# Western Sydney Street Design Guidelines

September 2020

## ACKNOWLEDGMENT OF COUNTRY

The Western Sydney Planning Partnership acknowledges the traditional owners of the lands that include the Western Parkland City and the living culture of the traditional custodians of these lands.

We recognise that the traditional owners have occupied and cared for this Country over countless generations, and celebrate their continuing contribution to the life of Greater Sydney.

## TEAM

Western Sydney Street Design Guidelines were prepared by ASPECT Studios for the Western Sydney Planning Partnership.

WESTERN SYDNEY PLANNING PARTNERSHIP

ASPECT Studios

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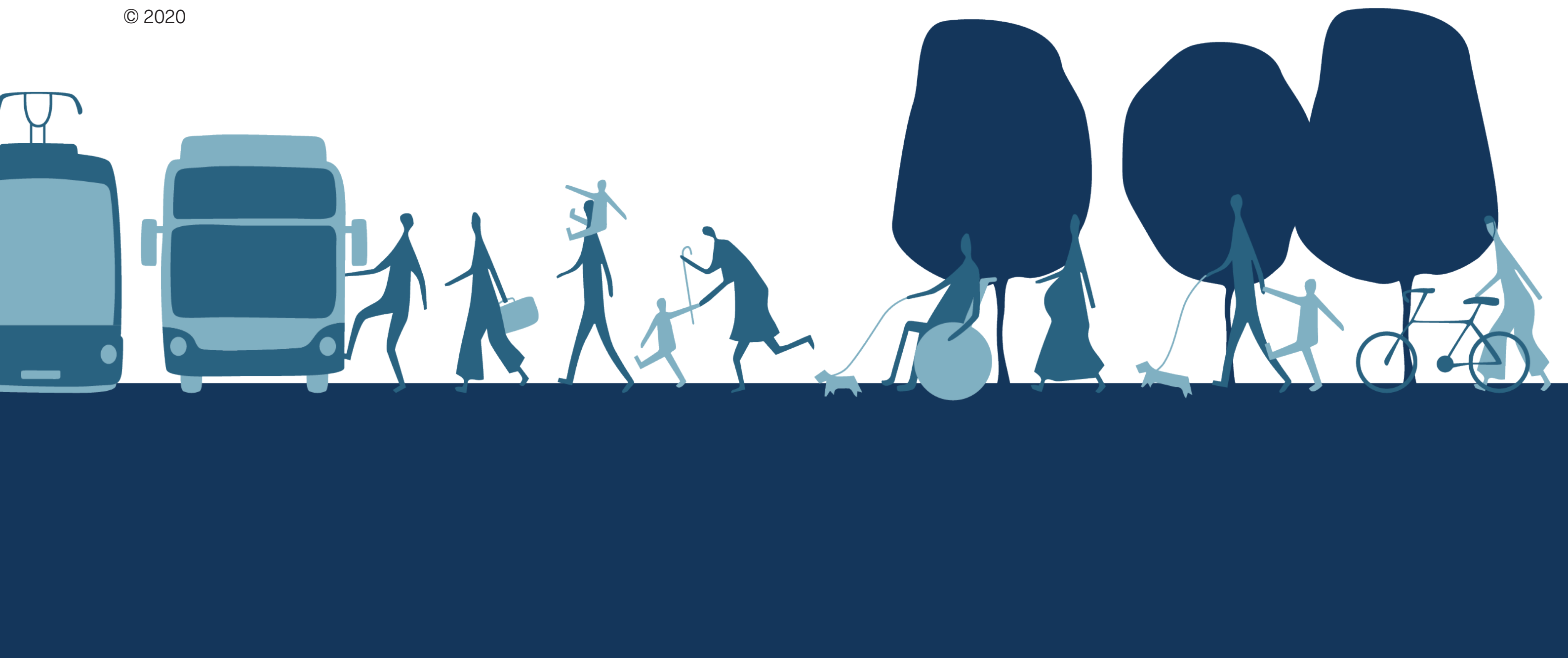

## PARTNERS

The Western Sydney Street Design Guidelines have been developed for the Western Sydney Planning Partnership as part of the Uniform Engineering and Design Standards project. This project is a commitment under the Western Sydney City Deal and is funded by the Australian Government.

The Western Sydney Planning Partnership is a local government-led initiative that brings together the Local councils of Blacktown, Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly and key NSW government agencies to drive more efficient and higher quality outcomes for Western Sydney through innovative and collaborative planning.

Australian Government

NSW GOVERNMENT

Blacktown City Council

blue mountains City Council

camden council

CAMPBELLTOWN CITY COUNCIL

FairfieldCity Celebrating diversity

Hawkesbury City Council

LIVERPOOL CITY COUNCIL

PENRITH CITY COUNCIL

Wollondilly Shire Council

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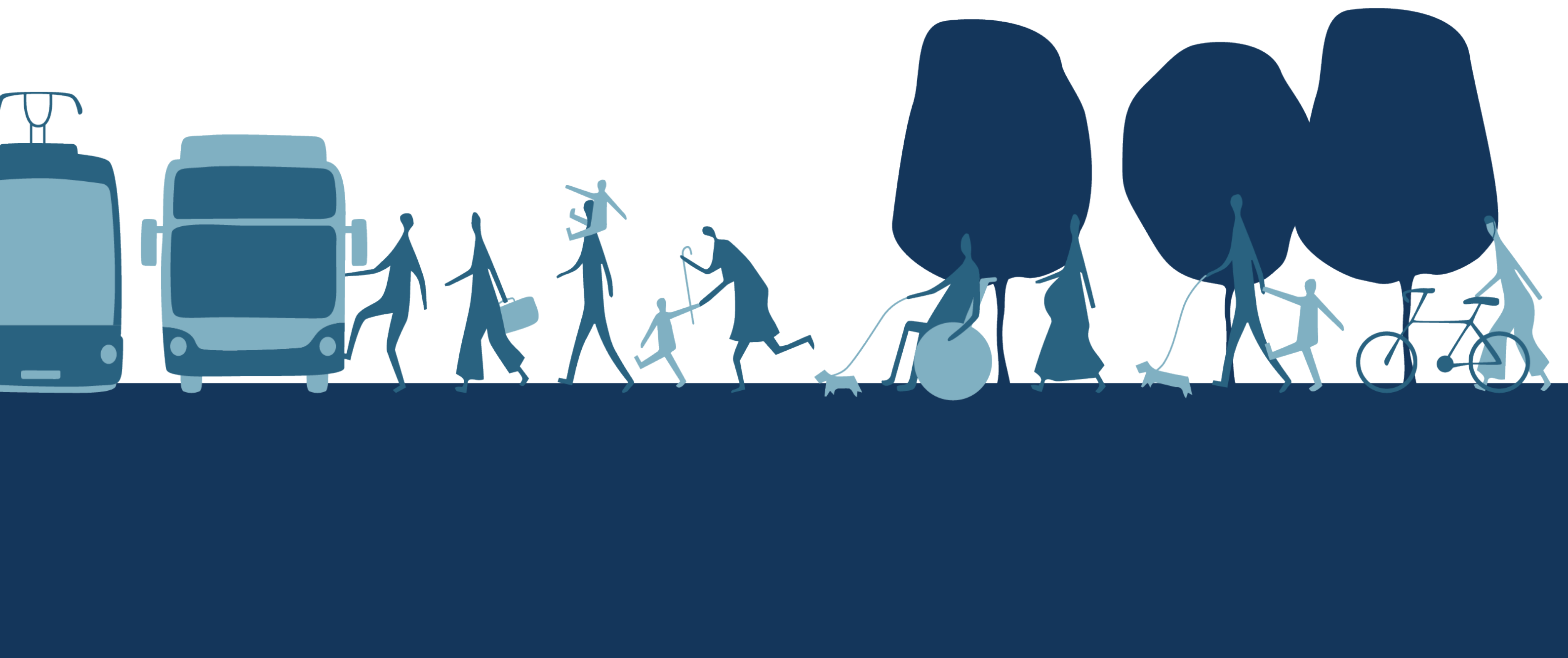
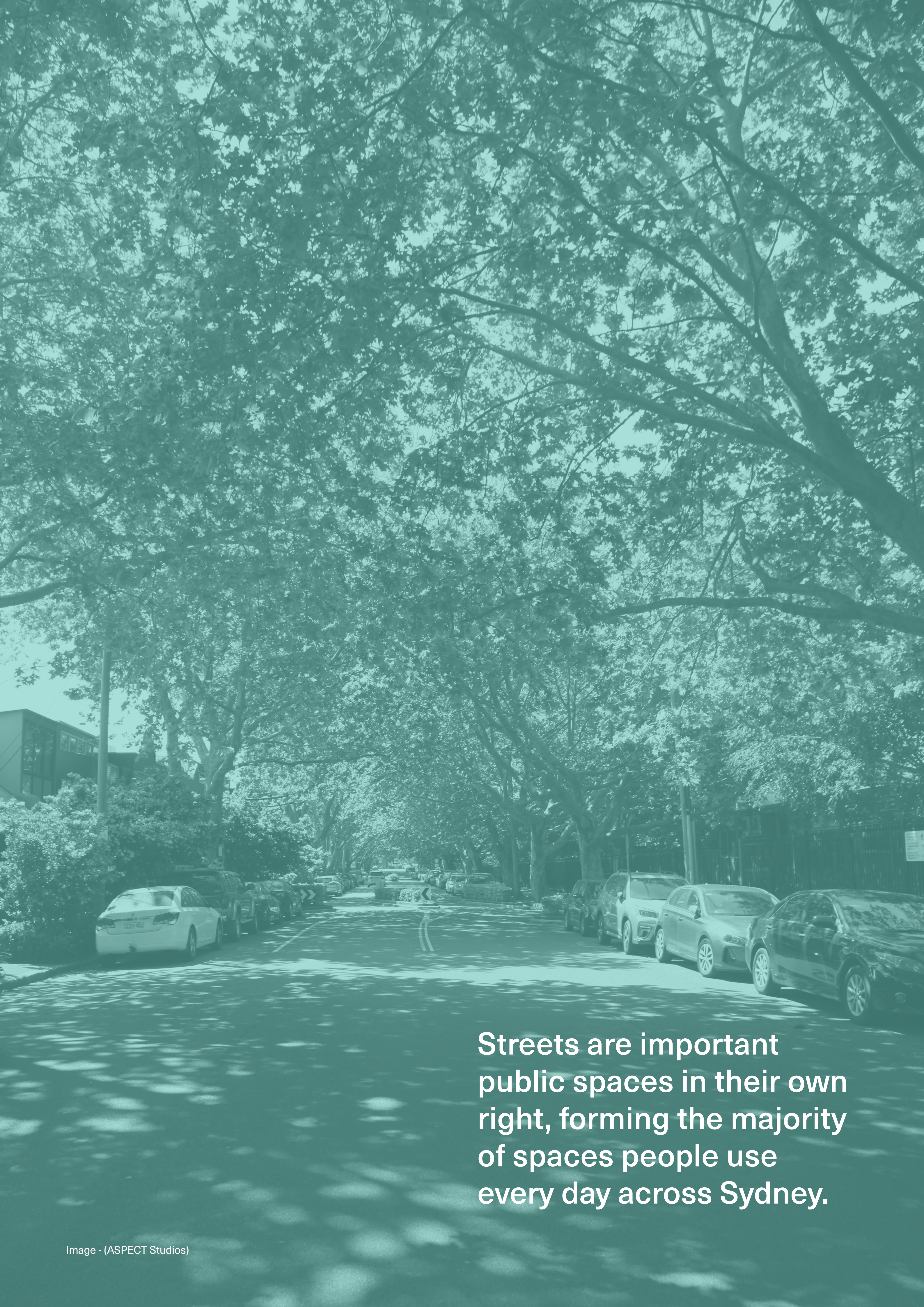


# A

# Introduction



**Streets are important public spaces in their own right, forming the majority of spaces people use every day across Sydney.**

Image - (ASPECT Studios)

# A1 FOREWORD

**Streets form the backbone of public space, often accounting for a quarter or more of the total land area in our cities and neighbourhoods. Streets typically make up around 80% of all public space in an urban area, with parks and squares comprising less than a fifth of our shared spaces.**

