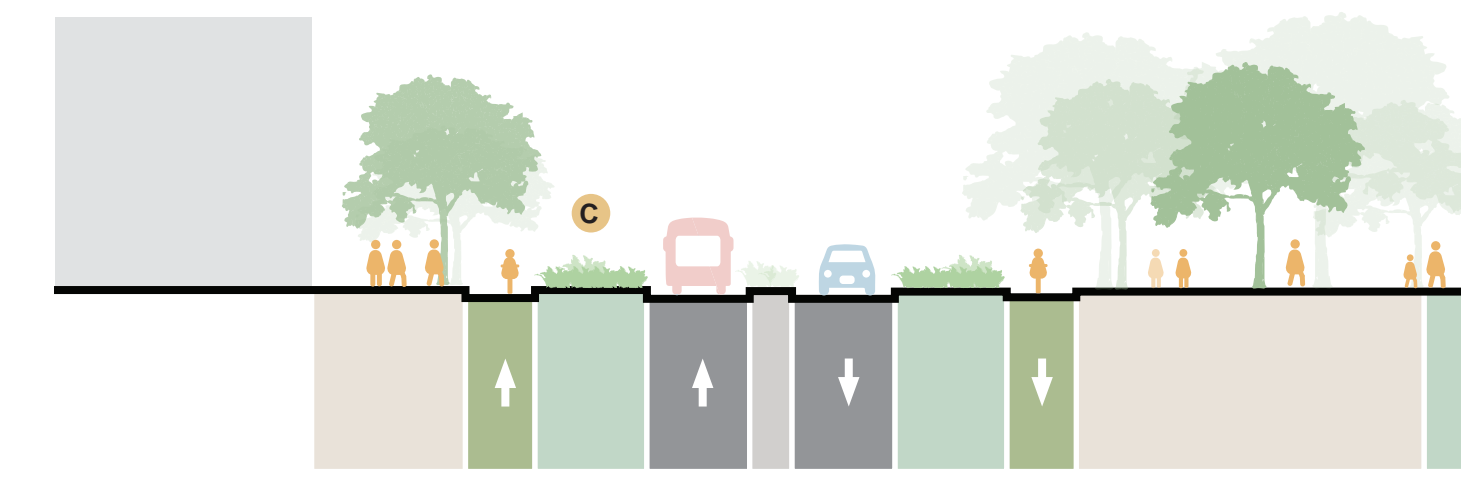


Retained treatments

- Likelihood
- 1 **Dedicated stop spaces for cycling:** shifted to accommodate new cycle lane
- Severity/Likelihood
- 2 **Buffer provided:** central raised median separating traffic flow with low planting on all approaches
- Severity
- 3 **Extended kerb in intersection:** kerb extended into the intersection with low planting
 - 4 **Modified surface:** footpath is a brick patterned surface



Summer Street, Orange Intersection



Desired user allocation



Additional treatments

- Exposure
- A Reduce number of vehicle lanes
 - B Remove on-street parking spaces
- Likelihood
- A Provide horizontal and vertical separation for cycling: concrete divider
 - B Introduce bicycle path/lane: uni-directional
 - C Adjust bicycle path/lane configuration
 - D Provide bus stop kerb modification
 - E Support safe access for all ages and abilities: TGSi
 - F
- Severity
- A Raise intersection: adjust ramp angle for buses
 - B Extend kerb in intersection: median tip
 - C Provide blue-green infrastructure: tree canopy to narrow perception of street and low planting to narrow perception of lane
 - D Provide street furniture: seating, human-scale elements alerting drivers of presence of other users

CIVIC SPACES CASE STUDIES





VICTORIA AVENUE, CHATSWOOD

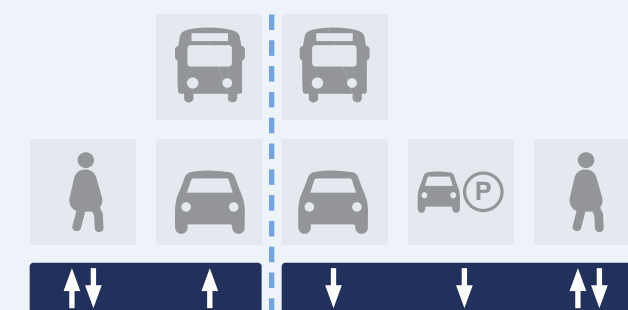
Context

Chatswood is a strategic centre in Sydney's north. Significant growth in recent years has seen an increase in residential population and employment in the area. The prevalence of high-rise apartment blocks as well as a strong commercial core makes the CBD quite dense. Several major retailers with large car parks make driving to Chatswood an attractive option despite a range of public transport options. Victoria Avenue is a major public

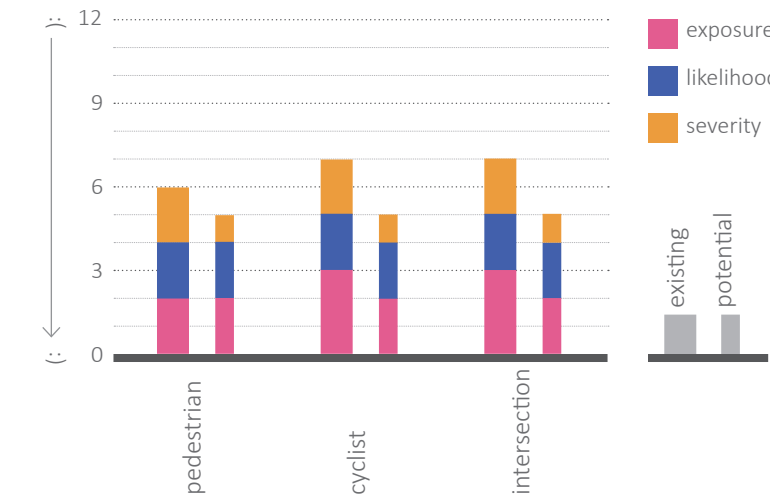
transport spine with large numbers of buses using it to access Chatswood Interchange, which provides access to both rail and metro services. Part of Victoria Avenue is already pedestrianised and is used by a large number of people walking. Footpaths along Victoria Avenue are often over-crowded as they struggle to cater to large volumes of people walking. Scramble crossings and pedestrian countdown timers at key intersections help to prioritise walking movements.

Existing user allocation

Victoria Avenue



Safety



Justification

The additional interventions aim to transition Victoria Avenue from a Main Street to a Civic Space. Currently, large volumes of people walking are in conflict with private vehicles and buses. Spring Street was recently closed to vehicles, signifying a desire and demand to create more pedestrianised spaces.

Exposure

Traffic volumes are already low along Victoria Avenue where one traffic lane in each direction restricts the number of vehicle movements. Interactions with buses and congestion often reduces the speed at which vehicles travel.

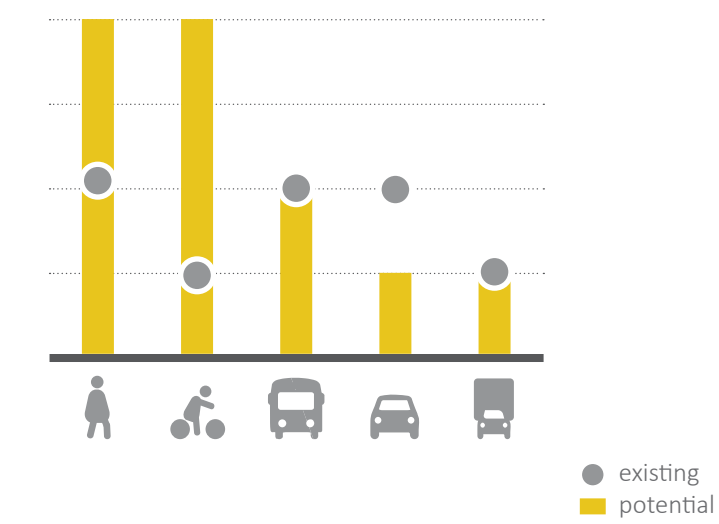
Likelihood

The key public transport spine will still be accommodated and the risk to people walking at key interface locations mitigated through a range of interventions, such as raised intersections and changes to the pavement type.

Severity

A Civic Space environment will be achieved primarily through reducing the sign posted speed limit to 20km/h.

Road user priorities



People walking

Footpaths are often over-crowded in busy areas, particularly in locations where there are obstacles such as outdoor dining and bus stops. Pedestrian fencing precludes informal crossing in many locations.

People on bicycles

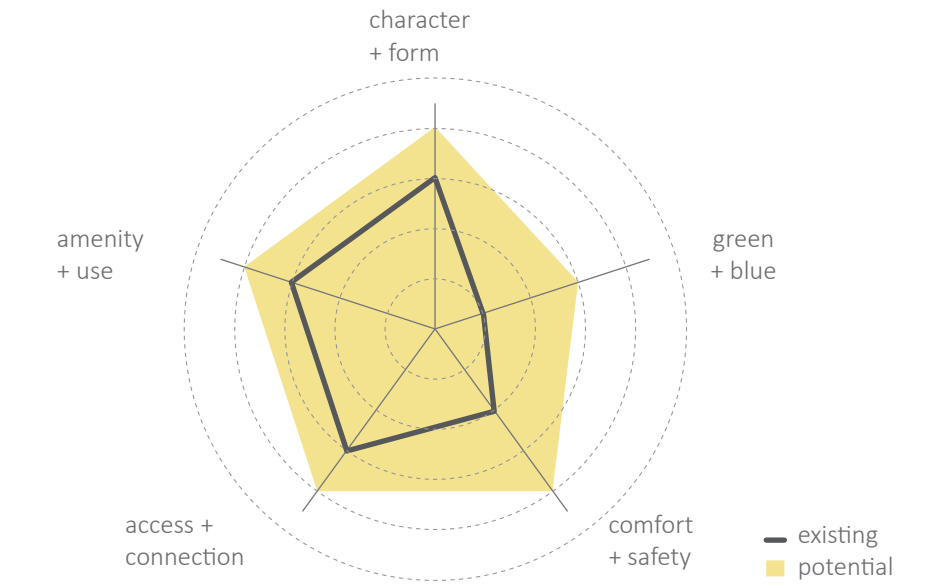
There is no formal bicycle infrastructure along Victoria Avenue. An alternative route runs along the parallel Johnson Street, approximately 400m south of Victoria Avenue. Bike hoops along Victoria Avenue allow for bicycle parking.

Buses

Victoria Avenue is a key bus route. A large number of services use the road to access Chatswood Interchange. There are bus stops on both sides of the road which attract high volumes of passengers and service a large number of routes.

Movement and Place

Evaluating movement and place performance



Green + blue

A mature tree canopy shades part of the street.

Comfort + secure

Active frontages, including cafes and restaurants, means there are eyes on the street throughout the day and well into the evening. An inconsistent awning provides shelter from the weather along parts of Victoria Avenue. The footpath is often over-crowded, particularly in busy areas where it has been narrowed due to outdoor dining or a bus stop.

Access + connection

A large number of buses provide public transport choice and reliability. Chatswood also has access to rail and metro services. Kerb ramps, TGS1 and audible crossings are present at all signalised intersections. There is a

slight grade change heading towards Chatswood Interchange. Signalised intersections are provided at regular intervals, however, pedestrian fencing reduces the permeability of the area and precludes any informal crossing.

Amenity + use

Street furniture and public, open space at the Concourse provide various areas for people walking to stop and rest. A mix of retail offerings, including large scale retail, cafes and restaurants, make the area distinct and interesting.

Character + form

The medium-rise buildings associated with Westfield Shopping Centre are balanced through a combination of two-storey buildings and public, open spaces and plazas.