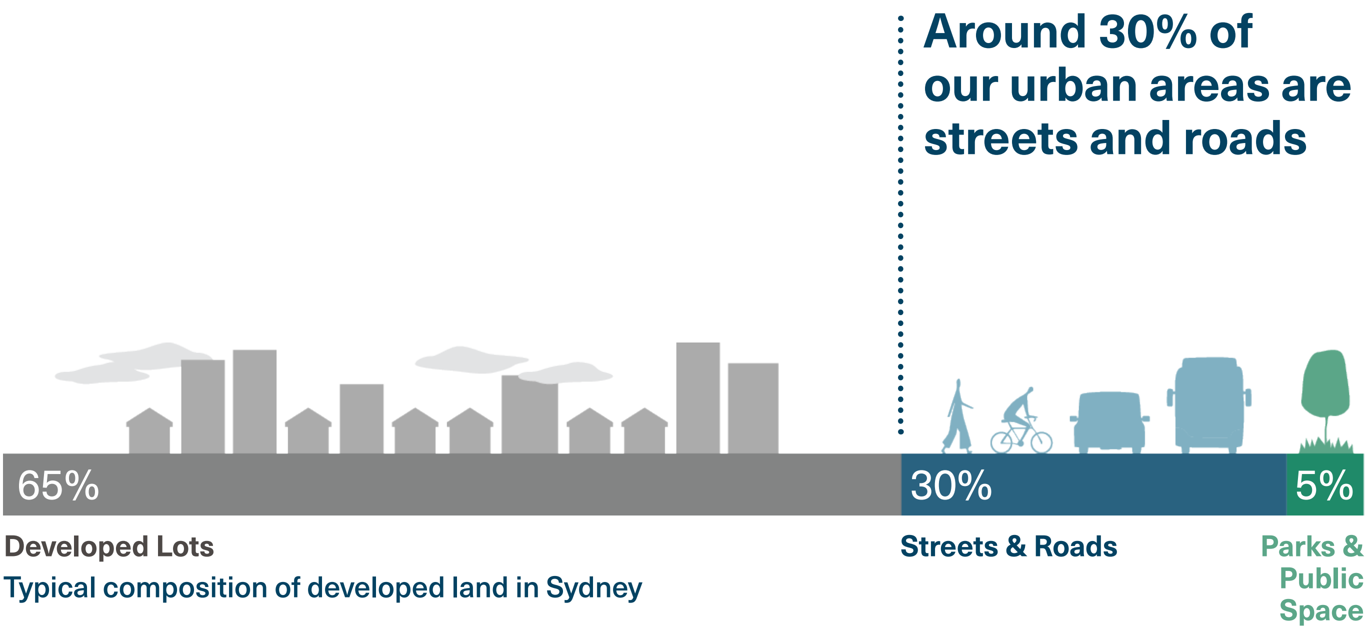
Streets are the spaces we move through, gather in and connect with our community. Streets form an important part of the visual appeal of every neighbourhood. They need to balance community demands, functional requirements, climate pressures, amenity and movement. Getting streets right is one of the most important demands of the urban landscape.

The design and establishment of new streets plays an instrumental role in the success of a neighbourhood or centre, and the health and happiness of the people that live in them.

Since the 1950s, with the increase in suburban development and private vehicle ownership in Sydney, streets were redefined with clear and defined rules about where traffic, stormwater and utilities were located. As vehicle speeds and traffic volumes increased, the complex activities and diversity of users on our streets dramatically reduced. Streets became simpler, more efficient but more often than not, less attractive, hotter, dominated by cars and less environmentally sustainable.

The Western Sydney Street Design Guidelines (The Guidelines) seek to address this imbalance to create streets with improved environmental, social and health outcomes for all street users.

The Guidelines are focused on service provision to new greenfield development areas in Western Sydney. They do however have the potential to be applied to existing areas that are undergoing significant change and are in an appropriate urban setting.




Typical composition of developed land in Sydney

# A2 BACKGROUND

## A2.1 WESTERN SYDNEY CITY DEAL


**In 2016 the Australian Government committed to the Smart Cities Plan. This Plan set out the Government's vision for productive and liveable cities that encourage innovation, support growth and create jobs. City Deals are the mechanism for delivering the Smart Cities Plan. They are a partnership formed between the three levels of government; Federal, State and Local.**

The Western Sydney City Deal outlines a 20-year strategy to create world-class jobs and a great quality of life for residents in Western Sydney. It outlines 38 commitments that will help realise this vision.

The Western Sydney Planning Partnership (WSPP) was formed in 2018 in response to one of these commitments. It is a collaboration between State and Local Governments, and includes representation from the Local councils of Blacktown, Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly, as well as key State agencies; Infrastructure NSW, Department of Planning, Industry and Environment, Sydney Water, Transport for NSW and the Greater Sydney Commission.

The approval for the new Western Sydney Airport has stimulated new investment, both public and private, that will drive the development of large areas of existing agricultural land for housing, commercial, industrial, agribusiness and logistics uses. With this investment comes a generational opportunity to establish new and innovative design and engineering standards that will improve liveability and amenity.

The WSPP has been tasked with delivering one of the key commitments of the City Deal — to develop uniform local government engineering design standards for the region. The Street Design Guidelines for Western Sydney (the Guidelines) has been developed as part of this commitment. They will be supported by the Engineering Design Manual for Western Sydney, a complementary document which provides the technical detail on designing and building the streets introduced in this Guide.

### PREMIER'S PRIORITIES

#### Greener public spaces

The NSW Government has set a target to increase the proportion of homes in urban areas within 10 minutes' walk of quality green, open and public space by 10 per cent by 2023.

#### Greening our city

The NSW Government has set a target to increase the tree canopy and green cover across Greater Sydney by planting one million trees by 2022.

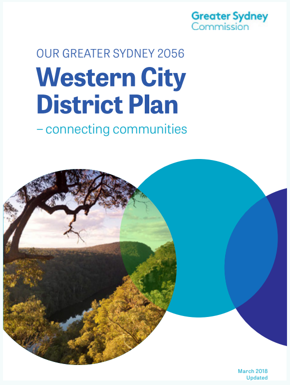
The City Deal, signed in March 2018, brings together the Australian and NSW governments and the eight Local councils in the Western Parkland City to deliver transformative change to the region over the next 20 years.

The three tiers of government are working collaboratively and contributing resources to deliver the 38 commitments within the City Deal and create quality outcomes for the Western Parkland City.

Integral to the City Deal is the development of the Western Parkland City, incorporating the existing metropolitan centres of Campbelltown, Liverpool and Penrith, together with Western Sydney Airport and the strategic centres of Richmond–Windsor, Katoomba, St Marys, Fairfield, Leppington and Narellan.

Image - (ASPECT Studios)

## A2.2 WESTERN CITY DISTRICT PLAN




**The Greater Sydney Commission (GSC) has committed to a Western Parkland City that sits within Greater Western Sydney and covers the local government areas that are part of the Western City Deal with state and federal governments. The Western City District Plan outlines a range of priorities for housing, infrastructure, public space and centres.**

The Western Parkland City is being developed as the third city in the Sydney Metropolitan area to complement the eastern Harbour City of Sydney and the central River City of Parramatta. The vision for a metropolis of three cities means residents in the Western City District will have quicker and easier access to a wider range of jobs, housing types and activities. This vision will improve the District's lifestyle and environmental assets.

Relevant key issues addressed in the plan include:

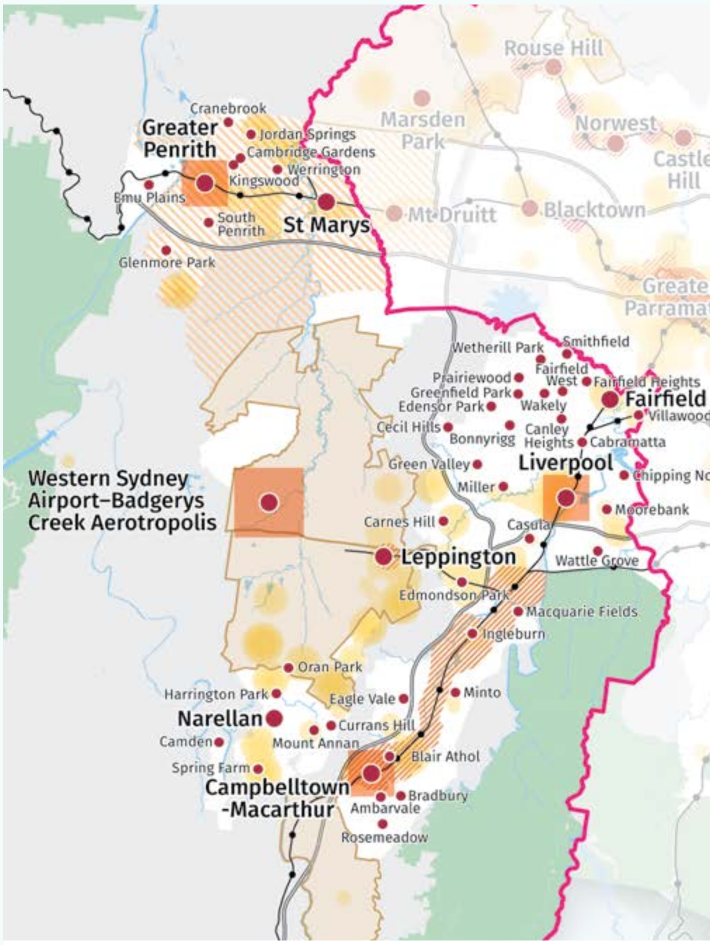
— Mitigating the urban heat island effect and providing cooler places by extending urban tree canopy and retaining water in the landscape.

— Developing a range of housing, providing access to public transport and infrastructure including schools, hospitals and community facilities.

— Linking walking and cycling paths, bushland and a green urban landscape which is framed by the Greater Blue Mountains World Heritage Area, the Scenic Hills and Western Sydney Parklands.

— Enhancing and protecting South Creek, Georges River and Hawkesbury–Nepean river systems.

— Protecting the District's natural landscapes, heritage and tourism assets, unique rural areas and villages.




**Western City District future housing supply**
GREATER SYDNEY COMMISSION
FIGURE 11, PAGE 43 WESTERN CITY DISTRICT PLAN 2018

Image - (ASPECT Studios)


**Priority W4**

**Fostering healthy, creative, culturally rich and socially connected communities**

OBJECTIVE 7
**Communities are healthy, resilient and socially connected.**

**Priority W15**

**Increasing urban tree canopy cover and delivering Green Grid connections**

OBJECTIVE 30
**Urban tree canopy cover is increased.**

OBJECTIVE 32
**The Green Grid links parks, open spaces, bushland and walking and cycling paths.**

The NSW Government has set a target to increase tree canopy cover across Greater Sydney to 40%

# A3 NEW APPROACHES AND OPPORTUNITIES

**With the approval to construct Sydney's second airport at Badgerys Creek, a new focus on coordinated infrastructure delivery for Western Sydney has been established through the Western Sydney City Deal and the Western District Plan.**

The new Western Sydney International (Nancy–Bird Walton) Airport provides a generational opportunity to lay important foundations for long term resilience and prosperity in Western Sydney. Government alignment seeks to build planned and timely infrastructure that supports new communities and new jobs. New investment in public transport including bus and rail will support a move from the existing heavy reliance on vehicles which accounts for around 85% of all trips within the region.

The planned future growth of the Western Parkland City will deliver around 10,000 new dwellings per year for a total of 185,000 by 2036. This anticipated growth will require over 1500 km of streets to be built at a rate of around 90–100 km per year. The importance of the task warrants careful and deliberate action to ensure new infrastructure is high quality and meets the highest performance standards.

The creation of The Guidelines and parallel Engineering Design Manual for Western Sydney will prepare local and state government to manage these imminent challenges and build the best possible streets. They will establish regional standards to be used across council boundaries, providing clarity and certainty to the community, industry, investors and developers.

New and existing streets will need to be flexible to adapt for changes in use, advances in technology and evolving community expectations. Making allowances for new services and 'smart infrastructure' that will seamlessly integrate is an important part of the project and will be delivered through agreement across government agencies and utility suppliers.

Image - (ASPECT Studios)

Image - (ASPECT Studios)

# A4 THE CASE FOR CHANGE

## Greener and cleaner streets

**Western Sydney is growing quickly, and future street design should anticipate changed environmental factors as well as provide the best possible outcomes for communities in the region.**

The improved retention and use of water in streetscapes is critical to establishing tree growth and healthy canopy, whilst reducing run–off pollution to local wetlands, creeks and rivers. A major factor in the liveability of every neighbourhood in the region will be the ability of surfaces in new developments to avoid retaining and re-radiating heat. This needs to be mitigated through new design and landscape measures.

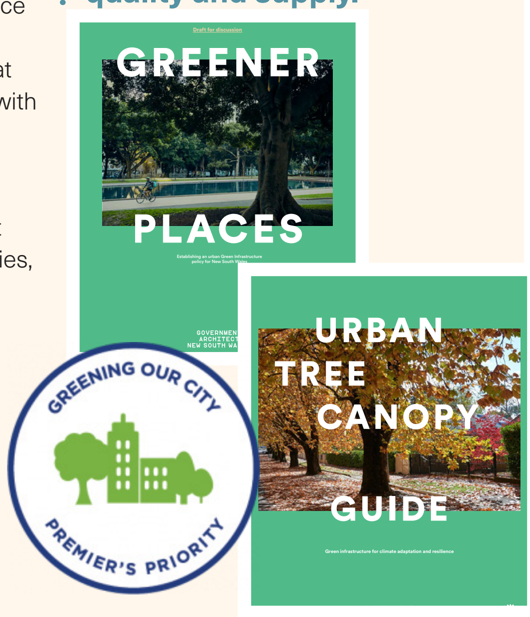
### More Trees, Cooler Cities

There is overwhelming evidence good tree canopy reduces ambient temperatures and mitigates the urban heat island effect through shade and evapotranspiration. Ambitious targets to increase street trees and green space will help create liveable streets and communities in a part of Sydney that already has a high number of days with significant heat.