Existing conditions

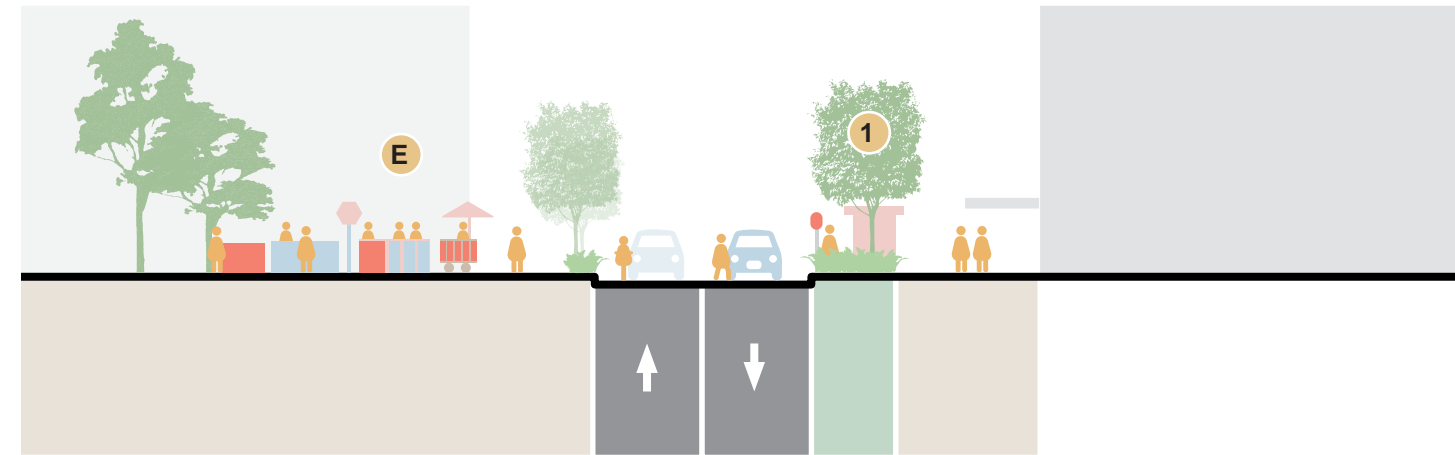


Retained treatments

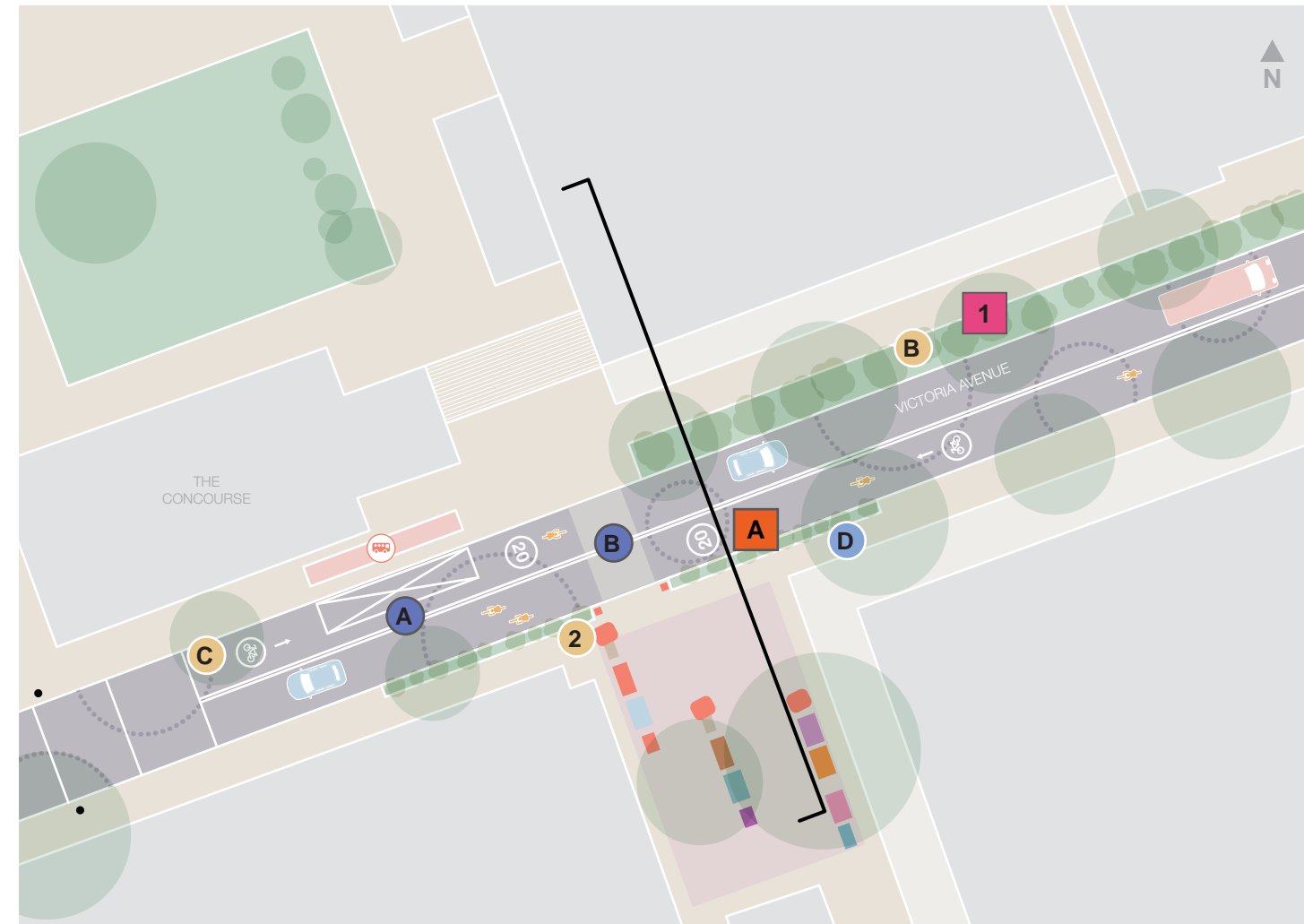
- Severity
- 1 **Blue-green infrastructure:** good tree canopy
 - 2 **Street furniture:** bins and seating

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Risk Element			
Exposure	Red square	Pink circle	Light pink circle
Likelihood	Dark blue square	Dark blue circle	Light blue circle
Severity	Orange square	Orange circle	Yellow circle

Victoria Avenue, Chatswood Mid-block



Desired user allocation



Additional treatments

- Exposure
- A **Remove on-street parking spaces**
- Likelihood
- A **Distinguish the bus stop:** indicate stop location
 - B **Install uncontrolled crossing:** informal crossing along key desire lines

- Severity
- A **Lower signed speed limit:** 20km/h
 - B **Provide blue-green infrastructure:** trees and planting to narrow perception of street
 - C **Modify surface:** artistic pavement with speed limit and cycling symbols
 - D **Provide blue-green infrastructure:** low planting as deterrent instead of existing pedestrian fencing
 - E **Provide temporary facilities:** kiosks and stalls

Existing conditions

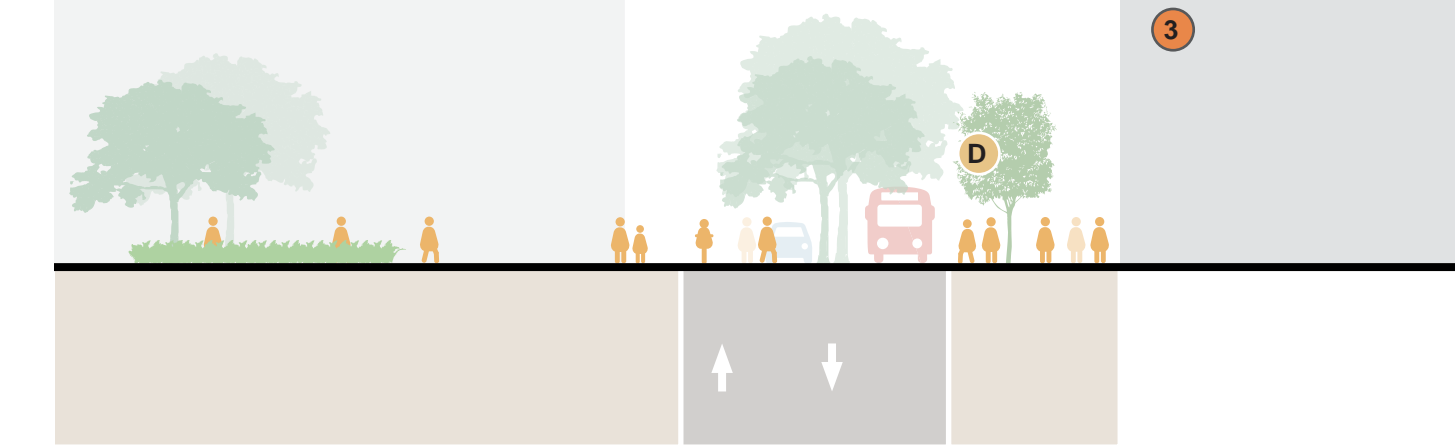


Retained treatments

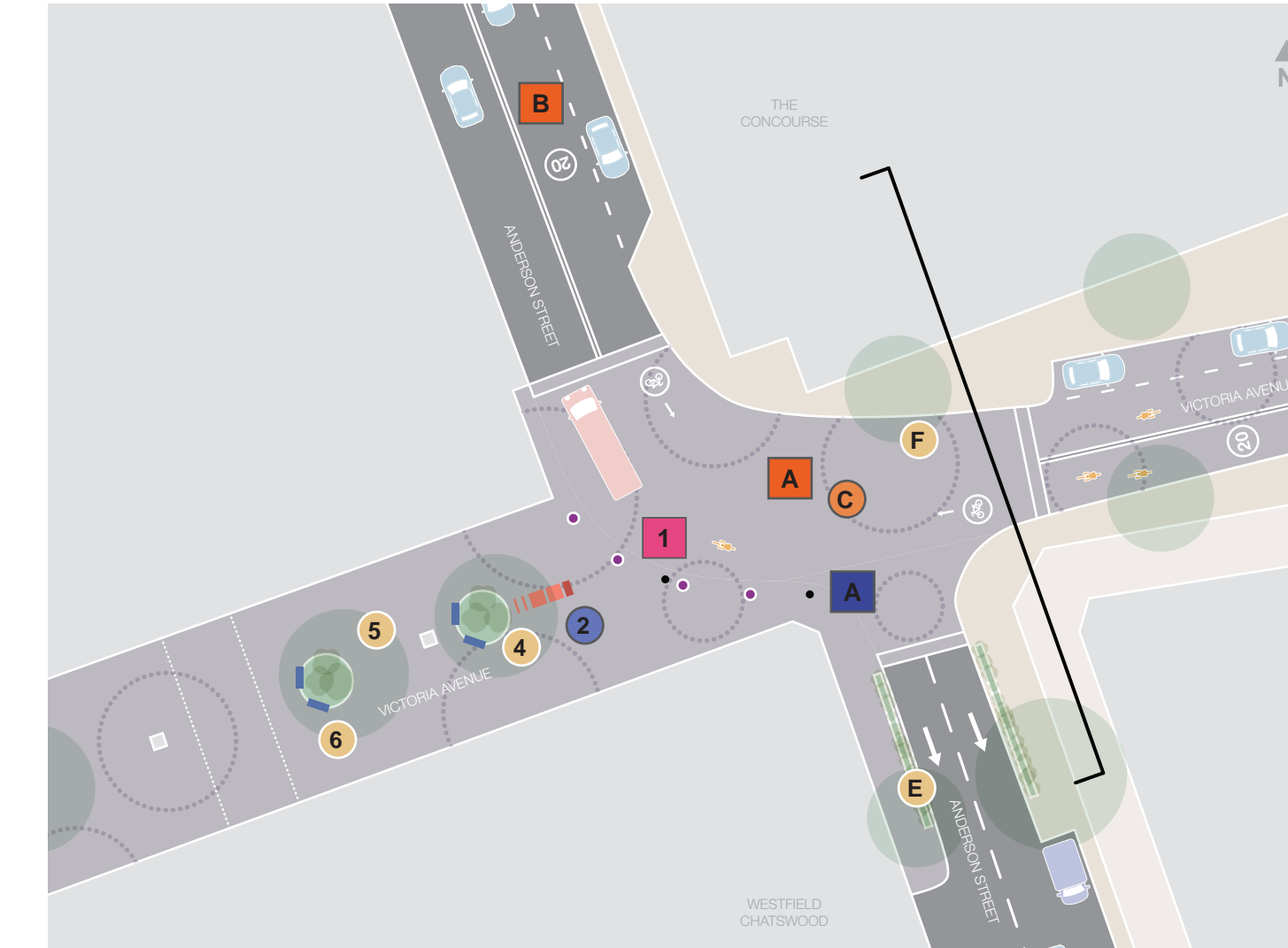
- Exposure
- 1 **Restricted vehicle access:** pedestrian plaza along Victoria Avenue east, retractable bollards are proposed given raised intersection
- Likelihood
- 2 **Dedicated stop and pause spaces for cycling:** cycle racks
- Severity
- 3 **Limited setbacks:** buildings are close to the footpath edge on all sides making the intersection feel narrow and helping to calm traffic
 - 4 **Street furniture:** bins, seating
 - 5 **Temporary facilities space:** market stalls are regularly setup in this space
 - 6 **Blue-green infrastructure:** tree canopy and planting provided

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Risk Element			
Exposure	Red square	Pink circle	Light pink circle
Likelihood	Dark blue square	Dark blue circle	Light blue circle
Severity	Orange square	Orange circle	Yellow circle

Victoria Avenue, Chatswood Intersection



Desired user allocation



Additional treatments

- Likelihood
- A **Introduce pedestrian signal phase:** scramble crossing
- Severity
- A **Raise intersection:** level with existing footpath
 - B **Lower signed speed limit:** 20km/h
 - C **Encourage self-monitoring:** remove delineation
 - D **Provide blue-green infrastructure:** trees and tree canopy
 - E **Provide blue-green infrastructure:** low planting as deterrent instead of existing pedestrian fencing
 - F **Modify surface:** continue artistic pavement into intersection, connecting with pedestrianised section of Victoria Avenue



BANKSTOWN CITY PLAZA, BANKSTOWN

Context

Bankstown is a suburb in the south-west of Sydney and is located 16 kilometres south-west of the Sydney CBD. It has a population of approximately 32,000 and is considered one of the most ethnically diverse and multicultural communities in Australia. Bankstown City Plaza is in the heart of the commercial and retail core of Bankstown and is the interface between the train station and bus interchange.

Most of the Plaza operates as a 10km/h shared zone with a one-way traffic lane and timed parking on both sides of the street. Various treatments have already been implemented in the Plaza to ensure motorists slow down to the posted speed limit. Wide footpaths can accommodate large volumes of people walking, as well as alfresco dining and outdoor retail displays. In some locations, kerb build outs narrow the crossing width for people walking to just one lane. Ample street furniture and lighting makes the Plaza a welcoming place for all users at all times of the day.

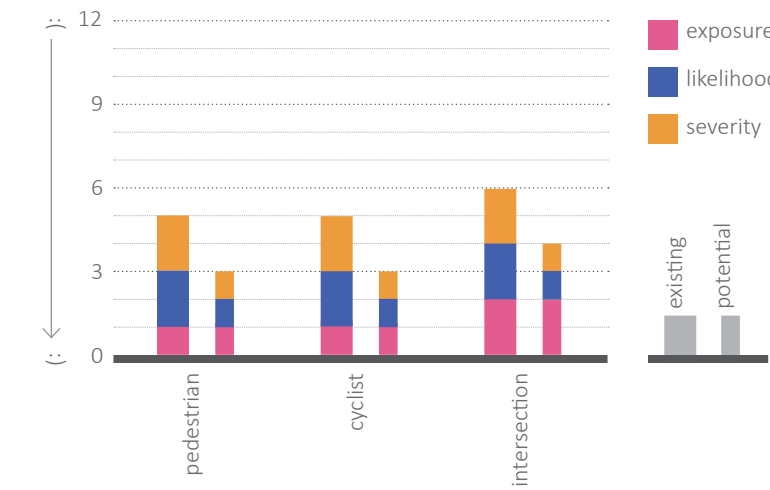
The bus interchange interfaces directly with the Plaza, forming a conflict point between buses and people walking. The low number of vehicles and short crossing distances results in low exposure. The absence of segregation between some modes (people cycling and vehicles) means that the likelihood of a crash is higher, however, slow speeds and low vehicle volumes help to mitigate this risk. The posted speed limit is 10km/h, which will result in a very low severity of crash between a vehicle and a person walking if it were to occur.

Existing user allocation

Bankstown City Plaza



Safety



Justification

Bankstown City Plaza is already considered a successful Civic Space where pedestrian movements are prioritised over private vehicles. A pedestrian fatality at the bus interchange prompted specific interventions to improve safety at the entry to the interchange.

Exposure

Traffic volumes have been reduced through previous interventions, such as restricting vehicle access and narrowing the lane width.

Likelihood

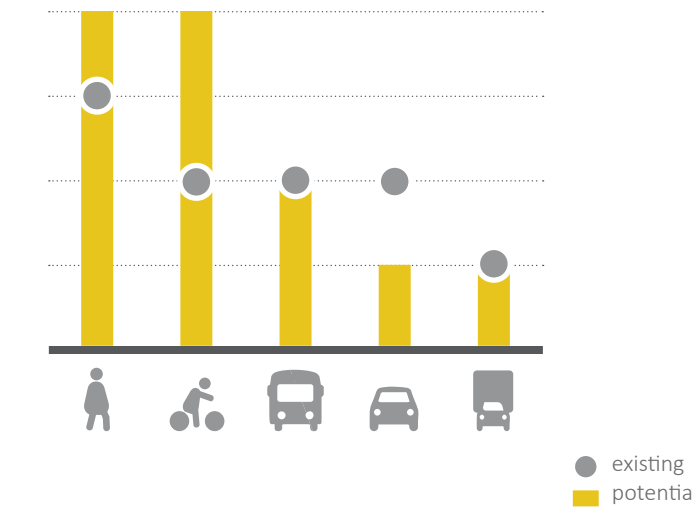
Additional interventions, such as uncontrolled crossings at following desire lines, build upon the range of significant existing place elements.