### A Better Environment

Tree canopy extends animal habitat and increases the biodiversity of cities, serving as a home for animals and birds. Air quality is improved by removing fine particles from the air. Trees also mitigate the impact of climate change by acting as a storehouse for carbon dioxide. Permeable ground surfaces, raingardens and swales help to reduce nitrogen and phosphorus pollution in our creeks and rivers.

**This priority is part of a long term commitment to planting five million trees in Sydney by 2030 and managing environmental pressures including water quality and supply.**




## Designing safer streets

**The NSW Government has a long-term ambition to reduce road fatalities to zero by 2056. A State Priority Target was established to reduce fatalities by at least 30% from 2008–2010 levels by 2021.**

In NSW 70% of all fatalities occur on country roads, and rates of fatality are five times higher by population in rural areas — but around two-thirds of serious injuries occur in urban metropolitan areas.

Designing safer roads and reducing speeds in urban areas whilst also improving separation between various road users (including drivers, riders, cyclists and pedestrians) will not only assist to reduce death and injury but also greatly improve urban amenity.

### Towards Zero

The Towards Zero program is designed to increase safety for all users of the street by adopting the Safe Systems approach, recognising that roads need to be designed for the separation of vulnerable road users and with safe speeds. This includes self-reinforcing road designs, pedestrian crossings, refuges and traffic calming devices, as well as expanding 40km/h zones in high pedestrian and local areas. It will also support the Local Government Road Safety Program and Local councils in their role as managers of broad local road networks.

### Reduced speeds

Reducing vehicle speeds in urban areas is a key factor in safety, injury rates, amenity and perception of street spaces as fundamentally 'dangerous'. With minimal impact on vehicle drivers, neighbourhoods can reclaim street space as multi-functional places that feel welcoming and safe.

**This guide will help to deliver safer, slower streets in Western Sydney through new design measures and improved safety for all road and street users.**


TOWARDS ZERO

# Making better public spaces

**Streets are the most common type of public space in urban areas. Streets provide a great opportunity to contribute to the identity and amenity of every neighbourhood.**

Better Placed by the NSW Government Architect establishes the value of good design. The document identifies key concepts, good process, and objectives for good design outcomes.

Good design in the built environment is informed by and derived from its location, context and social setting. It is place–based and relevant to and resonant with local character, and communal aspirations. It also contributes to the evolving local character and setting.

### Better look and feel

The built environment should be welcoming and aesthetically pleasing, encouraging communities to use and enjoy local places.

The feel of a place, and how we use and relate to our environments is dependent upon the aesthetic quality of our places, spaces and buildings. The visual environment should contribute to its surroundings and promote positive engagement.

### Good design everywhere

Good design creates user friendly, enjoyable and attractive spaces, which provide value to people, the place and the natural environment. Good design brings benefits socially, environmentally and economically, and builds on these benefits over time — continually adding value.

**Streets can be much more than places for cars and trucks. They should be beautiful and well designed to encourage inhabitation and connection to community.**


# Improving health and wellbeing

**It is acknowledged that current rates of walking and cycling in Western Sydney are well below desired levels.**

**High vehicle dependence, longer travel distances, unfavourable climate and a reduced emphasis on the provision of high-quality walking and cycling environments have contributed to very low take-up rates of active transport.**

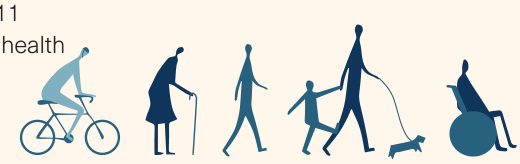
Most people in Sydney make at least two walking trips per day and around 15% walk all the way to work when they live in proximity to major centres and employment hubs. But on average each Sydneysider only walks for about 11 minutes each day leading to poor health outcomes.

### Walking to school

More than 50% of children live less than 2 km from school. However, the number of children walking to school has dropped significantly over the last four decades. Reduced vehicle speeds, improved crossing design and better footpath environments will help to reverse this decline.

### Making space now

To encourage a new generation of pedestrians and cyclists, safe and protected facilities should be included wherever possible. Designing streets with cycleways and shared paths that provide safe unhindered access for all ages and abilities is a priority to increase active lifestyles and reduce reliance on vehicles for local trips.



**The Guidelines places an increased emphasis on the need to construct well designed footpaths, shared paths and cycleways that promote behaviour change and set new standards of comfort and safety.**

Image - (ASPECT Studios)

# Future-proofing streets

**Technology and community needs change over time, and streets should be flexible enough to accommodate new requirements for the delivery of services, utilities and transport modes.**

Streets have accommodated dramatic changes in human habitation and use for thousands of years and over the last century the addition of electricity and telephone services, and the transport revolution inspired by the bicycle, electric tram and the shift from horse and cart to internal combustion engines in the early 20th Century.

The NSW Government is seeking to improve infrastructure investment by embedding smart technology in new and upgraded infrastructure, adopting interoperability protocols and cybersecurity standards.

### Changing transport

The recent rise in on–demand bus and ride share services aided by mobile phone applications is a good example of behaviour change delivered through technology. Connecting people to services, real time tracking and digital contactless fare systems such as Opal are changing the transport options and the way streets are used. A shift to electric vehicles will also have an impact on streets with reduced emissions.

### Technology and utilities

The roll out of 5G mobile services will deliver transfer speeds projected to be about 10 times higher than 4G. This speed will mean reduced data latency that can support significant advances in driverless vehicles and 'smart' components. The connection of a wide network of sensors and data points through these networks can have a significant impact on traffic, pollution and other environmental measures.

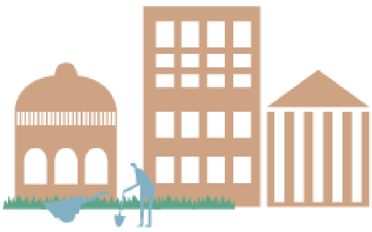
**Smarter cities and neighbourhoods will always need to integrate new and changing technologies, that help shape places and change human behaviour.**



Image - (ASPECT Studios)

# A5 A HOLISTIC DESIGN PROCESS

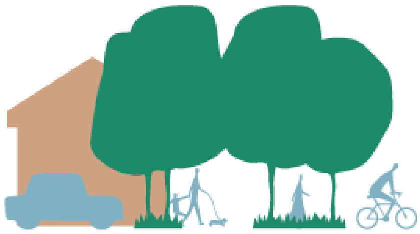
A holistic design process will underpin the delivery of the Guidelines in Western Sydney, ensuring successful outcomes for the future streets. The process to design streets will involve working with stakeholders and various authorities, all of whom play a critical role in the design and delivery of streets in the Western Parkland Sydney. This engagement should occur before, during and after an iterative design process in a meaningful way.



## Governance

**Engage with the multiple agencies** that will play a role in the various aspects of shaping and maintaining the street, and seek buy–in to the new parameters of street design.

**Understand the responsibility for ongoing asset maintenance** and how it is spread across numerous agencies, including Local Government and utility providers.



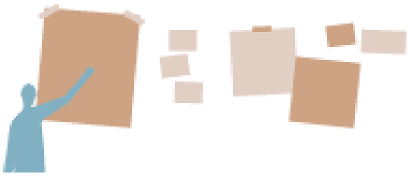
## A Clear Vision

**Develop a clear vision** for the street's look, feel and function in the future.

**Draw on best–practice street design** strategies and innovative examples that are most applicable to the local context.

**Use best–practice precedents** to explain and illustrate the vision for a street.

**Agree what success looks like**, how it will be measured, and against what subsequent iterative design options it can be tested.



## Iterative Design & Testing

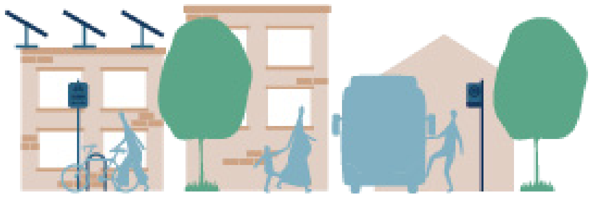
**Generate and explore** multiple solutions, challenging assumptions, conventional methods, mainstream ways of working.

**Test the various requirements of stakeholders** against agreed measures of success to balance aspirations and allocation of street space.

**Inform options testing with analysis** of environmental performance such as urban tree canopy mapping and urban heat.

Involve civil engineers, traffic consultants and landscape architects to **work collaboratively** to develop street designs.

**Adopt trials and prototypes when initial budgets are limited** as a way of testing community and stakeholder support for further investment in the long term.



## Delivering and Monitoring

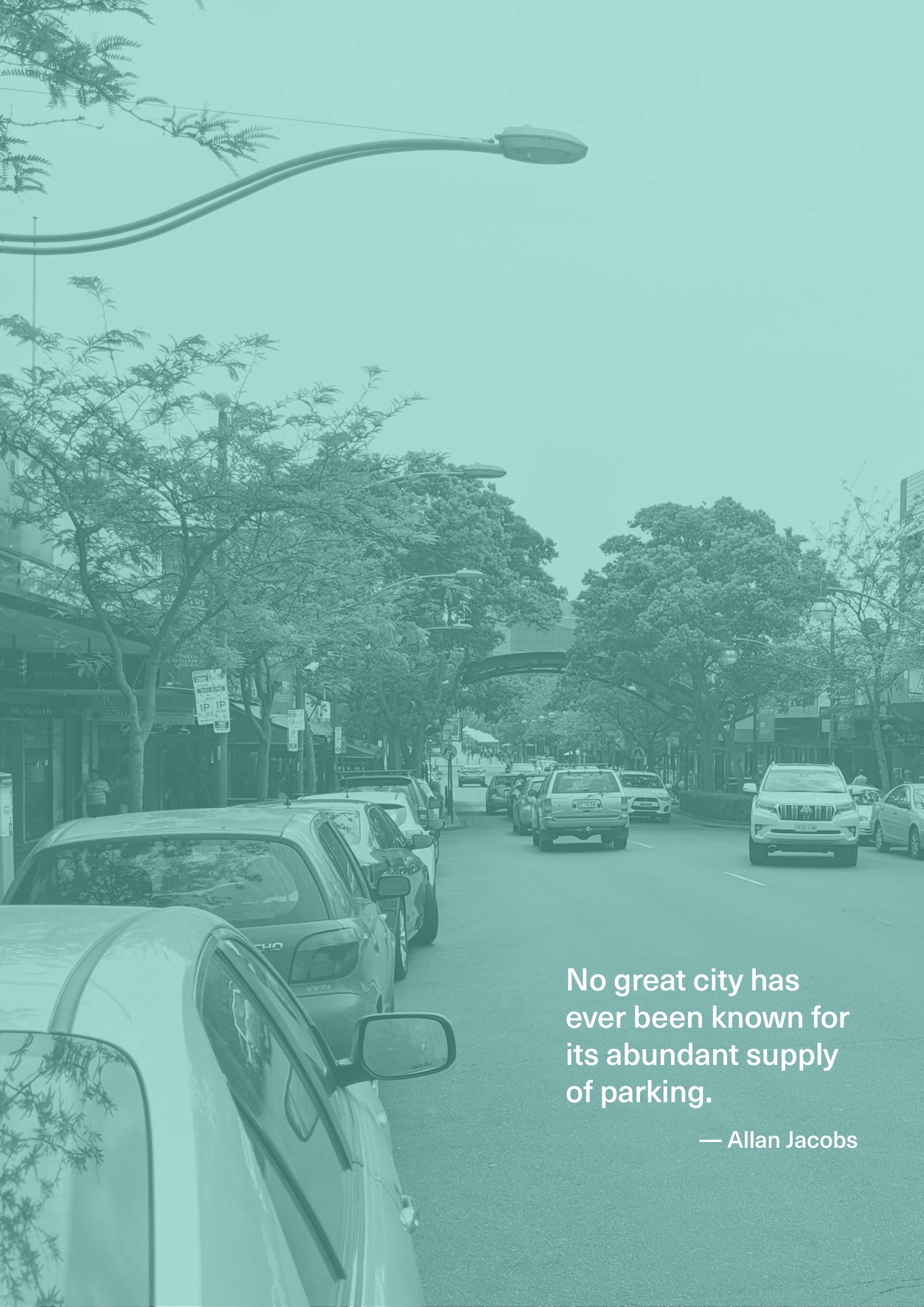
**Carry forward the vision and design intent** through the design process and retain throughout delivery.