Severity

A raised intersection in conjunction with a reduction in the sign posted speed limit aims to reduce the speed at which buses approach the interchange and bring it in line with other sections of the plaza which already have a sign posted speed limit of 10km/h.

Movement and Place

Road user priorities



People walking

Very wide footpaths can accommodate a large number of people walking. Kerb build outs and raised crossings form regular crossings points, however, as the Plaza operates as a shared zone, people walking are free to cross at any location.

People on bicycles

There is no formal bicycle infrastructure along the Plaza, however, the slow road environment makes cycling a safe option.

Buses

The bus interchange facilitates a large number of bus movements. Pedestrian fencing precludes informal crossing between pick-up and drop-off stops, requiring people walking to use the signalised crossing to the west of the

interchange. Seating, signage and wayfinding, including timetabling information and route maps, makes the interchange easy to use and navigate. Sheltered cycle parking is also provided.

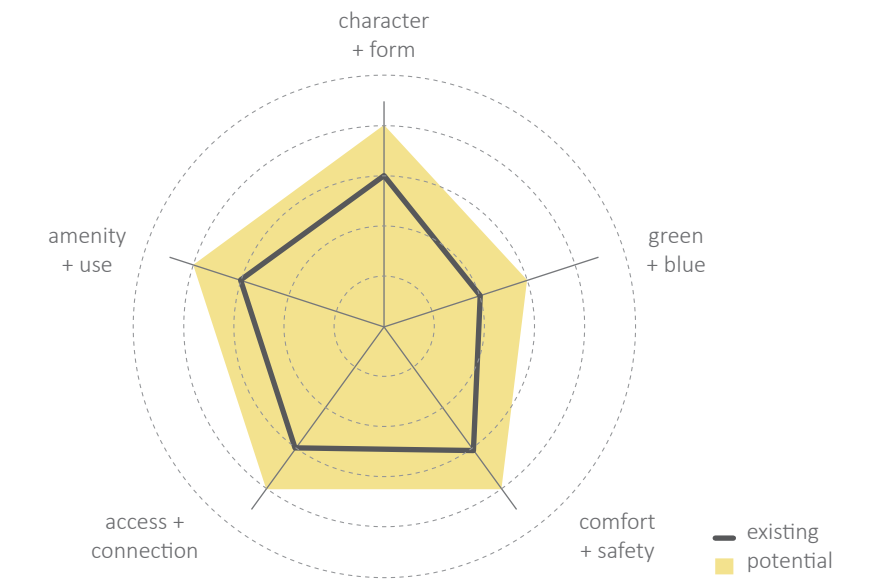
Private vehicles

A one-way traffic lane operates at 10km/h throughout most of the Plaza. Timed parking on both sides of the road visually narrows the carriageway and parking cars create friction.

Freight

There is a small dedicated loading zone along the Plaza which operates from 6am-6pm. Small delivery vans may also utilise parking bays to make deliveries to adjacent shops.

Evaluating movement and place performance



Green + blue

A mature tree canopy shades most of the footpath. Kerb build-outs are planted and hedges have been used in place of pedestrian fencing in some areas.

Comfort + safety

The slow road environment and wide footpaths make the Plaza a comfortable place for people walking to visit. This is compounded by ample tables and seating, appropriate lighting and consistent signage and wayfinding. Shop awnings protect people walking from the weather.

Access + connection

The Plaza is very well connected to a range of public transport options, including bus and rail. The slow road environment may encourage visitors to the Plaza to consider modes other than private vehicle. Kerb ramps, raised table crossings and TGSIs make the

area accessible for all users. A shared zone is, by nature, highly permeable as people walking can cross in all locations. This permeability is further facilitated by several, closely spaced pedestrian crossings.

Amenity + use

The Plaza provides a range of useful and convenient features including: wayfinding totems, seating, outdoor dining tables, public art and shade. These amenities complement predominant uses of retail and dining.

Character + form

The Plaza hosts a range of shops, including cafes, restaurants, retail and food shops, making the area interesting and engaging to visit. Wide footpaths, a narrow carriageway and one to two-storey buildings give the area a distinct feel and a human-scale.

Existing conditions



Retained treatments

Exposure

- 1 Restricted vehicle access:** one-way

Likelihood

- 2 Additional lighting provided:** with lamp post banners indicating this as a destination

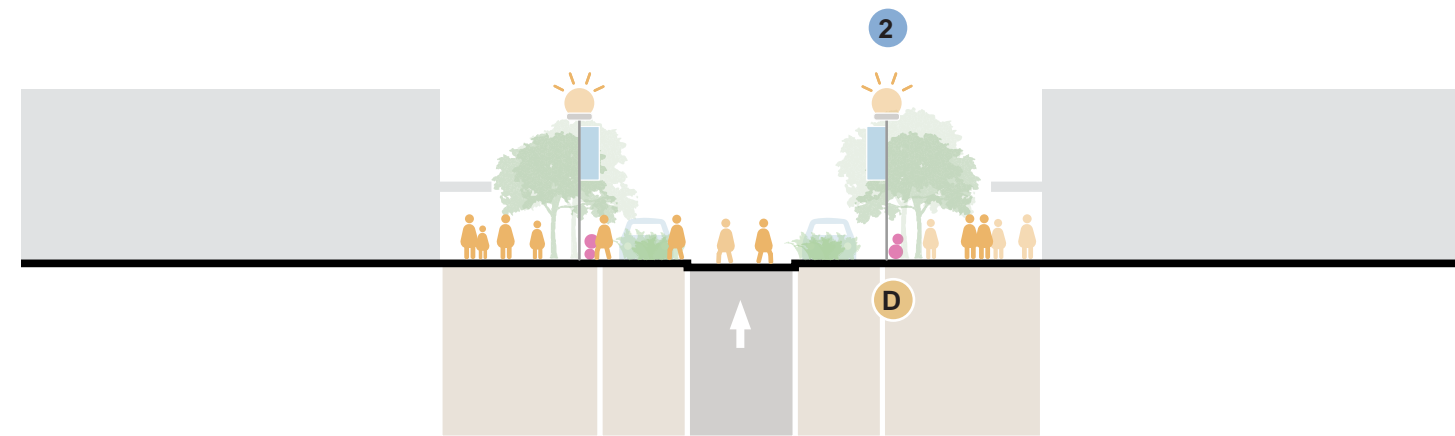
- 3 Information provided:** wayfinding totems

Severity

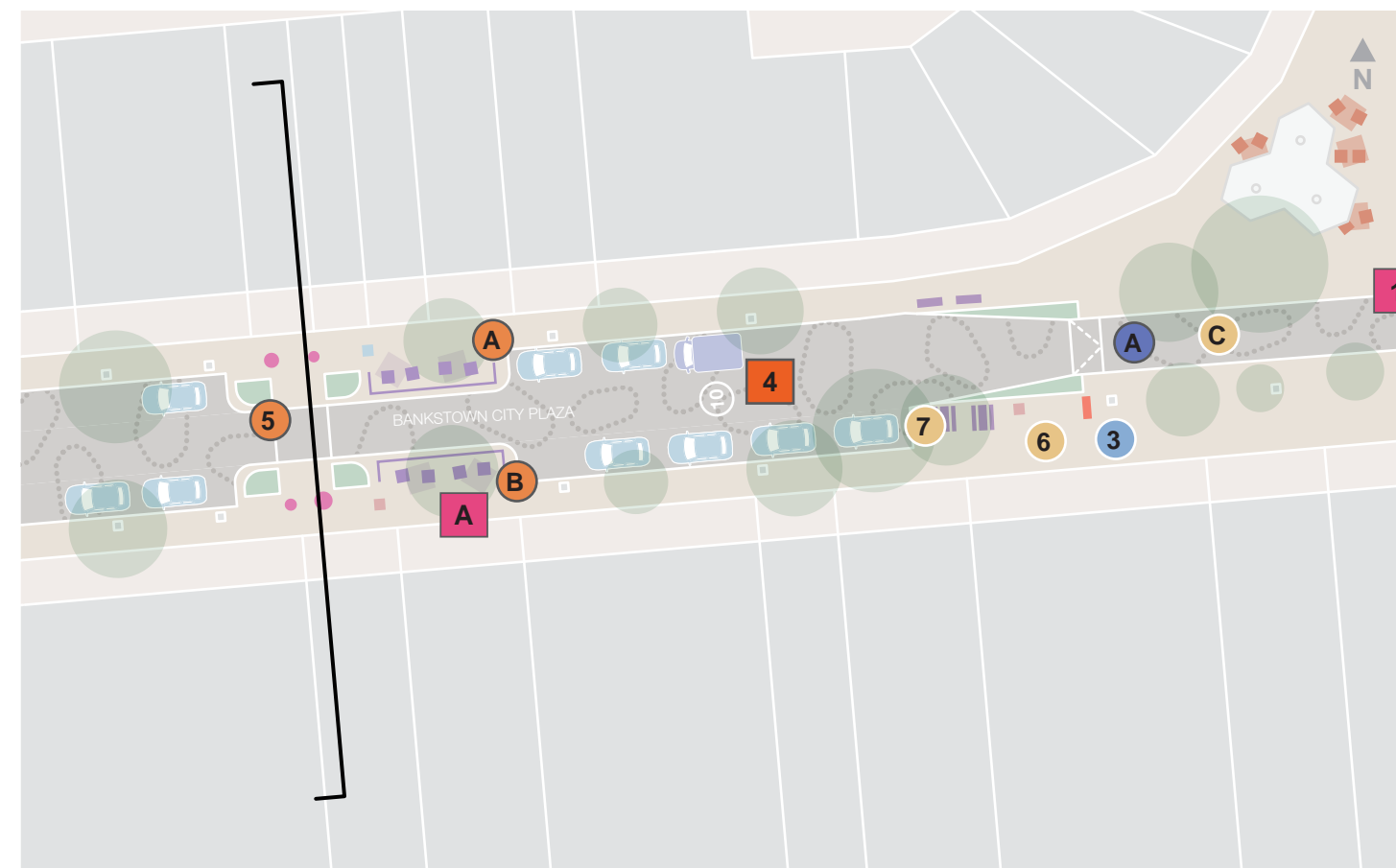
- 4 Low signed speed limit:** 10km/h shared zone
- 5 Extended mid-block kerb:** pinchpoint with planting to facilitate uncontrolled crossing
- 6 Street furniture:** seating, tables and bins
- 7 Blue-green infrastructure:** good tree canopy and low planting

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Exposure	Red square	Pink circle	Light pink circle
Likelihood	Dark blue square	Blue circle	Light blue circle
Severity	Orange square	Orange circle	Yellow circle

Bankstown City Plaza, Bankstown Mid-block



Desired user allocation



Additional treatments

Exposure

- A Remove on-street loading and parking spaces**

Likelihood

- A Install an uncontrolled crossing:** replace existing wombat crossing with informal crossing to suit shared zone and address desire lines

Severity

- A Extend mid-block kerb:** extend existing pinchpoint
- B Activate footpath:** create more space for outdoor dining
- C Modify surface:** vary pavement to indicate shared zone, reinforce speed limit through pavement marking
- D Provide prominent features:** remove existing bollards and install public art as disguised bollards

Existing conditions



Retained treatments

Exposure

- 1 Restricted vehicle access:** one-way

Likelihood

- 2 Information provided:** wayfinding totems

Likelihood/Severity

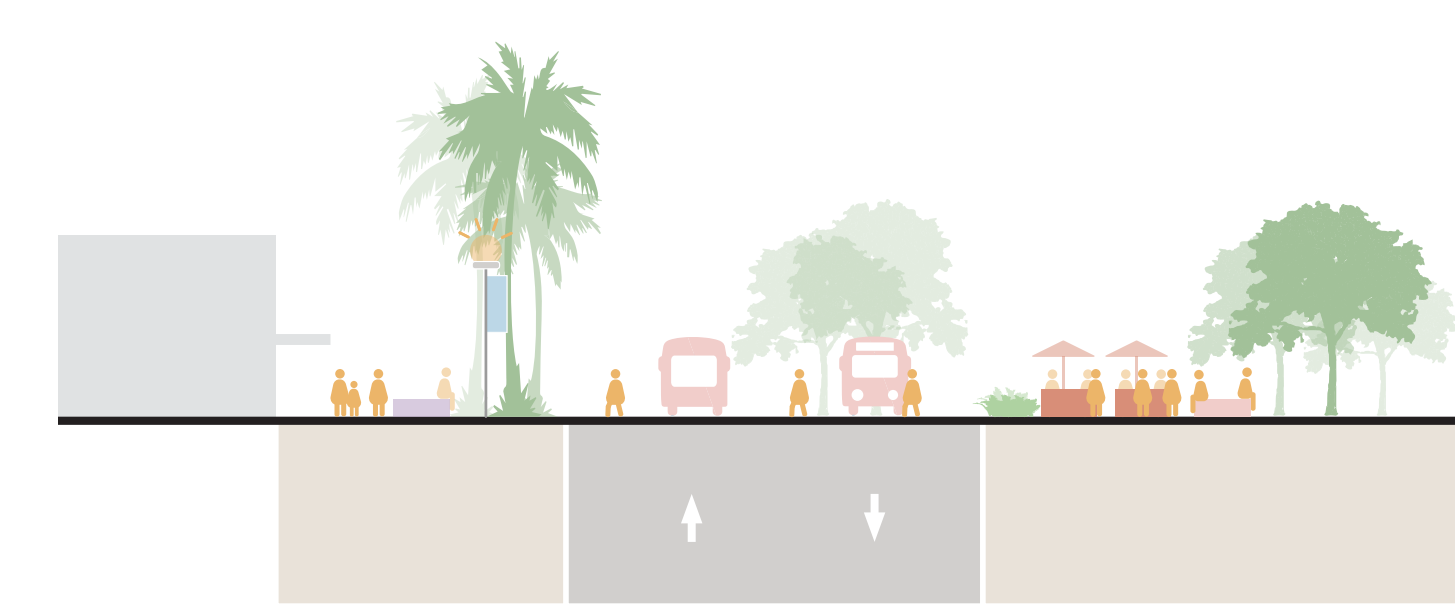
- 3 Pedestrian protection:** concrete barriers narrowing perception of lane and separating users