**Monitor built outcomes** to provide lessons learned and inform iterations of The Guidelines and Engineering Design Manual for Western Sydney.

**Formalise case studies** of completed street projects, including lessons learned and community feedback providing input to future iterations of The Guidelines.

# B

# Designing Great Streets



No great city has ever been known for its abundant supply of parking.

— Allan Jacobs

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# B1 STREET DESIGN OBJECTIVES

The Guidelines are structured around eight Street Design Objectives, which have been developed with, and endorsed by the nine partner local councils as the result of an interactive stakeholder engagement process.

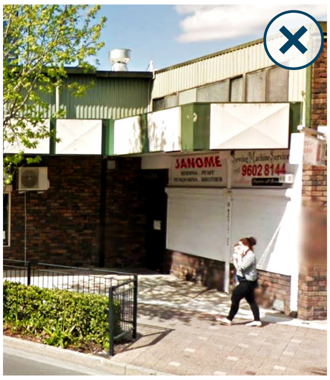
The street design objectives set the aspirational vision for how the standards can drive best practice outcomes for Western Sydney communities. To achieve this, the objectives address urban cooling, water management, public safety and wellbeing while embracing emerging technologies.

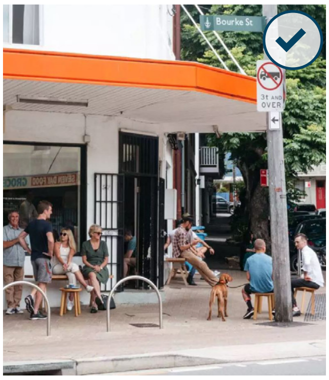
The Guidelines respond to:

- the Premier's Priority for increased tree canopy and green cover across Greater Sydney (also Objective 30 in the Western City District Plan);
- the "Towards Zero" vision in the NSW Road Safety Plan 2021;
- greater NSW Government emphasis on place-based planning as articulated in recent Government Architect NSW publications

## OBJECTIVE 1

### Streets encourage social activation through their design.



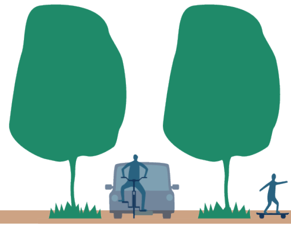


### Why?

Streets are critical to the liveability of their urban contexts and need to serve a variety of community uses. Street space needs to be allocated to all street users, which, in some areas, will mean sacrificing the carriageway and parking for alternate uses.

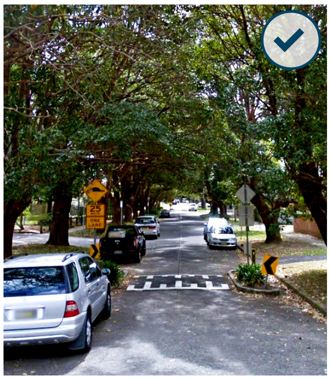
**Potential barriers to implementation raised by stakeholders:**

- Potential conflicts between traffic and alternate social uses of the street.
- Consideration between different street users - pedestrians, cyclists, motorcyclists, public transport users, and drivers.
- Existing streets may be narrow and require the removal of parking to achieve optimal footpath widths.



## OBJECTIVE 2

### Streets are self–explaining slow environments that are safe and comfortable for all users.



### Why?

Vehicle speed is the main determinant of fatality or injury. Street environments need to reinforce the desired travel speed, naturally encouraging drivers to adapt their behaviour in a way that is compatible with the design, function and speed of a road.

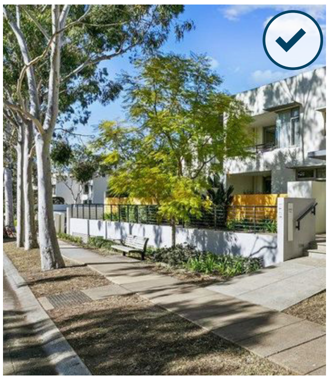
**Potential barriers to implementation raised by stakeholders:**

- Speeds cannot be reduced simply by changing the posted speed limit.
- Different street types have different target speeds and context. Some roads, such as those with higher movement functions, can be expected to be a faster–speed environment.

# B1 STREET DESIGN OBJECTIVES

## OBJECTIVE 3

### Streets are inclusive with footpaths on both sides.



**Why?**

Universal accessibility through public space is a basic human right. Footpaths on both sides of the street remove the need for inconvenient and unnecessary crossings for vulnerable street users and provide measurable public health benefits.

**Potential barriers to implementation raised by stakeholders:**

— Innovation in material use - additional concrete footpaths will increase impervious and heat capturing surfaces within streets.

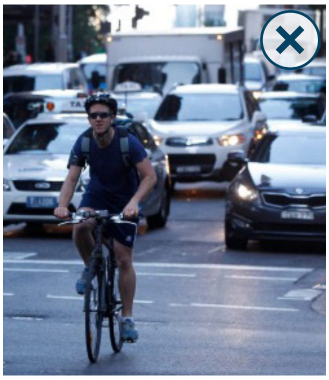
— Construction staging - coordination required with the construction of driveway crossovers.

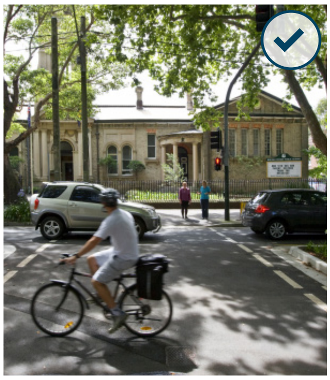
— Retrofitting existing streets - existing residents may disagree with footpaths in front of their property.

— Extra maintenance costs for additional footpaths.

## OBJECTIVE 4

### Streets are safe for cycling, with separated bicycle facilities on busy streets.





**Why?**

Improving the mode share of cycling in Western Sydney will require a vast improvement in the provision of cycling infrastructure. This means delivering infrastructure before demand to encourage a modal shift to cycling. While cyclists can share the travel zone with vehicles in slow-speed environments they require safe, physical separation in high-speed environments.

**Potential barriers to implementation raised by stakeholders:**

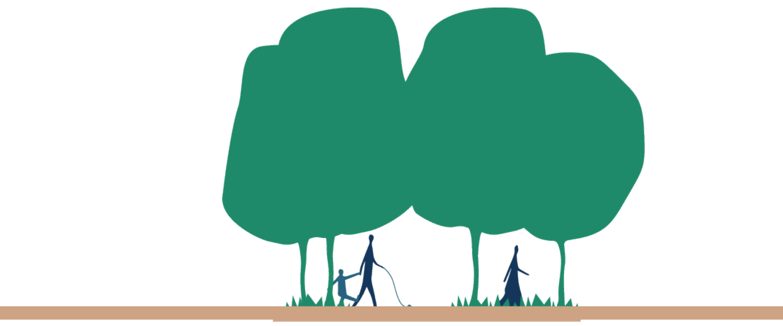
— Physical separation requires more space.

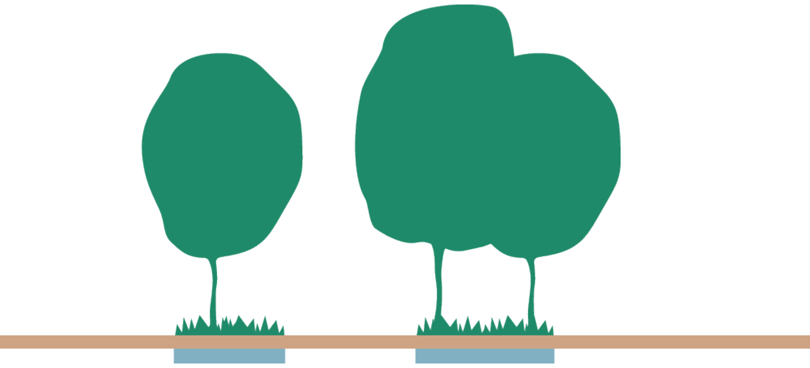
— The scale of cycle use varies on different street types and needs to be defined.

— Increased conflict may arise at driveways and intersections. Poorly designed separated paths can lead to delays for cyclists and a reduction in safety.

— Scepticism that a shift from shared paths to separated cycleways is of community benefit.

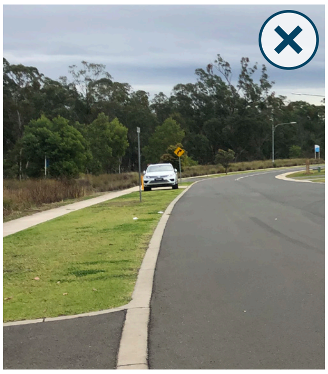
# B1 STREET DESIGN OBJECTIVES

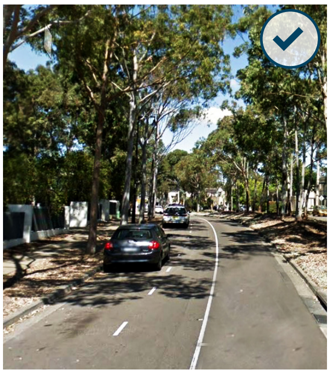




### OBJECTIVE 5

**Continuous canopy cover is achieved on both sides of every street.**





**Why?**

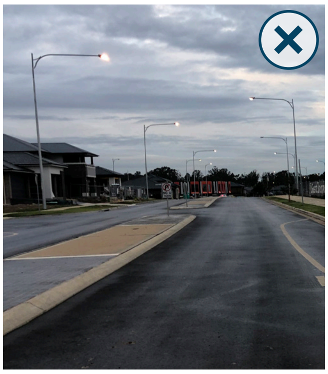
Western Sydney experiences significantly more urban heating, with residents increasingly exposed to high heat events. Street trees will play a critical role in reducing urban heating and improving health outcomes for people and the environment.

**Potential barriers to implementation raised by stakeholders:**

- Different tree spacing standards amongst local councils.
- Consideration needs to be given to certain areas including Bushfire Prone Land and areas near the airport.
- Consideration needs to be given to the width of the verge and the ability for trees to grow to mature sizes.

### OBJECTIVE 6

**Water sensitive urban design (WSUD) is integrated into every street.**



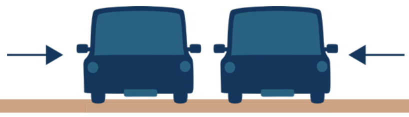
**Why?**

Western Sydney's waterways, particularly South Creek, will experience increasing pressure as future development within the region occurs. Treating water where it falls is the best way to alleviate these pressures.

**Potential barriers to implementation raised by stakeholders:**

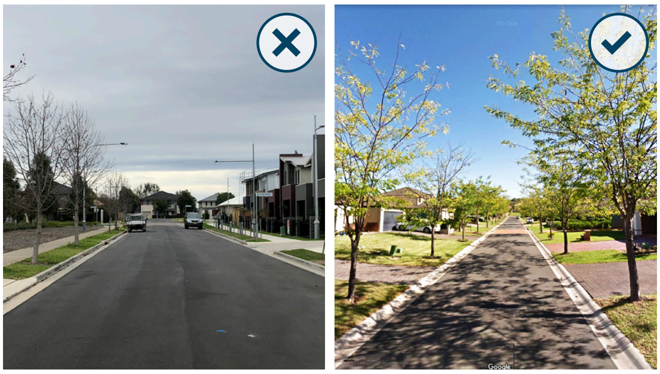
- Different requirements amongst local councils and lack of standardised best practice.
- Ongoing maintenance costs can vary, and be prohibitively high if not properly considered.
- Design and approval staging - site–specific considerations of WSUD features is required.
- Construction staging - coordination is required to translate works on the ground.

# B1 STREET DESIGN OBJECTIVES



## OBJECTIVE 7

**Design carriageway widths to maximise space for alternate uses and users.**



### Why?

Wide carriageways increase impervious, heat–trapping surfaces and encourage high-speed driving and the storage of private property within the street. We can reallocate street space to alternate street design objectives by narrowing carriageways.

**Potential barriers to implementation raised by stakeholders:**

— Outcomes depend on the number of lots the street is servicing.

— Central medians may inhibit the ability to reduce travel lane widths.

## OBJECTIVE 8

**Ensure future transport solutions maximise place outcomes for streets.**


### Why?

Future transport solutions will provide efficiencies within the transport network that will allow for a reduction in the amount of street space dedicated to private motor vehicles. Future transport technology must be harnessed to decrease driving, not merely make long drives more palatable. Redistributing street space to alternate uses is critical to this.

**Potential barriers to implementation raised by stakeholders:**

— Unknown ownership models for connected and autonomous vehicles.

— Potential impact of micromobility on street amenity and other street users.

Design is both a process and an outcome – a way of thinking and a result of making. Better Placed must respond to both of these components in order to achieve its vision. Good design outcomes result from good processes.

Design processes should embrace uncertainty and diversity, filter inputs and reviews to continually refine design outcomes.

A design process involves a series of actions or steps taken to achieve a particular end. Design processes are not linear; they are iterative, collaborative and at times circular, where feedback and ideas are continually intertwined. Design processes help provide solutions to complex problems where many inputs and concerns are needed to be resolved simultaneously.

A good design process is based on an understanding of place through research, analysis and precedent studies and considers alternatives and options. Good process involves many diverse groups of people through consultation that synthesises their issues. Scenarios and options are sorted and improved with testing, competition and critical thinking.

— Better Placed,
Government Architect NSW

# B2 TERMINOLOGY AND DESIGN CONSIDERATIONS

## B2.1 DESIGN REQUIREMENTS AND DESIGN GUIDANCE

Part B of the Western Sydney Street Design Guidelines includes information for practitioners designing new and retrofitted streets in Western Sydney, in the form of ten Street Types. The Street Types include six local street types and four mixed-use street types. Because the street types are defined by different metrics and characteristics, rather than a fixed geometry in either plan or section, they are equally well suited for new or refurbished streets.

For each street type, The Guidelines provides Design Requirements and Design Guidance for various street features and street details. Design Requirements cover compulsory measures and Design Guidance encompasses optional metrics which can be implemented within the streetscape.

**Design Requirements**

Design Requirements are the mechanism for streets to deliver the Street Design Objectives. They are the main way for designers to achieve greener, cooler, and safer streets in Western Sydney.

Note that the metrics for Design Requirements are given in a variety of formats. Where a number or percentage is given, this should be measured per 1000m2 of a typical road reserve.

**Design Guidance**

In addition to the ‘Design Requirements’, The Guidelines includes ‘Design Guidance’. Design Guidance has two purposes. Firstly, Design Guidance can help to identify the most suitable street type for the local context.

Secondly, Design Guidance provides metrics that contribute to the Street Objectives by supporting the Design Requirements. For example, when 'Cycling' is a Design Requirement, the Design Guidance might build on that with suggested cycle facilities.

In Part C, Design Guidance occasionally covers advice which can only be applied in particular contexts. The Guidelines are clear on when and how to apply these.

**DESIGN GUIDANCE**

Throughought The Guidelines, Design Guidance will appear in a light blue box like this.

**DESIGN REQUIREMENTS**

Throughought The Guidelines, Design Requirements will appear in a dark blue box like this.

## B2.2 DESIGN CONSIDERATIONS

In addition to consulting The Guidelines, designers also need to consider other factors in the design process. The list below is not exhaustive, but it does covers some of the common design considerations when working in Western Sydney.

**Latent Site Conditions**

There is a variety of soil types and conditions across the whole of Western Sydney. Heavy clay soils, or saline soils as an example, will need careful consideration throughout the design process. This is especially the case when considering WSUD elements and selecting plants.

Designers should familiarise themselves with the specific conditions of their site – and incorporate this research into the design of street features.

**Ongoing Maintenance**

The ongoing maintenance of streets is, and will continue to be, a key consideration in the design and delivery of streets in Western Sydney. Fixed allocation of resources means that a rapid and uncoordinated increase in new assets which require additional or increased maintenance can be difficult for local councils to manage.

However, this must be balanced against the long-term risks for local areas. Without gradual improvements to local streets and suburbs, communities are likely to find themselves more vulnerable to longer and more severe summers. Residents are also more likely to see a decrease in the amenity of their built environment and quality of life.

For these reasons, it is critical to consider the costs and benefits of each improvement to a street. It is also important to consider that street improvements will continue to deliver benefits to the local community for decades to come.

Designers should ensure that the design of street features are supported by research and science, and that unnecessary maintenance tasks which provide no environmental benefit, such as clipping or regular pruning, are designed out

**Fire Danger**

Much of Western Sydney is particularly vulnerable to bush fire risk. A changing climate only exacerbates the risk.

Organisations such as the Rural Fire Service have the authority and expertise to guide designers on designing for bush fire protection. More information can be found in 'Planning for Bush Fire Protection', Rural Fire Service (November 2019).

**PRECEDENT // NEWINGTON BOULEVARD, NEWINGTON**
Image - (Aspect Studios)

**Designing for All Abilities**

A core objective of The Guidelines is to create streets which are accessible for everyone. This means considering Australian Standards 1428.1 as required by the *Disability Discrimination Act 1992 (Cwth)*, as well as considering the comfort and ease with which more vulnerable community members can access the built environment.

When spaces are designed for the most vulnerable, such as the elderly or parents with prams , the whole community benefits.

It is not the intent of this document to duplicate content already supplied elsewhere, such as in the Australian Standards. Further to this, the design guidance and requirements included in The Guidelines do not preclude the application of AS1428 . If there is a perceived conflict, complying with statutory requirements should take precedence.

**Crime Prevention Through Environmental Design**

Crime Prevention through Environmental Design (CPTED) is a crime prevention strategy that focuses on the planning, design and structure of cities and neighbourhoods. The aim of CPTED is to reduce the likelihood of criminal activity.

Keeping communities safe, and not contributing to the likelihood of a crime being committed in streets should be an important consideration in the design of new streets. This may factor into the design process through planting selection and the location of lighting elements.

More information about CPTED can be found on the NSW Police Force website and local councils may have further information in their DCPs  about their own CPTED design principles.

**Safety in Design (SiD)**

Safety in design is a key consideration when designing new streets.

SiD processes should be integrated into the design phase of all projects including new and refurbished streets. The SiD actions are dependent on the complexity of the design. Integrating SiD in the design process might include design team workshops and producing safety design reports. It may also include maintaining a risk register which considers the risks stemming from the design into the construction, maintenance and future demolition or decommissioning of the project.

In the context of the designing streets, designers might consider the construction works and the way the street and its features, like WSUD features or planted areas, will be maintained in the future.

**PRECEDENT // APPIAN WAY, BURWOOD**
Image - (Google)

## B2.3 STRUCTURE OF THE STREET

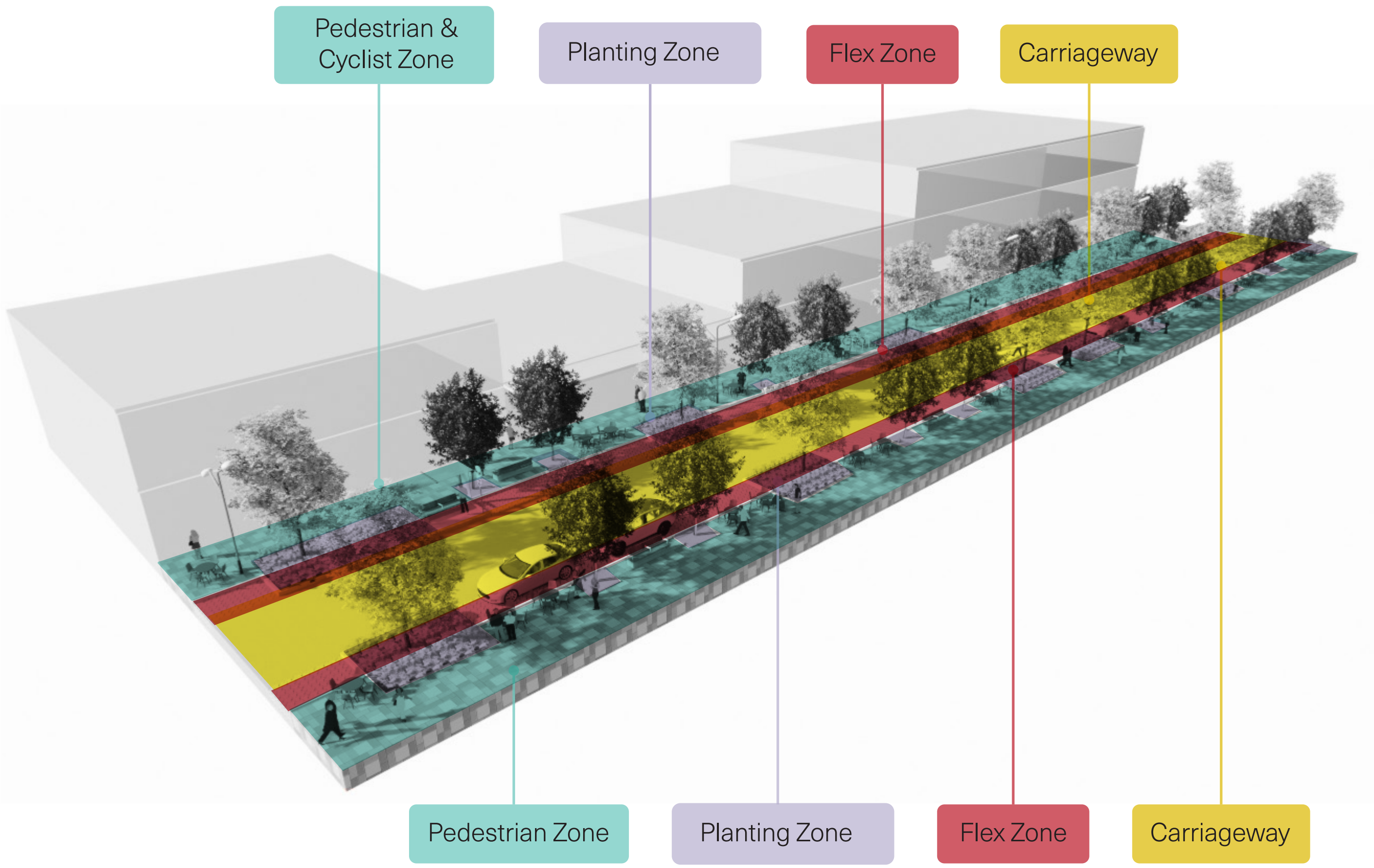
**For ease, The Guidelines gives names to the different parts (zones) of streets – both streets generally and in the proposed Street Types. Not all streets will include all zones, but most streets will include at least two zones.**

The **Pedestrian Zone** — an area, typically within the verge, provided for accessible pedestrian travel. Its total width will vary with street type and available street space. This zone must be clear of obstacles, including street furniture, street trees, outdoor seating, driveway ramping, and waste collection. It should be well–lit and functional in all weather conditions and meet accessibility standards.

The **Cyclist Zone** – sometimes merged with the Pedestrian Zone or Carriageway, and sometimes a distinct part of the street, the Cyclist Zone is somewhere designed for safe bike travel.

The **Carriageway** — refers to the part of the street dedicated to transport uses including motor vehicles, public transport, and cyclists where appropriate. This zone can be two–way, one–way, or become part of a shared environment.

The **Planting Zone** — refers to a part of the street which is critical for meeting canopy cover and permeable area Desing Requirements. The Planting zone includes street tree planting and understorey planting.



## B2.3 STRUCTURE OF THE STREET

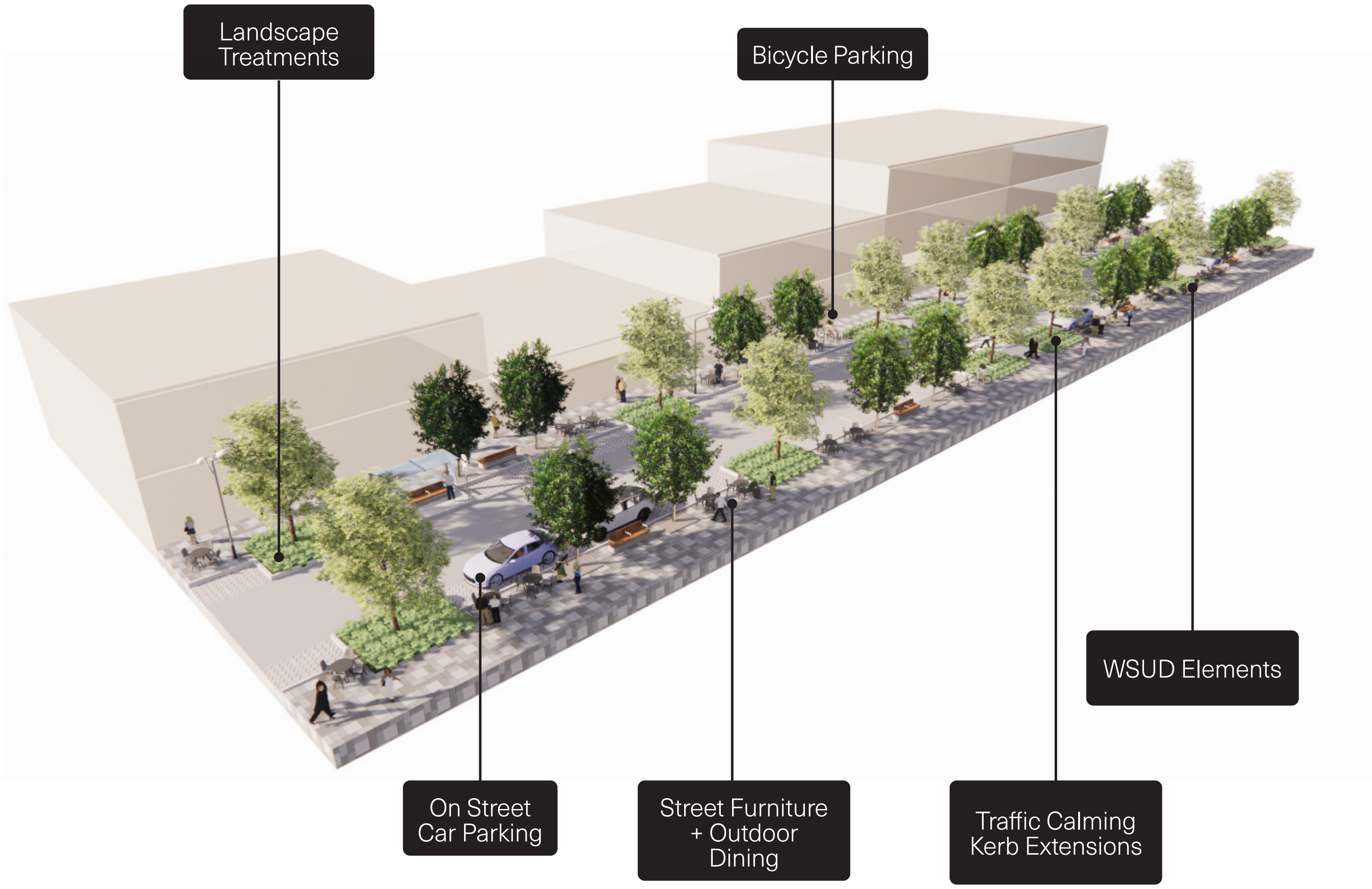
The **Flex Zone** — a flexible area that provides for street–specific design interventions depending on street type, location, and role within broader movement and environmental systems. This zone plays a critical role in achieving the street targets and objectives discussed throughout Part B.