Severity

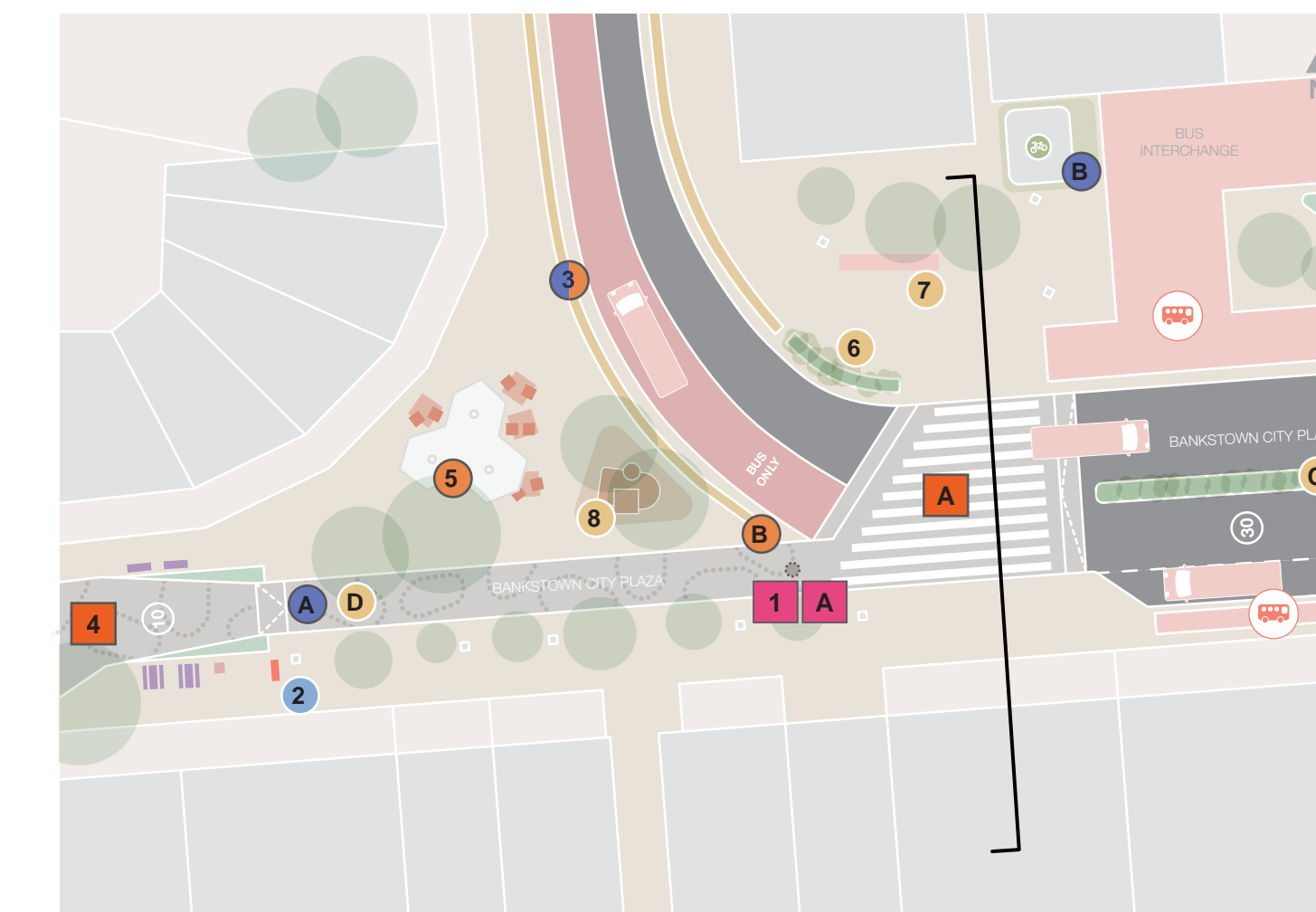
- 4 Low signed speed limit:** 10km/h shared zone
- 5 Activated footpath:** outdoor dining, shade, seating
- 6 Blue-green infrastructure:** low planting narrowing perception of carriageway
- 7 Street furniture:** seating, tables and bins
- 8 Public art feature**

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Exposure	Red square	Pink circle	Light pink circle
Likelihood	Dark blue square	Blue circle	Light blue circle
Severity	Orange square	Orange circle	Yellow circle

Bankstown City Plaza, Bankstown Intersection



Desired user allocation



Additional treatments

Exposure

- A Restrict vehicle access:** use retractable bollards to completely close street to vehicles for events

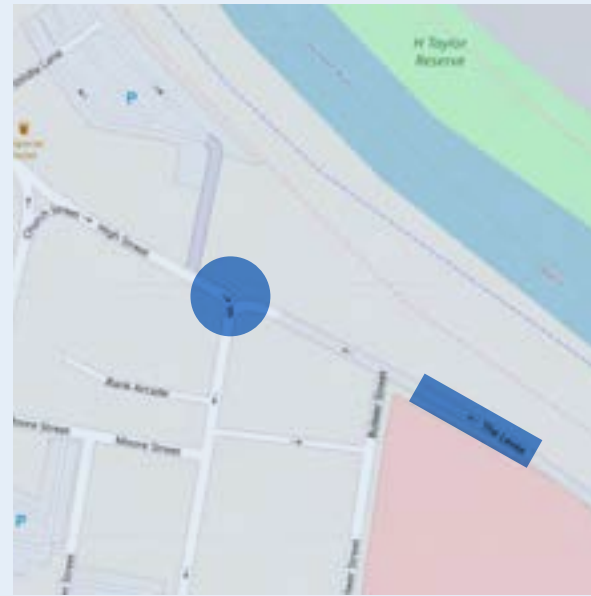
Likelihood

- A Install an uncontrolled crossing:** replace existing wombat crossing with informal raised crossing to suit shared zone, pedestrian barriers are removed to address key desire lines

- B Provide dedicated stop space for cycling:** end of trip facility

Severity

- A Raise intersection:** modify existing controlled crossing with a raised table, adjust ramps for bus movement and raise level to footpath level
- B Extend kerb in intersection:** narrow entry into shared zone
- C Provide blue-green infrastructure:** maintain existing pedestrian fencing and improve amenity through low planting
- D Modify surface:** opportunity to improve amenity of existing concrete protection through painting and art



THE LEVEE, MAITLAND

Context

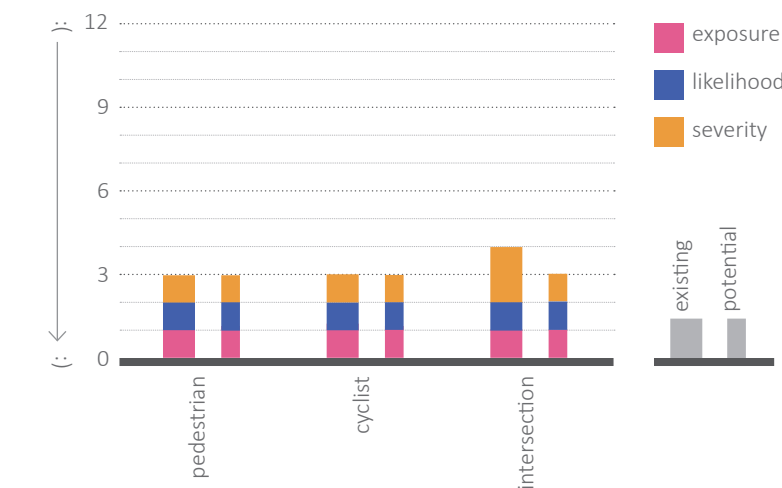
Maitland is a regional city, north of Newcastle, with a population of approximately 78,000 people. In 1988, after many decades of economic decline, the main retail street was converted to a pedestrian mall. Cars were removed from The Levee in keeping with the global urban movement to remove vehicles from town centres. By 2010, vacancy rates had increased to 50% and business confidence was an all-time low – mainly

attributed to the lack of visitors to the area. A masterplan for the area was developed to retain walking amenity whilst increasing retail activity by reintroducing slow moving traffic. The pedestrian mall was converted to a shared 10km/h zone. Walkability and pedestrian networks were supported so as to continue encouraging pedestrians to the area. Flexibility was embraced – parking could be swapped to outdoor dining as retail tenancies

were changing. The street’s tree canopy was increased and signage, wayfinding and art were introduced. The project has enabled economic regeneration – retail vacancy rates dropped to nearly 0 while average daily pedestrian activity has increased by around 1/3. The behaviour of the community has changed as drivers and pedestrians mix safely at low speed.

Existing user allocation

The Levee



Justification

This location was chosen to undertake a retrospective review of previous interventions that contributed to creating a successful Civic Space. The Levee has undergone several iterations, with varying levels of success, to reach its current state. The review identified a number of successful interventions and very few additional interventions in addition.

Exposure

One-way circulation restricts the number of vehicles that can move along the street.

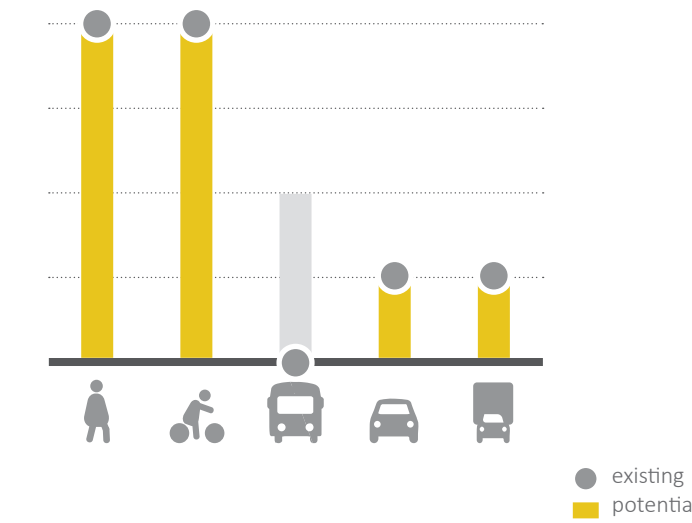
Likelihood

Existing interventions have reduced the likelihood of a crash occurring. The review highlighted the importance of parking in a regional context – it was reintroduced to The Levee following years of economic decline in the area following its removal.

Severity

The majority of existing treatments are aimed around reducing the speed of private vehicles in an environment where people walking have priority. The sign posted speed limit has been reduced and infrastructure aimed at reducing speeds, such as street furniture and textured paving, was introduced to the street environment.

Road user priorities



People walking

People walking have priority in the shared zone. Sloped tiles for drainage demarcate the pedestrian-only footpath from the shared zone where slow moving traffic is allowed and parking occurs.

People on bicycles

There is no formal bicycle infrastructure, however, the low speed environment and wide road is conducive to cycling activity.

Buses

No bus services operate along The Levee.

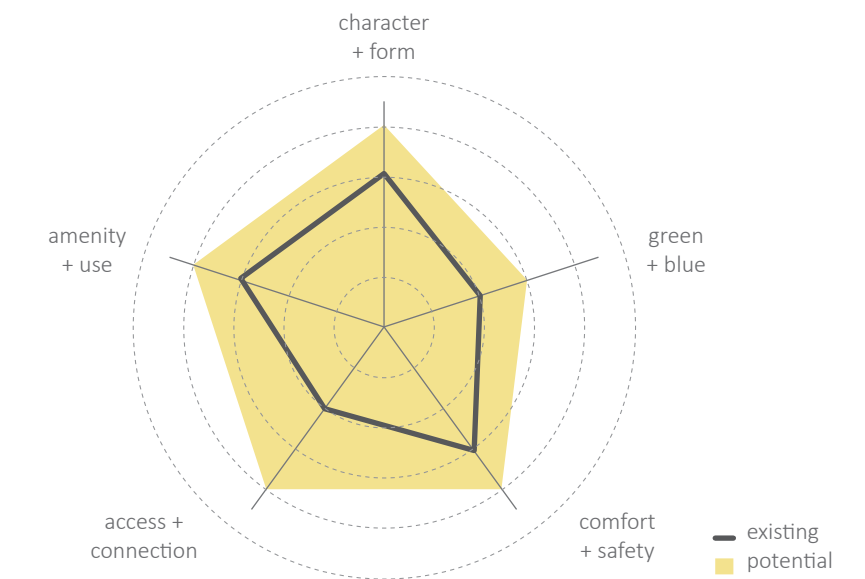
Private vehicles

One-way slow traffic operates along The Levee. A change in paving signals the presence of a shared zone and encourages drivers to proceed with caution. Half an hour parking encourages a high turnover of visitors to the area.

Freight

There are no dedicated loading zones, however, small delivery vehicles could utilise timed parking spaces for small deliveries.

Evaluating movement and place performance



Green + blue

A mature tree canopy shades parts of the shared zone. Street trees and planted bollards provide visual amenity to the area and capture rainfall.

Comfort + safety

Continuous shop awnings provide shelter from the weather and street furniture facilitates spaces for people walking to stop and rest. The pedestrian-only footpath is wide and the shared zone provides ample space to spill-over if the footpath becomes crowded. Wayfinding, signage and appropriate lighting mean the area is easy to navigate throughout the day and into the evening.

Access + connection

There is no public transport provision on The Levee, however, walking is prioritised over private vehicles. The shared zone has no formal crossing points and there is no kerb between the

pedestrian-only area and the shared zone. Shared zones without a defined kerb can be difficult for those who are vision impaired to navigate as it is often difficult to determine when pedestrian-only spaces become shared spaces. The sloped drainage signifies this point, however, without TGSi it may still be difficult to navigate.

Amenity + use

Seating and outdoor dining facilities are provided along the street. In addition, bicycle racks and bins are also provided. The street is primarily comprised of retail and dining uses.

Character + form

A mix of one and two-storey buildings bring visual interest and vibrancy to the street. The modified surface treatment also adds a more leisurely character to the street.