The Flex Zone can support the Planting Zone by including additional street trees, WSUD and understorey planting. It can also include a variety of furniture and fixtures like light poles, street furniture, traffic and parking infrastructure. Depending on verge width, the Flex Zone can include outdoor dining in commercial centres.

The uses and materials within the Flex Zone should be based on place-based analysis. Each Street Type sets a benchmark for the extent of permeable area (a combination of greenery and permeable surfaces) and extent of canopy cover. These are treated as targets and the Flex Zone should be appropriately designed to help reach and exceed these metrics wherever possible.

Some example uses within the Flex Zone include:

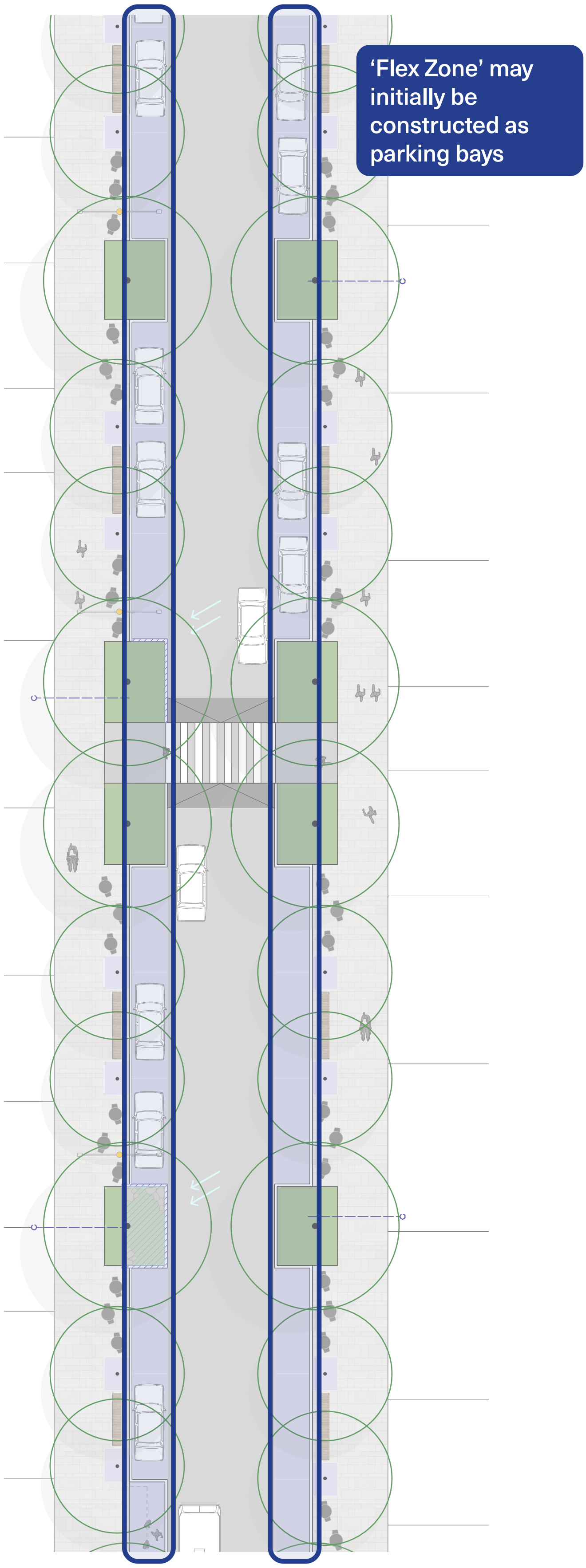
- Landscape treatments, tree planting, and WSUD features
- Street furniture and outdoor dining
- On–street car parking
- Bicycle parking
- Traffic calming kerb extensions



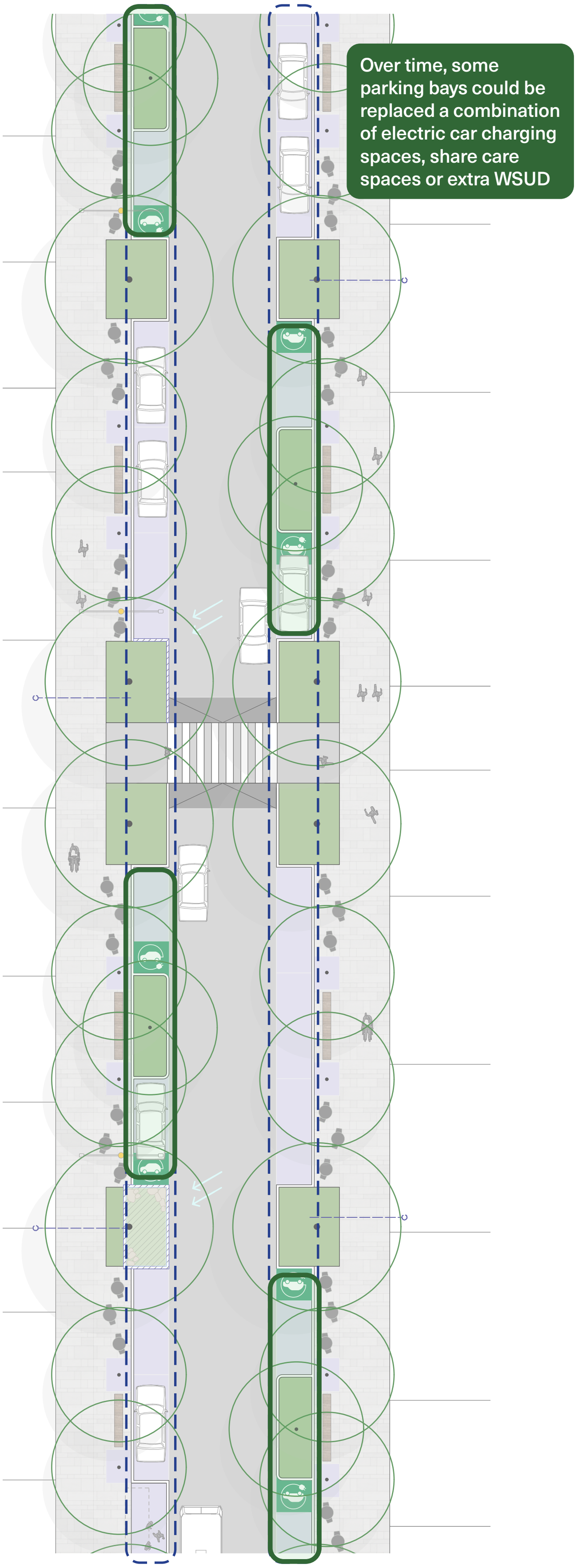
## B2.3 STRUCTURE OF THE STREET

The following scenarios demonstrate the adaptability of Flex Zones. Each 'scenario' could easily represent three different high streets, or the same high street at three different phases of its evolution as community needs evolve.

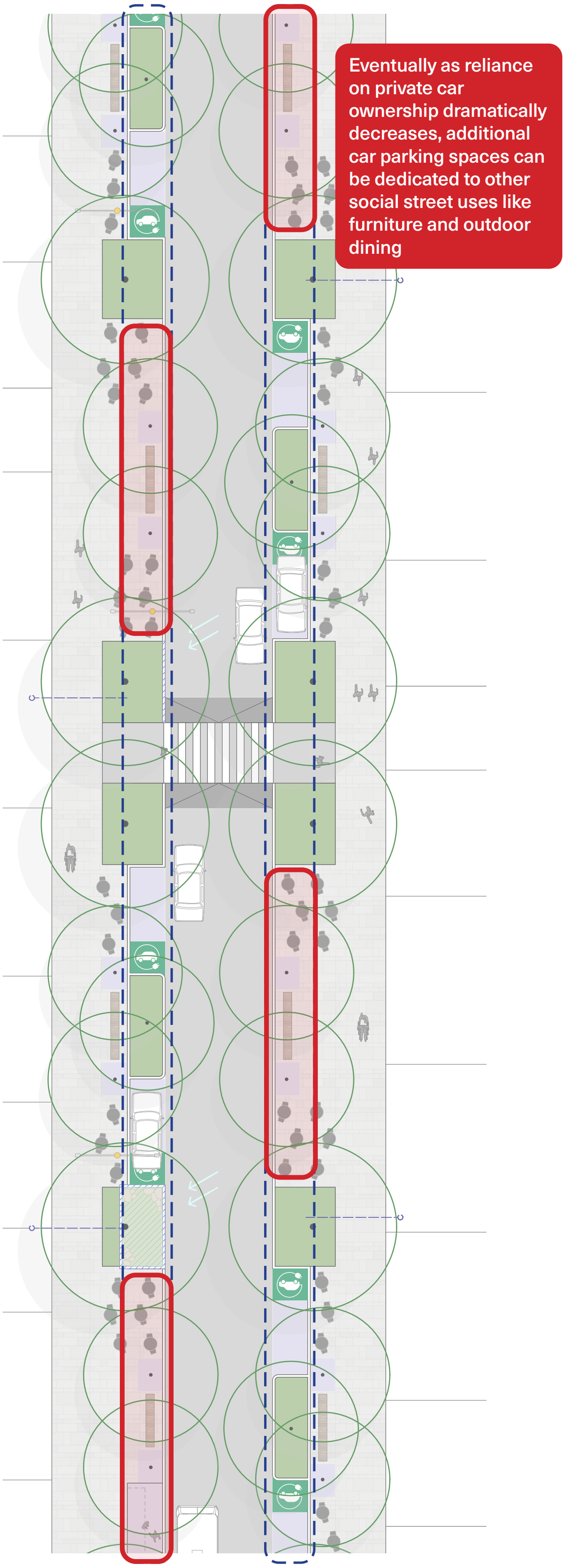
### Scenario 1



## Scenario 2




## Scenario 3



## B2.4 TRAFFIC DESIGN CONTROLS

**Traffic design controls play a significant role in the design of streets and are central to achieving the Street Design Objectives.**

Traffic design controls influence the speed at which vehicles travel. In turn, vehicle speeds influence the pedestrian and cyclist experience, as well as the severity of incidents involving pedestrians and vehicles. TfNSW, as well as other LGAs in NSW, are undertaking a number of trials and studies of slower speeds in local areas with the objective of reducing road fatalities.

The traffic design controls included in The Guidelines are:

— Behavioural speed
— Design vehicles
— Check vehicles

These controls are important for their ability to shift street design priorities away from car movement and towards walking, cycling, and riding transit.

### Behavioural Speed

The underlying principle of behavioural speed is for the physical street environment to be self-reinforcing in limiting the potential travel speeds of motor vehicles.

Streets should be designed to feel uncomfortable to travel above the behavioural speed. This is consistent with the design philosophy of self–explanatory streets.

Behavioural speed is to be achieved with the use of traffic calming measures—for example, travel lane narrowing, chicanes, threshold treatments, and reducing the visual width of the road corridor—as described in Part C of The Guidelines.

### Design Vehicle

The Design Vehicle is the largest vehicle that frequently uses a street. Designing streets for large vehicle movements that rarely occur creates disproportionately wide carriageways, inducing high speeds and reducing street safety for all users. They also cost more to build and maintain, compromise urban amenity and can discourage certain land uses and transport modes.

### Check Vehicle

The Check Vehicle is a larger vehicle that occasionally uses the street. An example of a Check Vehicle is a garbage truck, which is unlikely to access streets more than a few times per week. They may not be able to remain within a traffic lane at all times, rather encounters between them and Design Vehicles must take place in a predictable and safe manner.

### Selecting a Design and Check Vehicle

In most cases, the kerb return radius Design Requirement should be used to design intersections.

The Design and Check Vehicle is provided as Design Guidance only, for use when designing non-standard intersections. When using design and Check Vehicles to design non standard intersections, designers should confirm their selection of design and Check Vehicles with local councils.

*On urban local [streets] pedestrian activity, and the potential for vehicle–pedestrian conflicts, is greatest. Pedestrians are particularly vulnerable to serious injury. Design considerations for local [streets] must therefore strive to ensure that these conflicts are avoided and that design speeds are commensurate with potential impact speeds that are survivable.*

— Austroads Guide to Road Design
Part 2: Design Considerations

## B2.4 TRAFFIC DESIGN CONTROLS

### Behavioural Speeds for Different Contexts

**10 km/h behavioural speed**

Local Streets that include Shared Zones must ensure users mix at very low speeds, in line with RMS Technical Directions. Street features and geometry aim to keep speeds low and safe for pedestrians and cyclists in shared travel zones.

**30 km/h behavioural speed**

Local Streets should encourage social activity in the street. 30 km/h is a safe speed for cyclists to ride in mixed traffic and presents low risks to people walking along and crossing the street.

**40 km/h behavioural speed**

Lower order streets with a high degree of activity in all modes and high demand for pedestrian crossings, such as Local Collectors, should aim to limit speeds to 40 km/h. This balances the social and transit related needs of all street users.

**60-70 km/h behavioural speed**

Speeds of 60 km/h or higher are potentially hazardous on urban streets with a variety of users. Extreme care must be used to protect vulnerable users without destroying the social and economic functions of the street or disrupting the walking network.

# B3 STREET TYPES

**The Western Sydney Street Design Guidelines set out new street types for Western Sydney.**

These Street Types build upon the street hierarchies currently presented in a variety of existing Guidelines—including Landcom's Street Design Guidelines and Austroads' Guide to Road Design—and provide a greater variety of street types required in Western Sydney.

Owing to the large scale of development ahead, it isn't possible to capture every street type that will be delivered in the Western Sydney. The Guidelines seek to balance a variety of conditions within a succinct set of street types.

Design Requirements and Design Guidance for the different street types are summarised in Table B3.

Following this, The Guidelines includes case studies for each street type. The purpose of these case studies is to demonstrate the different ways a street can achieve the Design Requirements whilst still retaining local variation and responding to the local context and council Requirements.

| STREET TYPES |
| --- |
| **Local Streets** |
| Local Street – Type 1 |
| Local Street – Type 2 |
| Local Street – Type 3 |
| Local Street – Type 4 |
| Residential Laneway |
| Local Collector |
| **Mixed Use Streets** |
| High Street |
| Industrial Street |
| Retail Laneway |
| Sub–Arterial Road |

## TYPICAL STREET ARRANGEMENTS

Note that diagram is intended to explain the street hierarchy or context that a street type might be used in. The Guidelines does not aim to show designers how to plan a street network

- Local Street Type 1
- Local Street Type 2
- Local Street Type 3
- Local Street Type 4
- Residential Laneway
- Local Collector
- High Street
- Retail Laneway
- Railway

## TABLE B.3 STREET TYPES

Note: All percentages are typical measurements per 1000m2 of road reserve area

**LEGEND** **Design Requirements** **Design Guidance**

| **LOCAL STREETS** | **Local Street – Type 1** (Shared Zone) | **Local Street – Type 2** (Yield Street) | **Local Street – Type 3** (Dual Carriage and Footpaths – Low Density) | **Local Street – Type 4** (Dual Carriage and Footpaths – Medium Density) | **Residential Laneway** | **Local Collector** |
|---|---|---|---|---|---|---|
| **STREET FEATURES** | | | | | | |
| **Trees (per 1000m²)** | 12 | 12 | 11 | 10 | 10 | 10 |
| **Canopy Cover** | 70% | 70% | 70% | 70% | 70% | 70% |
| **Permeable** | 35% | 35% | 35% | 35% | 35% | 35% |
| **WSUD** | YES | YES | YES | YES | YES | YES |
| **Dual Footpath** | SHARED ZONE | YES | YES | YES | SHARED ZONE | YES |
| **Cycle Infrastructure** | SHARED ZONE | - | - | - | SHARED ZONE | YES |
| **Traffic Calming** | YES | YES | YES | YES | - | YES |
| **STREET DETAILS** | | | | | | |
| GENERAL | | | | | | |
| **Road Reserve (nom.)** | 13m – 19m | 15m – 19m | 15 – 22m | 15m – 23m | 5.5m – 8.5m | 18.5m – 24m |
| **Context** | Residential neighbourhood | Residential neighbourhood | Residential neighbourhood | Residential neighbourhood | Residential neighbourhood | Residential neighbourhood |
| **Built Form** | Detached dwellings | Detached/semi–detached dwellings | Detached/semi–detached dwellings | Detached/semi–detached dwellings, multi–unit residential buildings | Detached/semi–detached dwellings | Residential dwellings and occasional commercial ground floor uses |
| **Typical Lot Width** | 10 – 12m | 10 – 12m | 10 – 12m | 10m + | 8 – 12m | 10m + |
| **Typ. Lots Served** | ≈ 10—15 | ≈ 10—15 | ≈ 10—15 | Varies | ≈ 5–10 | Varies |
| ACTIVE TRANSPORT | | | | | | |
| **Walking** | Shared Zone | Min 1.2m path both sides | Min 1.2m path both sides | Min 1.2m path both sides | Shared Zone | Min 1.5 m path both sides |
| **Cycling** | Travel zone shared with pedestrians and vehicles | Travel zone shared with vehicles | Travel zone shared with vehicles | Travel zone shared with vehicles **Consider bicycle paths or shared paths when appropriate to local context** | Travel zone shared with pedestrians and vehicles | Separated cycleway |
| VEHICLES | | | | | | |
| **Travel Lane Widths** | 2.75m – 3.0m | 2.8 – 3.0m | 2.8 – 3.0m | 2.8 – 3.0m | 5.5m one-way shared space | 3.2m – 3.5m |
| **Parking Lane Widths** | 2.0m – 2.4m | 2.0m – 2.4m | 2.0m – 2.4m | 2.0m – 2.4m | n/a | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m | 7.5m | 7.5m | 7.5m | 7.5m | 7.5m |
| **Kerb Extensions at Intersections** | Required | Required | Required | Required | n/a | Required |
| **Lot Access** | Front–loaded | Front–loaded | Front–loaded | Front–loaded | Rear–loaded | Front & rear–loaded |
| **Buses** | Typical - no bus route | Typical - no bus route | Typical - no bus route | Typical - no bus route | No bus route | Yes |
| **Design Vehicle** | B85 Car | B85 Car | B85 Car | B85 Car | B85 Car | B85 Car |
| **Check Vehicle** | Garbage Truck (11m) | Garbage Truck (11m) | Garbage Truck (11m) | Garbage Truck (11m) | Garbage Truck (11m) | Single unit truck/bus (12.5m) |
| **Behavioural Speed** | ≤ 10 km/h | ≤ 30 km/h | ≤ 30 km/h | ≤ 30 km/h | ≤ 10 km/h | ≤ 40 km/h |
| **Indicative Traffic VPD** | ≤ 300 | ≤ 500 | ≤ 500 | ≈ 3000 | ≤ 300 | ≈ 3000 - 6000 |
| **Max Length** | ≈ 100m | ≈ 100m | ≈ 100m | As required for local access | ≈ 150m | As required for neighbourhood access |
| **Typical Driveway Width** | 2.5m – single access<br>4.5m – double access | 2.5m – single access<br>4.5m – double access | 2.5m – single access<br>4.5m – double access | 2.5m – single access<br>4.5m – double access<br>≤ 6m – multi-residential buildings | n/a | 2.5m – single access<br>4.5m – double access<br>≤ 6m – multi-residential buildings |
| SAFETY & ENVIRONMENT | | | | | | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale | Low flow: passive irrigation<br>Higher flow: swale | Low flow: passive irrigation<br>Higher flow: swale | Low flow: passive irrigation<br>Higher flow: swale | Low flow: passive irrigation<br>Higher flow: pits and pipes solution | Low flow: passive irrigation<br>Higher flow: swale |
| **Flex Zone Uses** | Traffic calming, trees, WSUD and parking | Traffic calming, trees, WSUD and parking | Traffic calming, trees, WSUD and parking | Traffic calming, trees, WSUD and parking | n/a | Bicycle path, traffic calming, trees, WSUD and parking, bus stop, micromobility parking |

## TABLE B.3 STREET TYPES

Note: All percentages are typical measurements per 1000m2 of road reserve area

**LEGEND** **Design Requirements** **Design Guidance**

| **MIXED USE STREETS** | **High Street** (Rear-loaded via laneway or Front-loaded) | **Industrial Street** | **Retail Laneway** | **Sub-Arterial Road** |
|---|---|---|---|---|
| **STREET FEATURES** | | | | |
| **Trees** | 12 | 12 | 12 | 10 |
| **Canopy Cover** | 70% | 70% | 70% | 70% |
| **Permeable** | 20% | 35% | 35% | 35% |
| **WSUD** | YES | YES | YES | YES |
| **Dual Footpath** | YES | YES | SHARED ZONE | YES |
| **Cycle Infrastructure** | - | YES | SHARED ZONE | YES |
| **Traffic Calming** | YES | YES | YES | - |
| **STREET DETAILS** | | | | |
| GENERAL | | | | |
| **Road Reserve (nom.)** | 16m – 25m | ≈ 22m | ≈ 7m | ≈ 27m |
| **Context** | Commercial centre | Industrial and commercial precincts | Commercial centre | Varies |
| **Built Form** | Mixed–use with active ground floor uses | Large industrial and commercial buildings, typically setback from the road corridor boundary | Mixed–use with active ground floor uses | Varies |
| ACTIVE TRANSPORT | | | | |
| **Walking** | Generous footpaths with multiple uses | Min 1.2m path both sides | Shared Zone | Min 1.2m path both sides |
| **Cycling** | Travel zone shared with vehicles.<br><br>Consider separated bicycle paths when appropriate to local context | Provide cycle infrastructure | Travel zone shared with pedestrians and vehicles | Separated cycle way |
| VEHICLES | | | | |
| **Travel Lane Widths** | 3.2m – 3.5m | 3.5m | 6m – 8.5m | 3m – 3.5m |
| **Parking Lane Widths** | 2.0m – 2.4m | 2.0m – 2.4m | n/a | n/a |
| **Kerb Return Radius** | 7.5m | Based on swept path analysis | 7.5m | Based on swept path analysis |
| **Kerb Extensions at Intersections** | Rear-loaded: required<br>Front-loaded: - | n/a | n/a | n/a |
| **Lot Access** | Rear–loaded via laneway or Front-loaded | Front–loaded | Rear-loaded via laneway | Front or rear–loaded |
| **Buses** | Yes | Yes | No bus route | Yes |
| **Design Vehicle** | Rear-loaded: B85 Car<br>Front-loaded: Service Vehicle (8.8m) | Prime mover and semi-trailer (19m) | Service Vehicle (8.8m) | Prime mover and semi-trailer (19m) |
| **Check Vehicle** | Single unit truck/bus (12.5m) | B-Double (25m) | Garbage Truck (11m) | B-Double (25m) |
| **Behavioural Speed** | ≤ 30 km/h | ≤ 40 km/h | ≤ 10 km/h | Equal to speed limit |
| SAFETY & ENVIRONMENT | | | | |
| **WSUD** | Low flow: passive irrigation / raingardens<br>Higher flow: pits and pipes solution | Low flow: passive irrigation<br>Higher flow: swale or pits and pipes solution | Low flow: passive irrigation of street trees, or permeable paving for groundwater infiltration<br>Higher flow: pits and pipes solution | Pits and pipes solution |
| **Flex Zone Uses** | Outdoor dining, bike parking, micro mobility parking, bus stops, traffic calming, trees, WSUD and parking | Bicycle path, traffic calming, trees, WSUD, parking and bus stops | Trees, WSUD | n/a |

## B3.1 LOCAL STREET TYPE 1
Shared Zone, Residential Neighbourhood

### Overview

Local Street Type 1 provides a very slow speed shared travel zone which is designed to prioritise pedestrian and environmental amenity while discouraging vehicular thoroughfare.