Existing conditions



Retained treatments

Exposure

- 1 **Fine-grain land use mix**

Likelihood

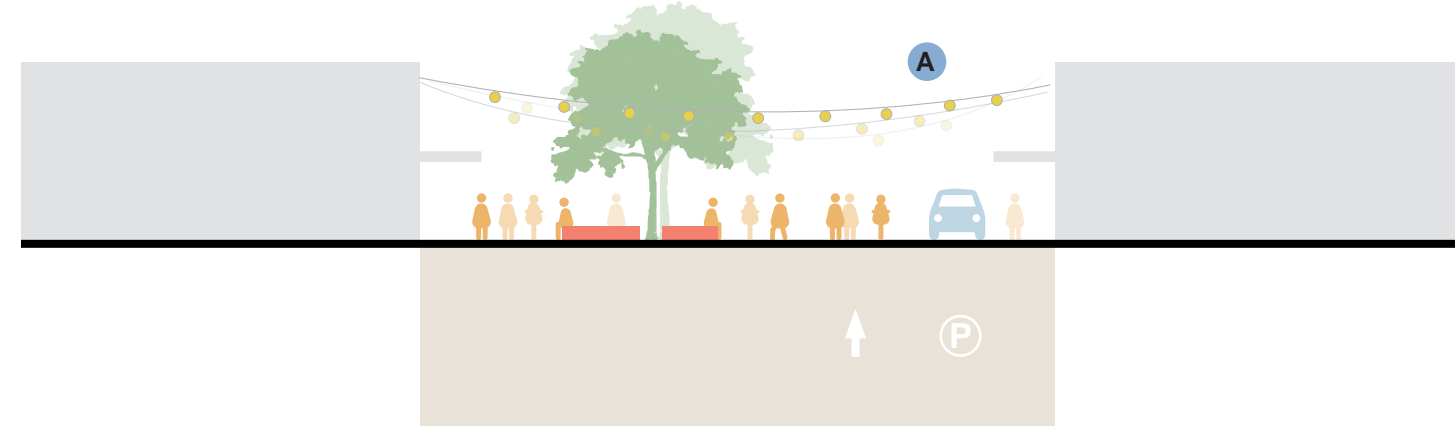
- 2 **Distinguished parking spaces:** indicated by change in pavement type

Severity

- 3 **Low signed speed limit:** pavement marking and signage upon entering indicating 10km/h shared zone
- 4 **Self-monitoring encouraged:** delineation removed to support driver alertness and vigilance
- 5 **Activated frontages:** visual variety of buildings and openings that engage with the street
- 6 **Blue-green infrastructure:** trees and planting
- 7 **Street furniture:** seating and bins
- 8 **Modified surface:** paving treatment with arrows to indicate traffic direction

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Risk Element			
Exposure	■	●	●
Likelihood	■	●	●
Severity	■	●	●

The Levee, Maitland Mid-block



Desired user allocation



Additional treatments

Likelihood

- A **Provide additional lighting:** complement existing lighting provided to encourage night-time activity

Severity

- A **Provide street furniture:** provide additional seating to prevent cars from following existing guttering line

Existing conditions



Retained treatments

Exposure

- 1 **Restricted vehicle access:** pavement marking and lane narrowing to indicate one-way vehicle direction

Likelihood

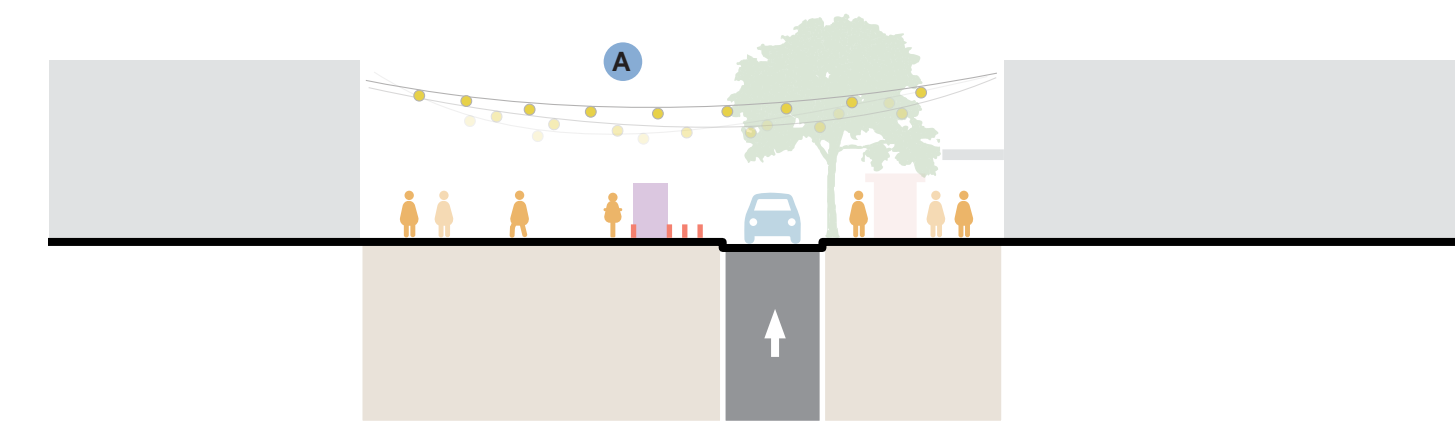
- 2 **Safe and accessible support for all ages and abilities:** TGS1 provided
- 3 **Dedicated stop spaces for cycling:** cycle racks
- 4 **Information provided:** wayfinding totems situated close to street furniture and cycle racks

Severity

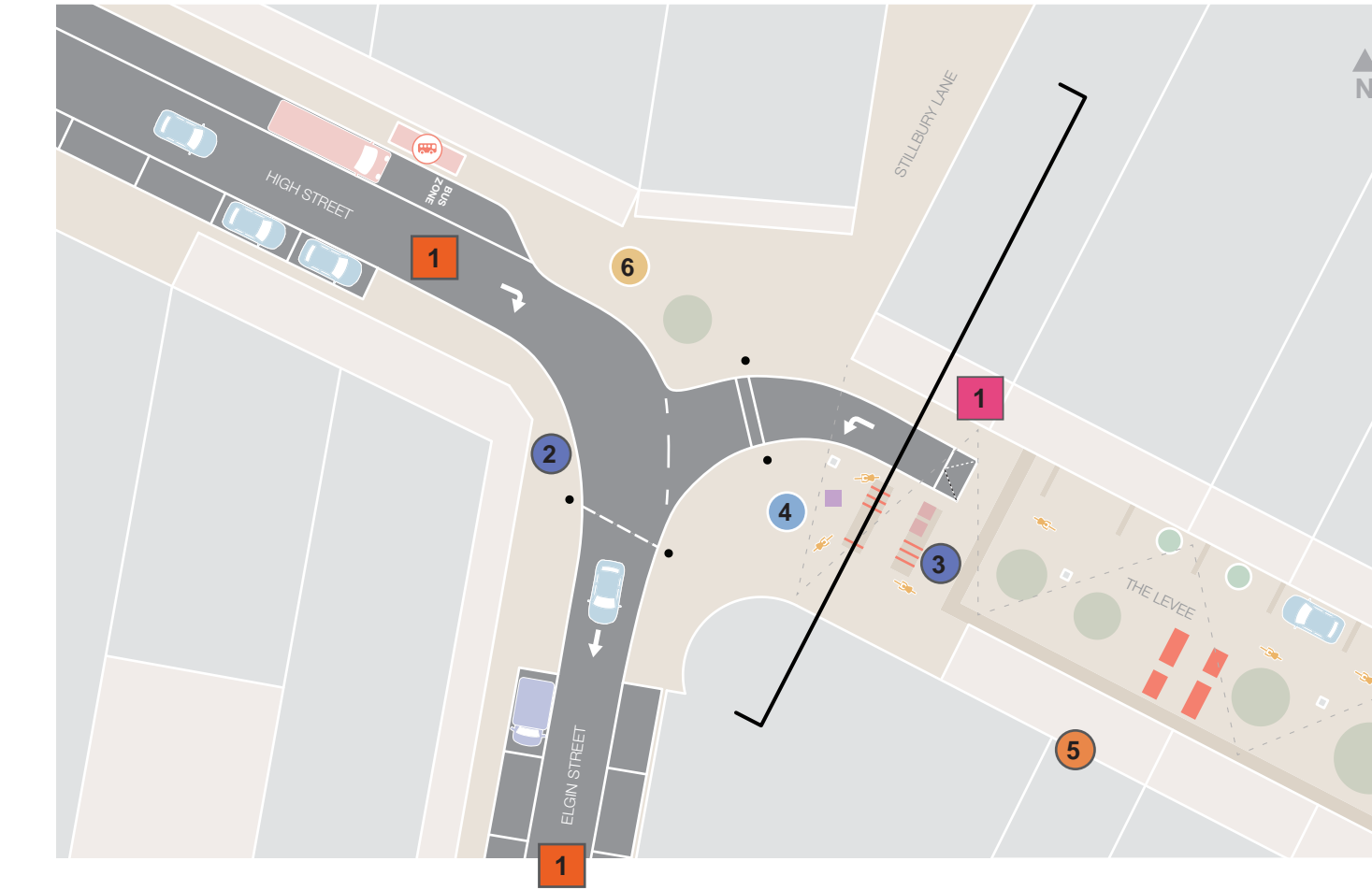
- 5 **Activated frontages:** visual variety of buildings and openings that engage with the street
- 6 **Modified surface:** paving treatment

Treatment Hierarchy			
	Primary	Supporting	Enhancing
Risk Element			
Exposure	■	●	●
Likelihood	■	●	●
Severity	■	●	●

The Levee, Maitland Intersection



Desired user allocation



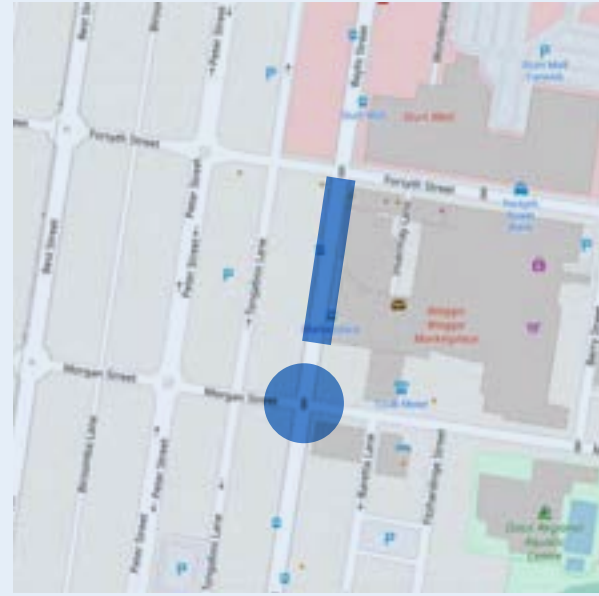
Additional treatments

Likelihood

- A **Provide additional lighting:** complement existing lighting provided to encourage night-time activity

Severity

- A **Lower signed speed limit:** 30km/h on Elgin Street and High Street



BAYLIS STREET, WAGGA WAGGA

Context

Wagga is a major regional city in the Riverina region of New South Wales, approximately 450 kilometres south-west of Sydney. It has a population of approximately 56,000. Baylis Street is a key street in Wagga, running north-south through the centre of the CBD. It currently has one traffic lane in each direction,

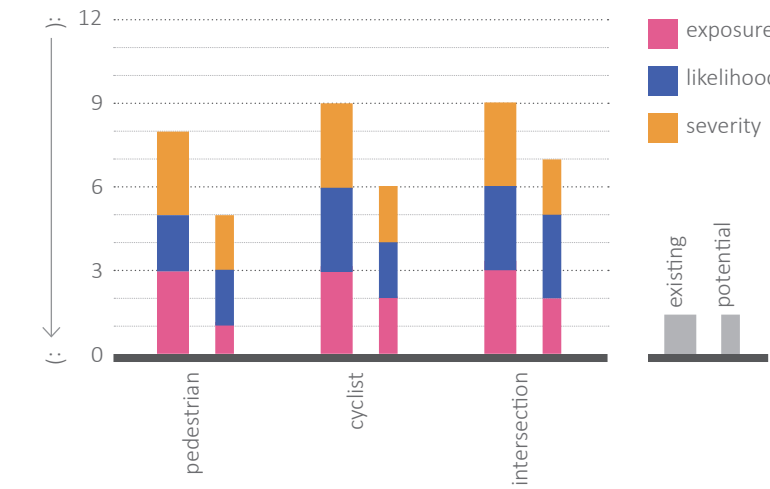
operating at 50km/h, flanked by kerbside parking on both sides of the road. Wagga Marketplace is a major shopping centre and has direct frontage onto Baylis Street. Several local bus routes operate along Baylis Street. The bus stops are not easily distinguishable along the street.

Existing user allocation

Baylis Street



Safety



Justification

Baylis Street is currently considered a Main Street as both movement and place functions are integral to its operation. The desired future outcome along Baylis Street is one where the place function is elevated, and the movement function is deprioritised. Therefore, the additional interventions aim to transform Baylis Street to a Civic Space.

Exposure

All private vehicle traffic will be restricted along Baylis Street. North-south through traffic can be accommodated on parallel Best and Tarcutta Streets. Any vehicular traffic wishing to access retail and hospitality along Baylis Street can be accommodated in ample parking to the rear of both blocks adjoining the street.

Likelihood

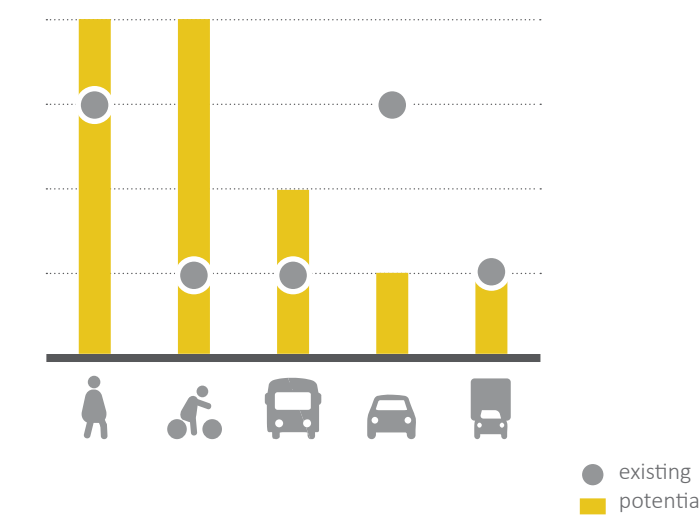
In order to maintain a high level of public transport accessibility through the CBD, bus movements will be retained along Baylis Street. Improvements to the interface between pedestrians and bus operations will ensure safety remains paramount and points of conflict are minimised.

Severity

The speed limit will be reduced from 50km/h to 30km/h to encourage greater pedestrian activity and perceived and actual safety. By restricting private vehicle access, more space can be allocated to people walking by widening the footpath and providing other place elements, such as seating.

Movement and Place

Road user priorities



People walking

Very wide footpaths on both sides of the street can accommodate large volumes of people walking. Outdoor dining and retail displays are prominent along Baylis Street and do not impede on walking flows. A mid-block wombat crossing prioritises walking movements across the street.

People on bicycles

There are no bicycle lanes along Baylis Street. A shared path is planned for the southern side of Morgan Street. Bicycle parking is provided at the entrance to the shopping centre.

Buses

Several local bus routes operate along Baylis Street. There are two bus stops along Baylis Street, however, they are not easily distinguishable from the street.

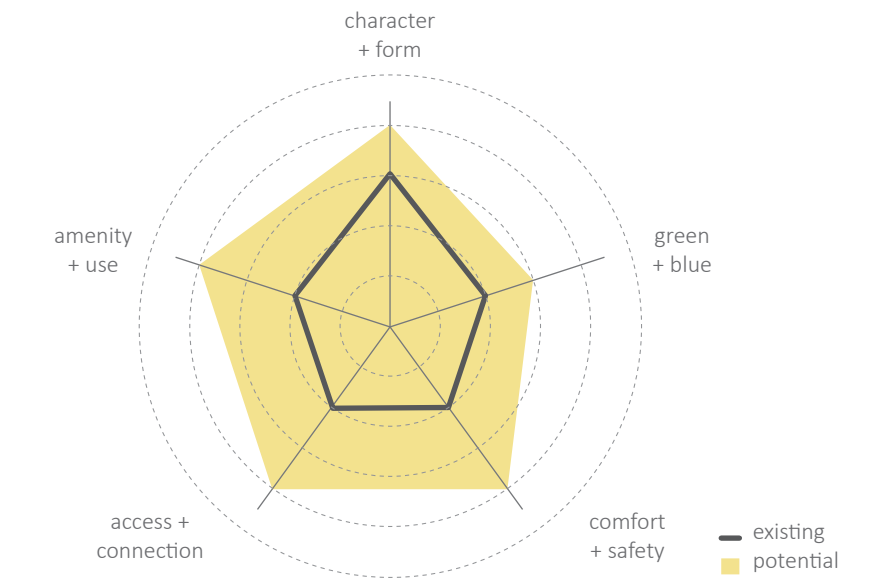
Private vehicles

One lane of traffic operates in both directions at 50km/h. Timed parallel parking is facilitated in the kerbside lanes. An abundance of parking is provided in the Wagga Marketplace shopping centre.

Freight

Loading zones are in operation along both sides of the street, providing approximately six spaces. The majority of businesses along Baylis Street are serviced at the rear, which reduces the number of loading vehicles operating along Baylis Street. Any loading that currently occurs on Baylis Street could be accommodated in other locations.

Evaluating movement and place performance



Green + blue

A mature tree canopy shades most of the street. Extensive planting and planted kerb build-outs provide amenity to the area.

Comfort + safety

A small number of cafes and restaurants provide some level of activity into the evening. A consistent awning provides shelter from the weather. Wide footpaths allow space for a variety of street furniture to be placed, including bins, tables, seating and water fountains.

Access + connection

Several local bus routes provide connectivity and transport choice in a car dominated area. Kerb ramps and TGSI are present at signalised intersections, which have scramble crossings. A mid-block wombat crossing increases the permeability of the area.

Amenity + use

Public space is incorporated along the streetscape through the inclusion of wide footpaths and public outdoor tables and seating. The street is dominated by retail offerings, however, dining and hospitality venues feature sparsely.

Character + form

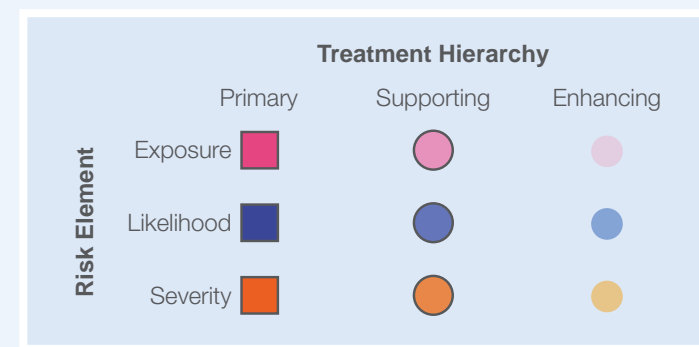
Two-storey buildings with active frontages result in a human-scale environment that is inviting and interesting for people to visit. There is an abundance of local retail, reflective of its context, giving Baylis Street a character distinct from other regional locations.

Existing conditions

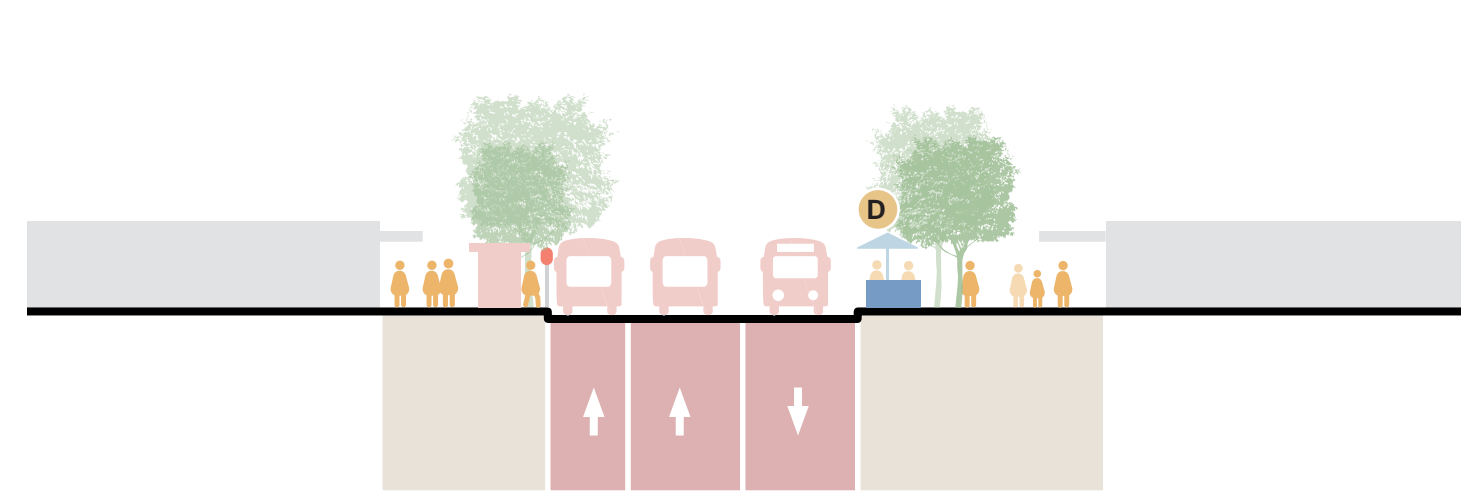


Retained treatments

- Exposure
- 1 **Fine-grain land use mix**
- Likelihood
- 2 **Dedicated stop spaces for cycling:** cycle racks
- Severity
- 3 **Controlled and raised crossing:** wombat
 - 4 **Activated footpaths:** outdoor dining furniture
 - 5 **Activated frontages**
 - 6 **Blue-green infrastructure:** tree canopy and low planting provided along street, these can be extended given additional footpath space
 - 7 **Street furniture:** bins, seating



Baylis Street, Wagga Wagga Mid-block



Desired user allocation



Additional treatments

- Exposure
- A **Restrict vehicle access:** allow buses only
 - A **Remove on-street parking spaces**
- Likelihood
- A **Provide bus stop kerb modification:** indent bus stop and locate closer to crossing points

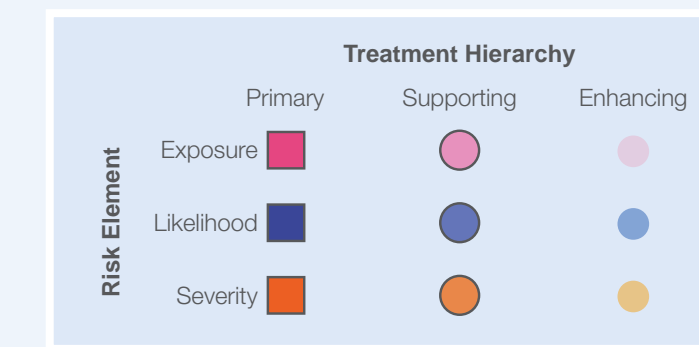
- Severity
- A **Lower signed speed limit:** 30km/h
 - B **Install a controlled and raised crossing:** wombat
 - C **Increase footpath width:** through narrowing the carriageway
 - D **Activate footpath:** provide additional outdoor dining furniture
 - E **Provide street furniture:** additional seating
 - F **Provide blue-green infrastructure:** low planting along edges of footpath, narrowing perceived lane width

Existing conditions

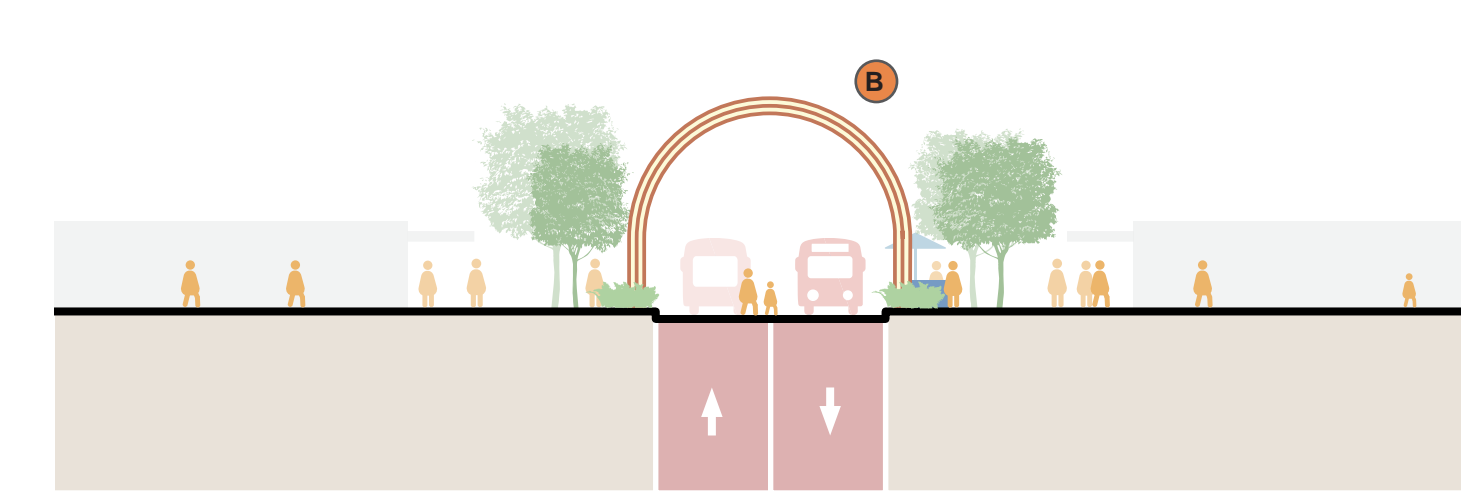


Retained treatments

- Likelihood
- 1 **Pedestrian signal phase:** scramble crossing, indicated through signage
 - 2 **Safe and accessible support for all ages and abilities:** TGS1 provided
- Likelihood/Severity
- 3 **Buffer provided:** small raised section separating traffic directions and narrowing lane width
- Severity
- 4 **Blue-green infrastructure:** low planting at edges of intersection along with tall trees with significant canopy
 - 5 **Street furniture:** seating and bins provided



Baylis Street, Wagga Wagga Intersection

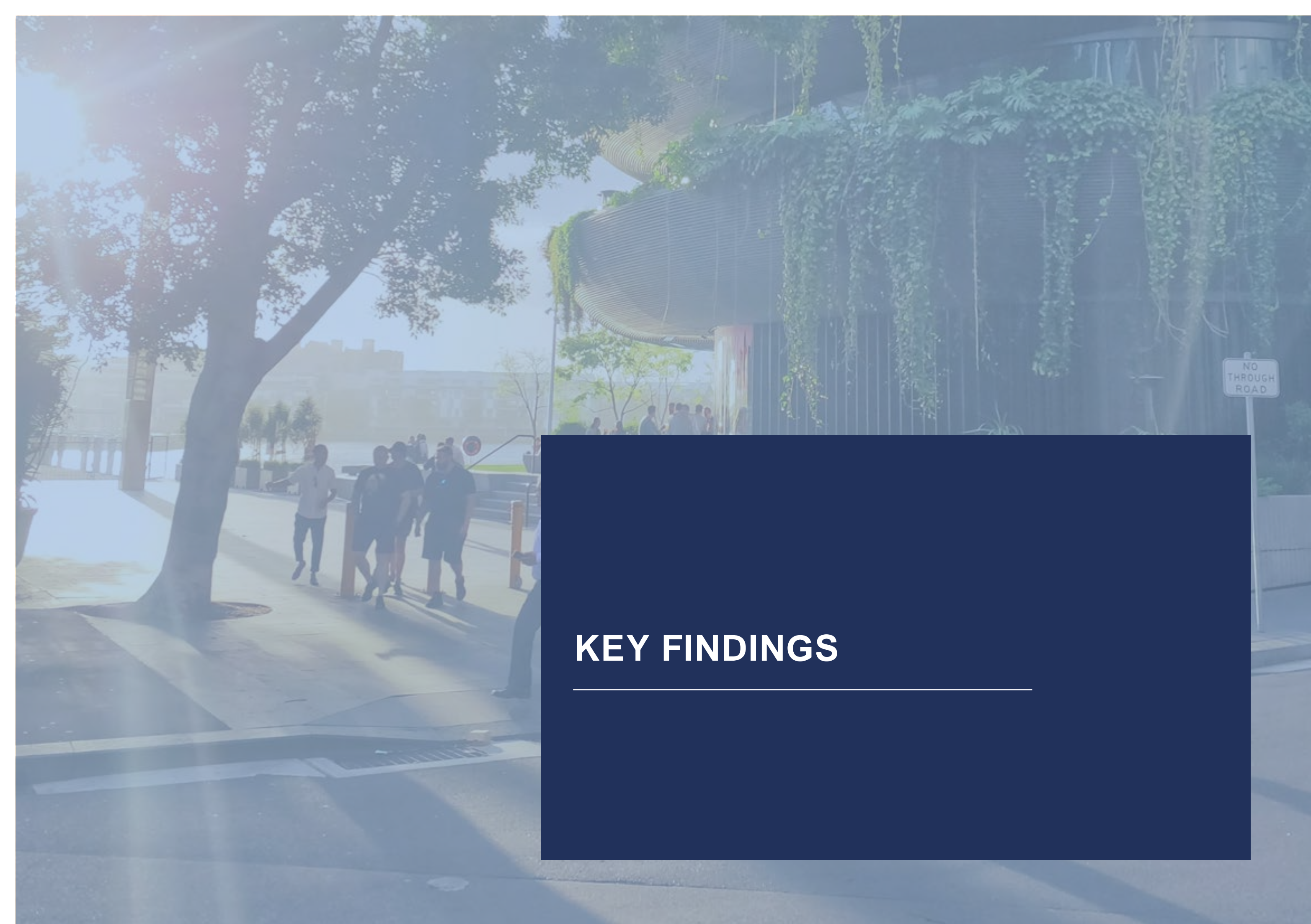


Desired user allocation



Additional treatments

- Exposure
- A **Remove on-street parking spaces**
 - B **Restrict vehicle access:** use signage
- Likelihood
- A **Provide dedicated stop space for cycling:** bicycle storage
- Likelihood/Severity
- A **Modify signal timing:** prevent vehicles heading straight into bus only zone
- Severity
- A **Increase footpath width:** through narrowing of carriageway
 - B **Create a gateway:** differentiate this section of street with an artistic feature
 - C **Modify surface:** emphasise presence of existing scramble crossing
 - D **Modify surface:** to reinforce no vehicle access
 - E **Modify surface:** colour surface to indicate shared space for pedestrians and people on bicycles



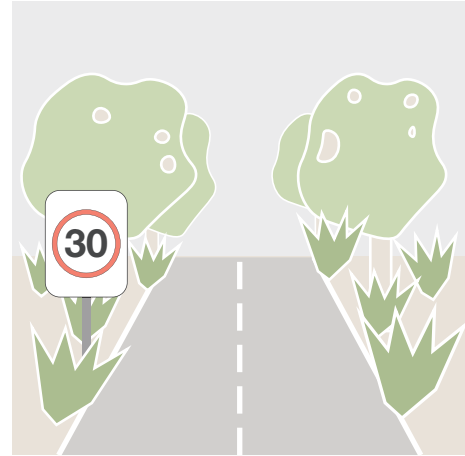
KEY FINDINGS

KEY FINDINGS

A number of key findings emerged from this project and relate to the 'Considerations of use' described previously in this report regarding the use of treatments.

Treatments work best when combined with others

Slowing down vehicles is more than just lowering the signed speed limit. A number of supporting and/or enhancing treatments in combination with other risk element treatments work together to reinforce and encourage the desired speed. This was evident when conducting the rapid Safe System Assessment. Combinations of treatments can include physical objects or interventions (such as signs or kerb extensions) as well as management treatments (such as signal timing/priority) and educational treatments (such as driver behaviour campaigns).



Context is paramount

Even though the case studies demonstrate best-practice, it is important to note that the exact combination of treatments will not necessarily apply to similar locations (whether they be regional or metropolitan).

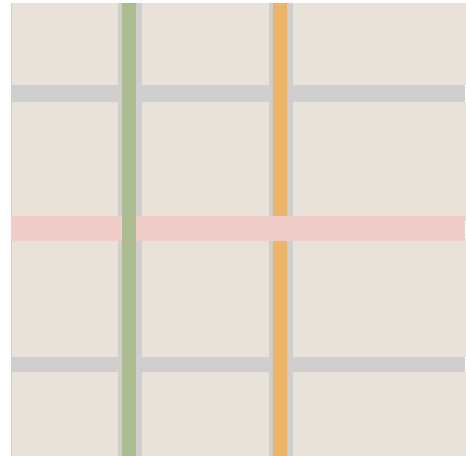
Selecting treatments must derive from key drivers and local challenges, as well as the macro conditions. This incorporates time, financial and spatial factors, as well as future projects and/or strategic plans for the area.



Remember the network

Despite working at a relatively localised scale, it is vital that the treatments respond to wider network requirements regarding traffic volumes, traffic speed, operational needs, user priority and so on. This is relevant for both the mid-block and intersection of the street under investigation given that the speeds and suite of treatments on the connecting streets will influence the overall crash risk.

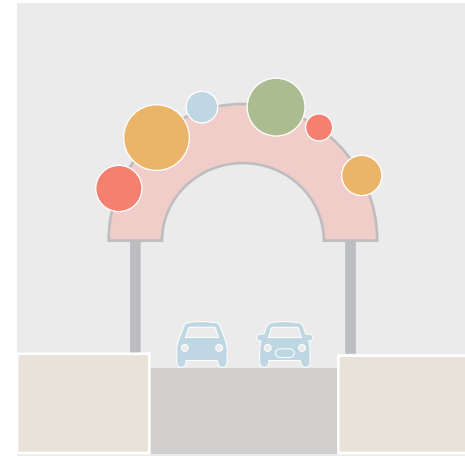
This simultaneous macro and micro negotiation requires wider discussions with key stakeholders to understand the complexities and conflicts involved.

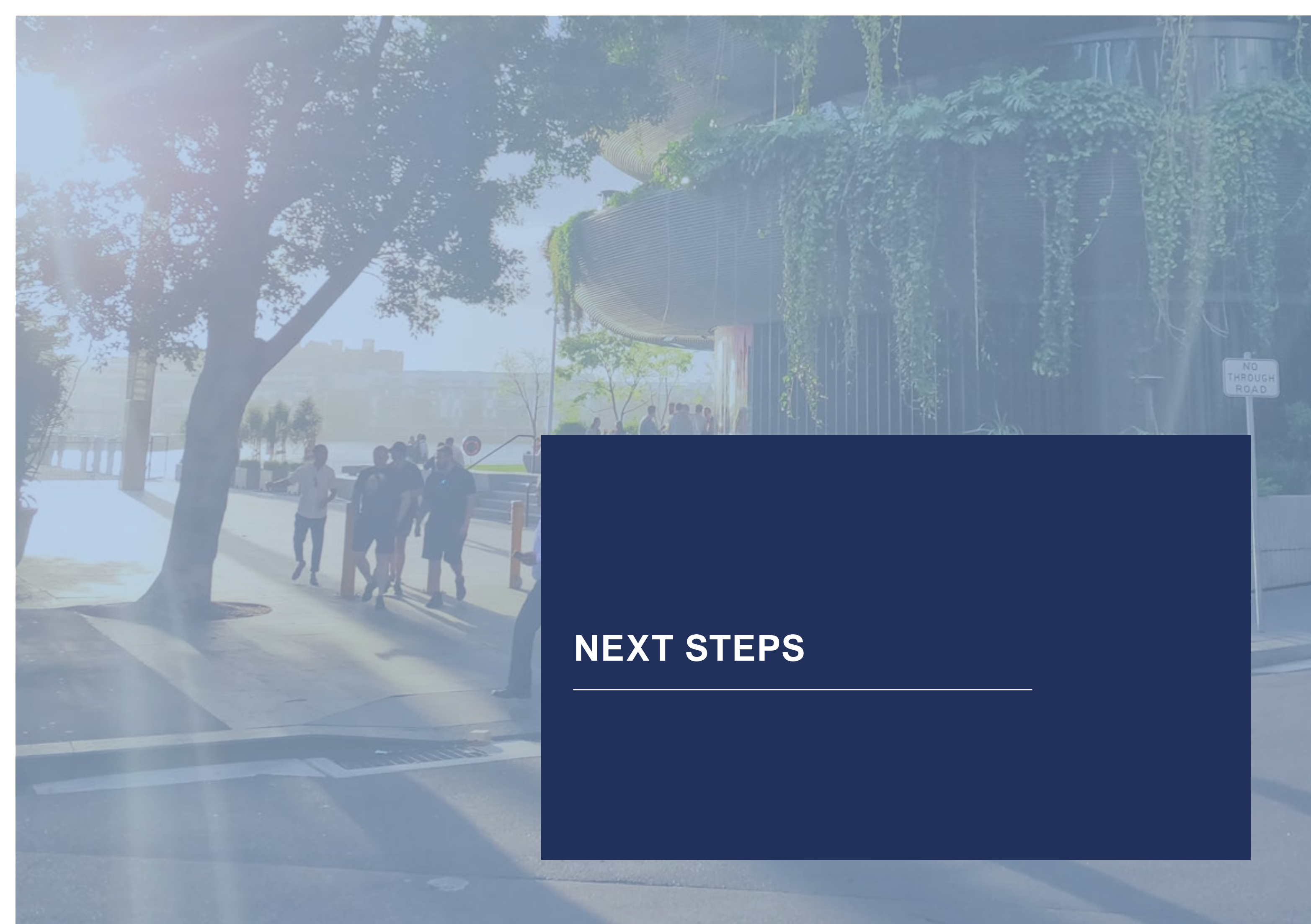


Safe outcomes emerge from good street design

A successful street requires holistic thinking. By acknowledging the movement and place priorities first, we can start to adopt a more proactive (rather than reactive) approach to street design.

This includes selecting treatments that address the relative user priority suitable to the street type, as well as setting place performance criteria to ensure the street can reach its potential.





NEXT STEPS

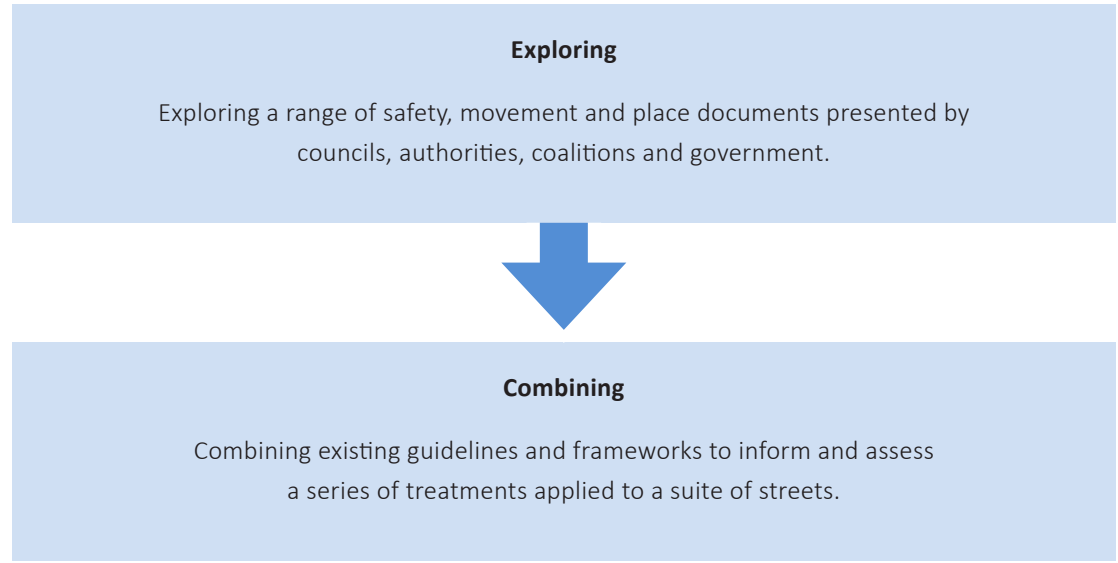
NEXT STEPS

By testing the process across metropolitan and regional locations, we were able to understand how safety, movement and place components can be assessed within the context of a potential street type.

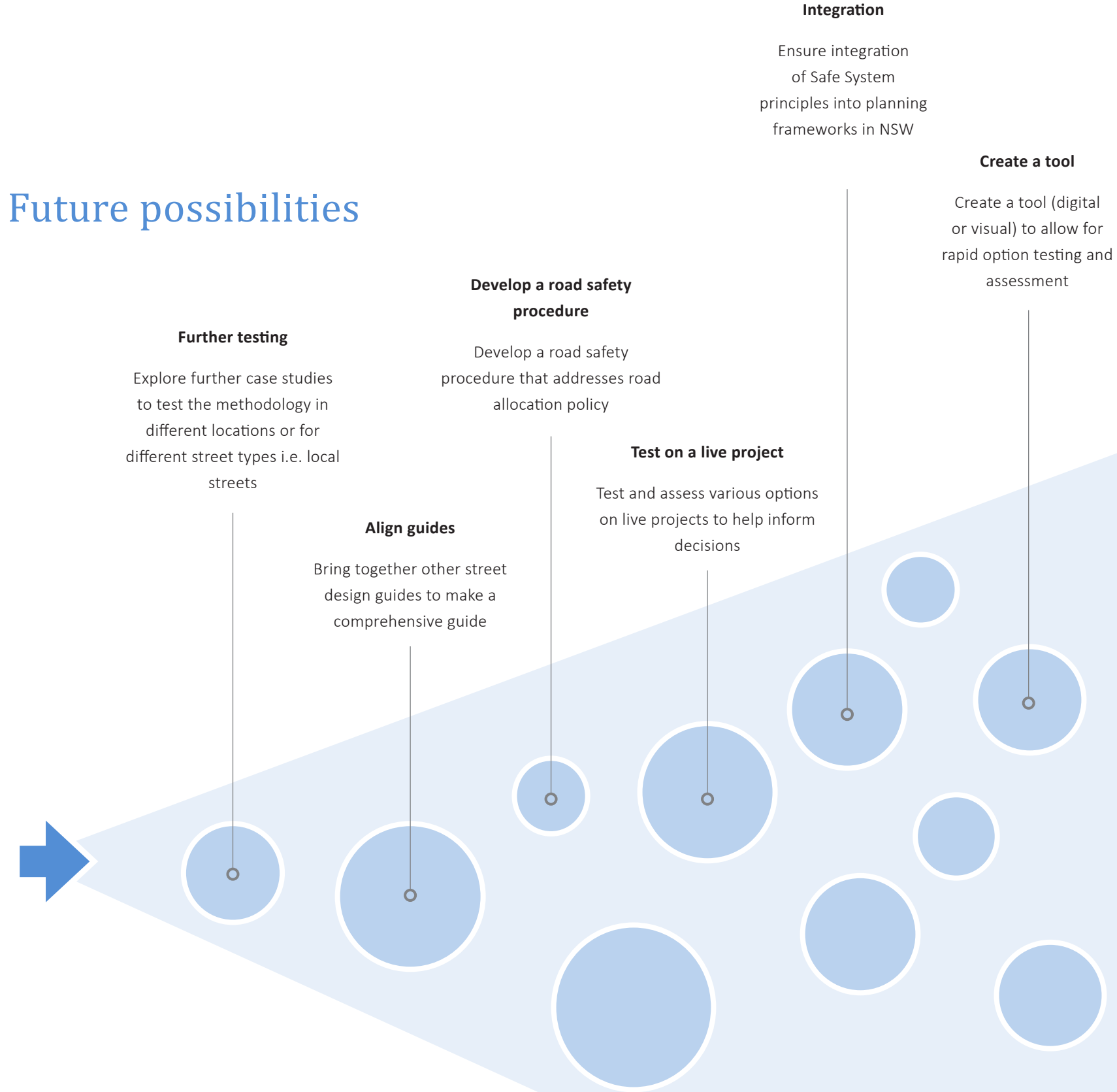
The case studies have demonstrated best-practice scenarios by applying and combining safety treatments while simultaneously viewing the street holistically in terms of movement and place.

This study provides many future opportunities and trajectories for exploration.

This document



Future possibilities





REFERENCES

REFERENCES

Key Report References

Safe System Assessment Framework, Austroads, 2016

Practitioners Guide to Movement and Place - Implementing Movement and Place in NSW, Government Architect NSW, 2020

Urban Street and Road Design Guide, Auckland Transport, 2019

Report Images

<https://unsplash.com/>

<https://www.google.com/maps>

<https://www.openstreetmap.org>

Key Literature Material

Bankstown Complete Streets; CBD Transport and Place Plan, Canterbury Bankstown Council, 2019

Safe System Assessment Framework, Austroads, 2016

Road Safety Countermeasure, TfNSW, 2015

Integrating Safe System with Movement and Place for Vulnerable Road Users, Austroads, 2020

Bondi Junction Complete Streets, Waverley Council, Waverley Council, 2013

Design and Implementation of Shared Zones Including Provision for Parking, RMS, 2013

Speed Camera Programs: 2018 Annual Review, TfNSW, 2019

Transport Plan for Brisbane- Strategic Directions, Brisbane City Council, 2018

Road Planning and Design Manual, Department of Main Roads, 2006

Intelligent Transport Systems: Traffic Systems, TfNSW, 2019

Campaigns- Safer Behaviour, TfNSW Centre for Road Safety, 2019

Urban Street and Road Design Guide, Auckland Transport, 2019

Roads and Streets Framework, Auckland Transport, 2019

Share the Wealth: Shared Spaces Make Great Business Places, Auckland Transport, 2015

Manual for Streets 2, CIHT, 2010

Urban Street Design Guide, NACTO, 2013

Measuring the Street: New Metrics for 21st Century Streets, NYCDOT, 2012

MAIN STREETS IMAGE SOURCES

Appendix 2.1

<https://welldesignedandbuilt.com/2013/06/10/superkilen-an-innovative-public-space-in-copenhagen/>
<http://www.alifefulloferendipity.com/brunswick-street-hip-happening/>
<https://globaldesigningcities.org/publication/global-street-design-guide/streets/pedestrian-priority-spaces/pedestrian-plazas/example/>
<https://globaldesigningcities.org/publication/global-street-design-guide/streets/pedestrian-priority-spaces/parklets/example/>
<https://www.dezeen.com/2015/11/28/portable-parklet-wmb-studio-greenery-bench-london-park/>
<https://www.britannica.com/technology/elevated-transit-line>
<https://japanjunk.com/akihabara-what-to-do-in-the-anime-otaku-world-of-tokyo/>
<https://www.itdp.org/2019/10/01/pedestrian-bridges-make-cities-less-walkable-why-do-cities-keep-building-them/>
<https://bicycledutch.wordpress.com/2015/11/24/amsterdam-central-station-tunnel/>
<https://www.mercerhoteles.com/en/blog/de-paseo-por-la-rambla-de-barcelona>
<https://peopleforbikes.org/blog/the-feds-jump-on-board-protected-bike-lanes-are-now-official-federal-policy/>
<https://denverurbanism.com/2011/07/buffered-bike-lane-provides-greater-access-to-downtown-for-people-on-bikes.html>
<https://www.gotokyo.org/en/spot/78/index.html>
<https://www.mentalfloss.com/article/76848/15-worlds-most-bike-friendly-cities>
<https://beatlesinlondon.com/the-abbey-road-crossing-has-it-moved/>
<https://www.yarracity.vic.gov.au/news/2018/07/26/red-wombat-crossing-installed>
<https://www.smh.com.au/national/nsw/oslo-cut-road-deaths-to-one-in-2019-can-sydney-do-the-same-20200111-p53qmqz.html>
<https://www.amusingplanet.com/2013/07/the-peculiar-architecture-and-design-of.html>
<https://nacto.org/publication/urban-street-design-guide/intersections/minor-intersections/raised-intersections/>
https://www.mankatofreepress.com/news/local_news/round-and-round-and-round-we-go/article_c2df06a8-7ec7-5f47-96dc-b278cba768c0.amp.html
<https://portadbug.org/2018/07/29/portadbug-dutch-roundabouts-in-south-australia/>
<https://www.eltis.org/discover/case-studies/utrechts-sustainable-freight-transport-netherlands>

Appendix 2.2

<https://www.griffith.edu.au/parking/parking-rules>
<https://www.boroondara.vic.gov.au/parking-roads/parking-fines/parking-public-holidays>
<https://www.griffith.edu.au/parking/parking-rules>
<https://www.theage.com.au/national/victoria/mobile-fiends-now-need-not-look-up-as-melbourne-tests-streetlevel-traffic-lights-20170327-gv73bd.html>
<https://smartcitiesconnect.org/toronto-implements-pilot-for-intersection-traffic-light-synchronization/>
<https://www.smartparking.com/smartpark-system/smart-app>
<https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/median-refuge-island/>
<https://www.governmentarchitect.nsw.gov.au/resources/case-studies/2017/11/bourke-street-cycleway>
<https://weburbanist.com/2015/09/20/sweet-transit-japans-cute-fruit-shaped-bus-stops/>
<https://www.yarracity.vic.gov.au/services/roads-and-traffic/wellington-street-bike-lanes--stage-2>
<https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/bike-boxes/>
https://en.wikipedia.org/wiki/Bicycle_parking_rack
<https://momentummag.com/protected-intersections-latest-trend-cycling-safety/>
<http://peopleforbikes.org/blog/it-turns-out-that-protected-bike-lanes-are-fantastic-for-walking-safety-too/>
<https://www.vicnews.com/news/bike-detection-sensors-installed-at-busy-saanich-intersection/>
<http://toolkit.irap.org/default.asp?page=treatment&id=56>, <https://facilityxexecutive.com/2014/07/asia-receives-grant-for-chinatown-green-project/>
<https://citygreen.com/case-studies/singleton-town-centre/>
<https://www.blogto.com/city/2018/04/map-busiest-pedestrian-intersections-downtown-toronto/>
<https://nacto.org/publication/urban-street-design-guide/street-design-elements/curb-extensions/pinchoint/>
<https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/corner-radii/>
<https://www.victoriastreet.org.au/post/grow-your-blog-community>
<https://smartgrowth.org/bigger-isnt-always-better-narrow-traffic-lanes-make-cities-safer/>
<http://www.farnhamherald.com/article.cfm?id=140051&headline=Alton%E2%80%99s%20flashy%20new%20speed%20signs%20ready%20to%20go§ionIs=&searchyear=2020>
<https://www.tvnz.co.nz/one-news/new-zealand/government-wants-widening-footpaths-more-cycleways-so-people-can-maintain-2m-distance-after-lockdown>
<https://nacto.org/publication/transit-street-design-guide/stations-stops/stop-configurations/boarding-bulb-stop/>
<https://centraiseattlegreenways.com/2012/08/inspiration-from-portlands-neighborhood-greenways/2012-08-11-09-21-58/>
<https://www.strongtowns.org/journal/2019/10/1/lessons-from-the-streets-of-tokyo>
<https://www.travelchannel.com/interests/food-and-drink/photos/best-cities-for-al-fresco-dining>
<https://www.wired.co.uk/article/traffic-lights-uk-london>

Appendix 2.3

<https://www.newcastleherald.com.au/story/5046554/intimidation-of-inspectors/>
<https://segd.org/what-wayfinding>
<https://heartofthecity.co.nz/article/queen-street-lights>
<https://towardszero.nsw.gov.au/sponsorships/sydney-swans>
<https://bicycledutch.wordpress.com/2011/06/02/rolling-out-a-red-carpet-for-cyclists/>
https://www.tohokuandtokyo.org/spot_181/
<https://www.livinspaces.net/projects/gardens-and-out-door/ourcacia-parklet-in-san-francisco-by-ogryd-ziak-prillinger-architects/>
<https://www.dezeen.com/2019/12/11/new-york-city-rubbish-bin-redesign/>
<http://citycollection.melbourne.vic.gov.au/the-public-purse/>
<https://www.couriermail.com.au/questnews/moreton/almost-2000-drivers-caught-out-in-moreton-bay-by-red-light-cameras/news-story/14fe1e812700fb643346d02f3bccd791>

Appendix 2.1

<http://www.rogersmarvel.com/projects/NYSE/>
<http://www.alifefulloferendipity.com/brunswick-street-hip-happening/>
<https://globaldesigningcities.org/publication/global-street-design-guide/streets/pedestrian-priority-spaces/pedestrian-plazas/example/>
<https://globaldesigningcities.org/publication/global-street-design-guide/streets/pedestrian-priority-spaces/parklets/example/>
<https://www.dezeen.com/2015/11/28/portable-parklet-wmb-studio-greenery-bench-london-park/>
<https://ahistoricalhiatus.com/2014/08/01/1040/>
<https://good-design.org/projects/caulfield-to-dandenong-level-crossing-removal-project/>
<https://www.heraldsun.com.au/leader/east/box-hill-central-mall-and-station-st-pedestrian-underpass-listed-in-melbournes-top-10-places-where-walkers-feel-unsafe/news-story/279ce6a7b19fdce63be34c1c019dbb97>
<https://bicycledutch.wordpress.com/2015/06/16/first-garden-bridge-in-the-netherlands-opened/>
<https://www.mercerhoteles.com/en/blog/de-paseo-por-la-rambla-de-barcelona>
<https://peopleforbikes.org/blog/the-feds-jump-on-board-protected-bike-lanes-are-now-official-federal-policy/>
<https://denverurbanism.com/2011/07/buffered-bike-lane-provides-greater-access-to-downtown-for-people-on-bikes.html>
https://en.wikipedia.org/wiki/Traffic_light
<https://www.mentalfloss.com/article/76848/15-worlds-most-bike-friendly-cities>
<https://www.flickr.com/photos/infomatique/34857285282>
<https://www.yarracity.vic.gov.au/news/2018/07/26/red-wombat-crossing-installed>
<https://www.smh.com.au/national/nsw/oslo-cut-road-deaths-to-one-in-2019-can-sydney-do-the-same-20200111-p53qmqz.html>
<https://www.amusingplanet.com/2013/07/the-peculiar-architecture-and-design-of.html>
<https://nacto.org/publication/urban-street-design-guide/intersections/minor-intersections/raised-intersections/>
<https://www.dailymail.co.uk/news/article-1375709/In-spin-Motorists-cyclists-baffled-pointless-double-roundabout.html>
<https://globaldesigningcities.org/publication/global-street-design-guide/intersections-4/mini-roundabout/>
<https://publications.wri.org/citessafer/>
<https://www.eltis.org/discover/case-studies/utrechts-sustainable-freight-transport-netherlands>

Appendix 2.2

<https://www.griffith.edu.au/parking/parking-rules>
<https://www.boroondara.vic.gov.au/parking-roads/parking-fines/parking-public-holidays>
<https://www.griffith.edu.au/parking/parking-rules>
<https://www.theage.com.au/national/victoria/mobile-fiends-now-need-not-look-up-as-melbourne-tests-streetlevel-traffic-lights-20170327-gv73bd.html>
<https://smartcitiesconnect.org/toronto-implements-pilot-for-intersection-traffic-light-synchronization/>
<https://www.smartparking.com/smartpark-system/smart-app>
<https://publicrealm.org/simplify-crossings/>
<https://www.governmentarchitect.nsw.gov.au/resources/case-studies/2017/11/bourke-street-cycleway>
<https://weburbanist.com/2015/09/20/sweet-transit-japans-cute-fruit-shaped-bus-stops/>
<https://www.yarracity.vic.gov.au/services/roads-and-traffic/wellington-street-bike-lanes--stage-2>
<https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/bike-boxes/>
https://en.wikipedia.org/wiki/Bicycle_parking_rack
<https://momentummag.com/protected-intersections-latest-trend-cycling-safety/>
<http://peopleforbikes.org/blog/it-turns-out-that-protected-bike-lanes-are-fantastic-for-walking-safety-too/>
<https://www.vicnews.com/news/bike-detection-sensors-installed-at-busy-saanich-intersection/>
<http://toolkit.irap.org/default.asp?page=treatment&id=56>, <https://facilityxexecutive.com/2014/07/asia-receives-grant-for-chinatown-green-project/>
<https://citygreen.com/case-studies/singleton-town-centre/>
<http://2030palette.org/shared-streets/>
<https://nacto.org/publication/urban-street-design-guide/street-design-elements/curb-extensions/chicane/>
<https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/corner-radii/>
<https://www.onlymelbourne.com.au/chinatown-melbourne-cbd>
<https://smartgrowth.org/bigger-isnt-always-better-narrow-traffic-lanes-make-cities-safer/>
<http://www.farnhamherald.com/article.cfm?id=140051&headline=Alton%E2%80%99s%20flashy%20new%20speed%20signs%20ready%20to%20go§ionIs=&searchyear=2020>
<https://www.tvnz.co.nz/one-news/new-zealand/government-wants-widening-footpaths-more-cycleways-so-people-can-maintain-2m-distance-after-lockdown>
<https://nacto.org/publication/transit-street-design-guide/stations-stops/stop-configurations/boarding-bulb-stop/>
<https://centraiseattlegreenways.com/2012/08/inspiration-from-portlands-neighborhood-greenways/2012-08-11-09-21-58/>
<https://www.strongtowns.org/journal/2019/10/1/lessons-from-the-streets-of-tokyo>
<https://www.travelchannel.com/interests/food-and-drink/photos/best-cities-for-al-fresco-dining>
<https://www.wired.co.uk/article/traffic-lights-uk-london>

Appendix 2.3

<https://www.newcastleherald.com.au/story/5046554/intimidation-of-inspectors/>
<https://segd.org/what-wayfinding>
<https://www.arch2o.com/wait-for-the-pedestrian-friendly-oxford-street-coming-up-in-2018/>
<https://towardszero.nsw.gov.au/sponsorships/sydney-swans>
<https://www.tvnz.co.nz/one-news/new-zealand/government-wants-widening-footpaths-more-cycleways-so-people-can-maintain-2m-distance-after-lockdown>
<https://dirt.asia.org/2016/04/18/margie-ruddick-is-wild-by-design/>
<https://www.livinspaces.net/projects/gardens-and-out-door/ourcacia-parklet-in-san-francisco-by-ogryd-ziak-prillinger-architects/>
<https://www.dezeen.com/2019/12/11/new-york-city-rubbish-bin-redesign/>
<https://edition.cnn.com/travel/article/worlds-most-bright-colorful-places/index.html?gallery=1>

Prepared for

NSW Centre for Road Safety

Prepared by

Arup

Arup Pty Limited

Level 5, 151 Clarence Street

Sydney, NSW 2000

Australia