The use of traffic calming measures and an absence of footpaths encourages informal sharing of street space between all street users.

### Street Priorities

— A very slow shared zone street environment is provided which allows for pedestrians, cyclists of all ages and vehicles to safely use the travel zone
— Active travel infrastructure facilitates connectivity to nearby public transport stops
— Verge swales are utilised to consolidate large areas of soil for optimal street tree growth
— All impervious surfaces are graded to allow for passive irrigation of street planting
— WSUD systems are provided to improve water quality

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| GENERAL | |
| **Road Reserve** (nom.) | 13m – 19m |
| **Context** | Residential neighbourhood |
| **Built Form** | Detached dwellings |
| **Typical Lot Width** | 10 – 12 m |
| **Typ. Lots Served** | ≈ 10 – 15 |
| ACTIVE TRANSPORT | |
| **Cycling** | Travel zone shared with pedestrians and vehicles |
| VEHICLES | |
| **Lot Access** | Front–loaded |
| **Buses** | Typical - No bus route |
| **Design Vehicle** | B85 Car |
| **Check Vehicle** | Garbage Truck (11m) |
| **Behavioural Speed** | ≤ 10 km/h |
| **Indicative Traffic** | ≤ 300 |
| **Max Length** | ≈ 100m |
| **Typical Driveway Width** | 2.5m – single access<br>4.5m – double access |
| SAFETY + ENVIRONMENT | |
| **Flex Zone Uses** | Traffic calming, trees<br>WSUD and parking<br>Refer Part C: 3.3, 2.1, 2.2, 2.5, 2.6, 3.5 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| ACTIVE TRANSPORT | |
| **Walking** | Shared Zone |
| VEHICLES | |
| **Travel Lane Widths** | 2.75m – 3.0m |
| **Parking Lane Widths** | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | Required |
| SAFETY + ENVIRONMENT | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale<br><br>Refer Part C: 2.8, 2.7 |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **SHARED ZONE** | **SHARED ZONE** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // TUNG HOP ST, WATERLOO**
A very slow shared zone street environment which allows pedestrians, cyclists and vehicles to safely use the travel zone.
Image - (Google)


**PRECEDENT // ARCHIBALD AVENUE, WATERLOO**
WSUD systems are incorporated within the shared zone.
Image - (Google)

# **B3.1 Local Street** Type 1

## DESIGN REQUIREMENTS

**STREET FEATURES**

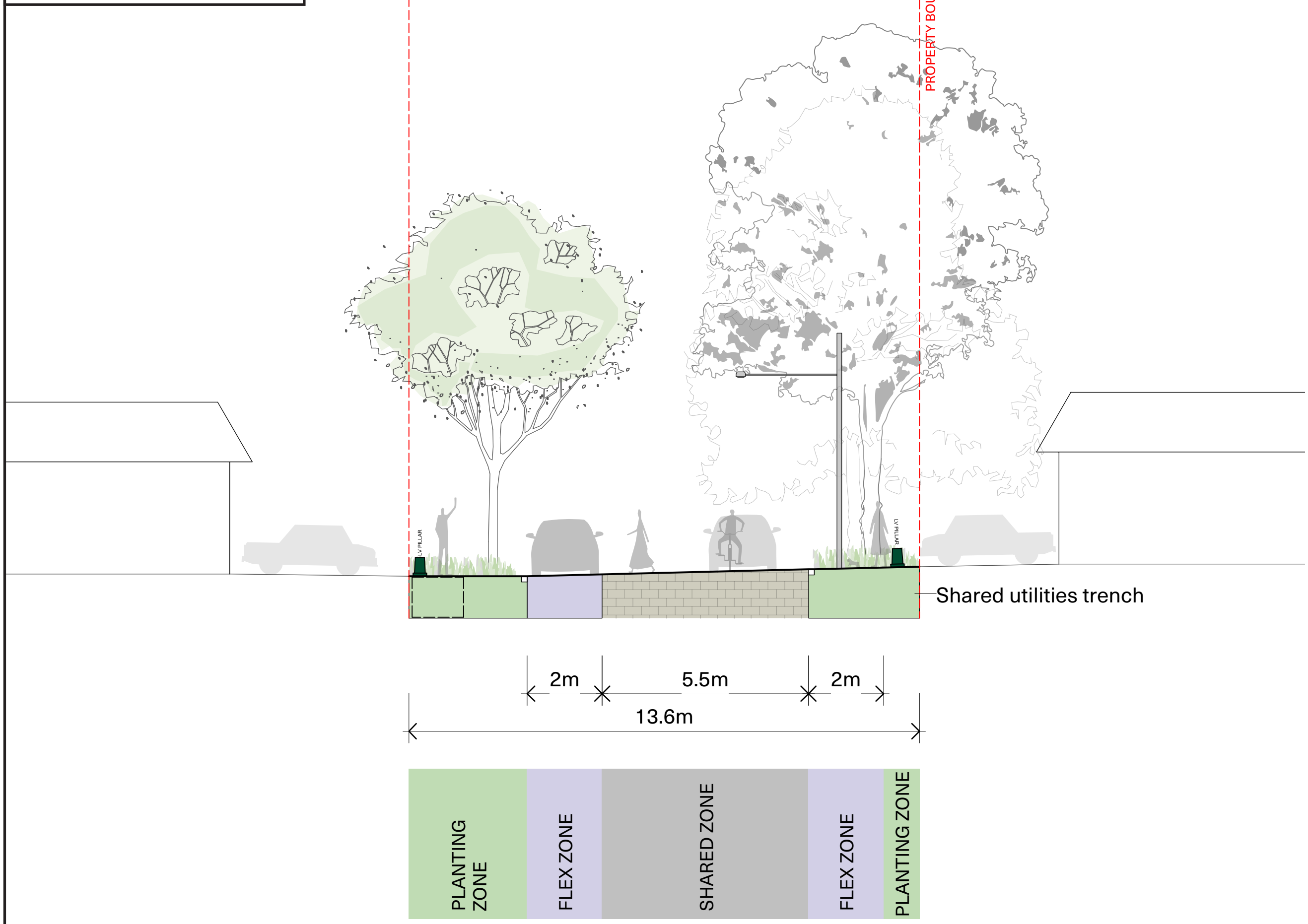
| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **SHARED ZONE** | **SHARED ZONE** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

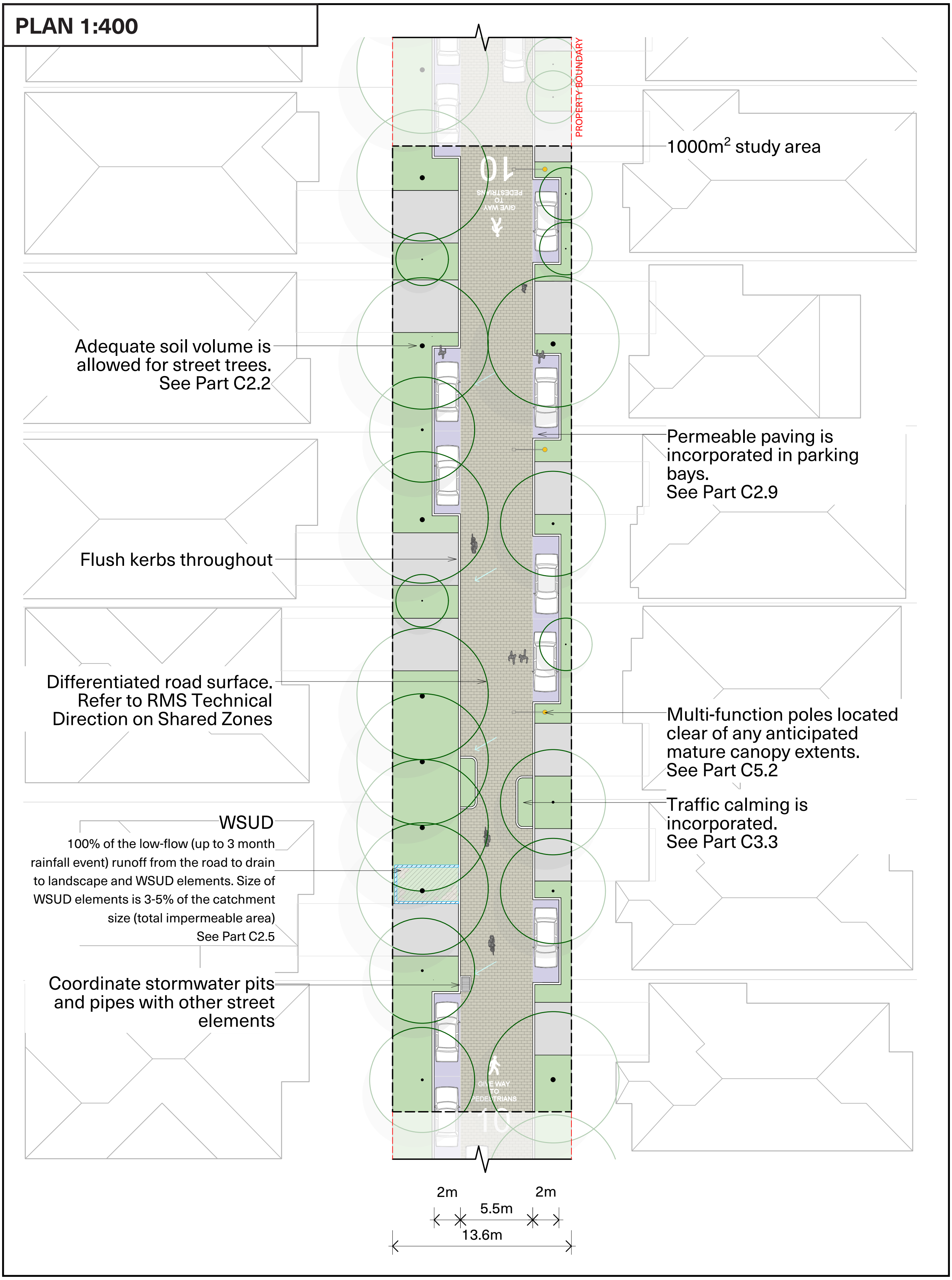
**Case Study**

| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
|---|---|---|---|---|---|---|
| 21 | 82% | 43% | YES | **SHARED ZONE** | **SHARED ZONE** | YES |

**SECTION 1:200**



# **B3.1 Local Street** Type 1



## B3.2 LOCAL STREET TYPE 2

Yield Street, Residential Neighbourhood

### Overview

Local Street Type 2 is a yield street and is designed to be a very slow speed environment.

Yield streets require that one vehicle yield to another as they pass at specific points, for example through a pinch point created by kerb extensions. Different mechanisms are used to limit behavioural speeds on these types of roads, such as a narrow carriageway, parking or kerb extensions.

Narrow carriageways also allow for maximised verge space for street tree planting and WSUD features.

These streets discourage vehicular traffic and balance car parking with other environmental and community uses of the verge.

### Street Priorities

- Footpaths are provided on both sides of street for continuous and universal accessibility
- Provide a very slow street environment that allows for cyclists to safely use the vehicle travel zone
- Active travel infrastructure facilitates connectivity to nearby public transport stops
- Verges on both sides of the street provide adequate soil volume for optimal street tree growth
- All impervious surfaces graded to allow for passive irrigation of street planting
- Provide WSUD systems to improve water quality
- Design as 'very slow streets' with minimised carriageways and increased vehicle calming measures

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | 15m – 19m |
| **Context** | Residential neighbourhood |
| **Built Form** | Detached/semi–detached dwellings |
| **Typical Lot Width** | 10 – 12 m |
| **Typ. Lots Served** | ≈ 10 – 15 |
| **ACTIVE TRANSPORT** | |
| **Cycling** | Travel zone shared with vehicles |
| **VEHICLES** | |
| **Lot Access** | Front–loaded |
| **Buses** | Typical - No bus route |
| **Design Vehicle** | B85 Car |
| **Check Vehicle** | Garbage Truck (11m) |
| **Behavioural Speed** | ≤ 30 km/h |
| **Indicative Traffic** | ≤ 500 |
| **Max Length** | ≈ 100m |
| **Typical Driveway Width** | 2.5m – single access<br>4.5m – double access |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Traffic calming, trees<br>WSUD and parking<br><br>Refer Part C: 3.3, 2.1, 2.2, 2.4, 2.5, 2.6, 3.5 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Min 1.2m path both sides |
| **VEHICLES** | |
| **Travel Lane Widths** | 2.8 – 3.0m |
| **Parking Lane Widths** | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | Required |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale<br><br>Refer Part C: 2.8, 2.7 |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // TILLOCK STREET, HABERFIELD**
Pinch points narrow a section of the carriageway which requires opposite motorists to yield to one another.
Image - (Google)

# **B3.2 Local Street** Type 2

Yield street, Residential Neighbourhood

## DESIGN REQUIREMENTS

**STREET FEATURES**

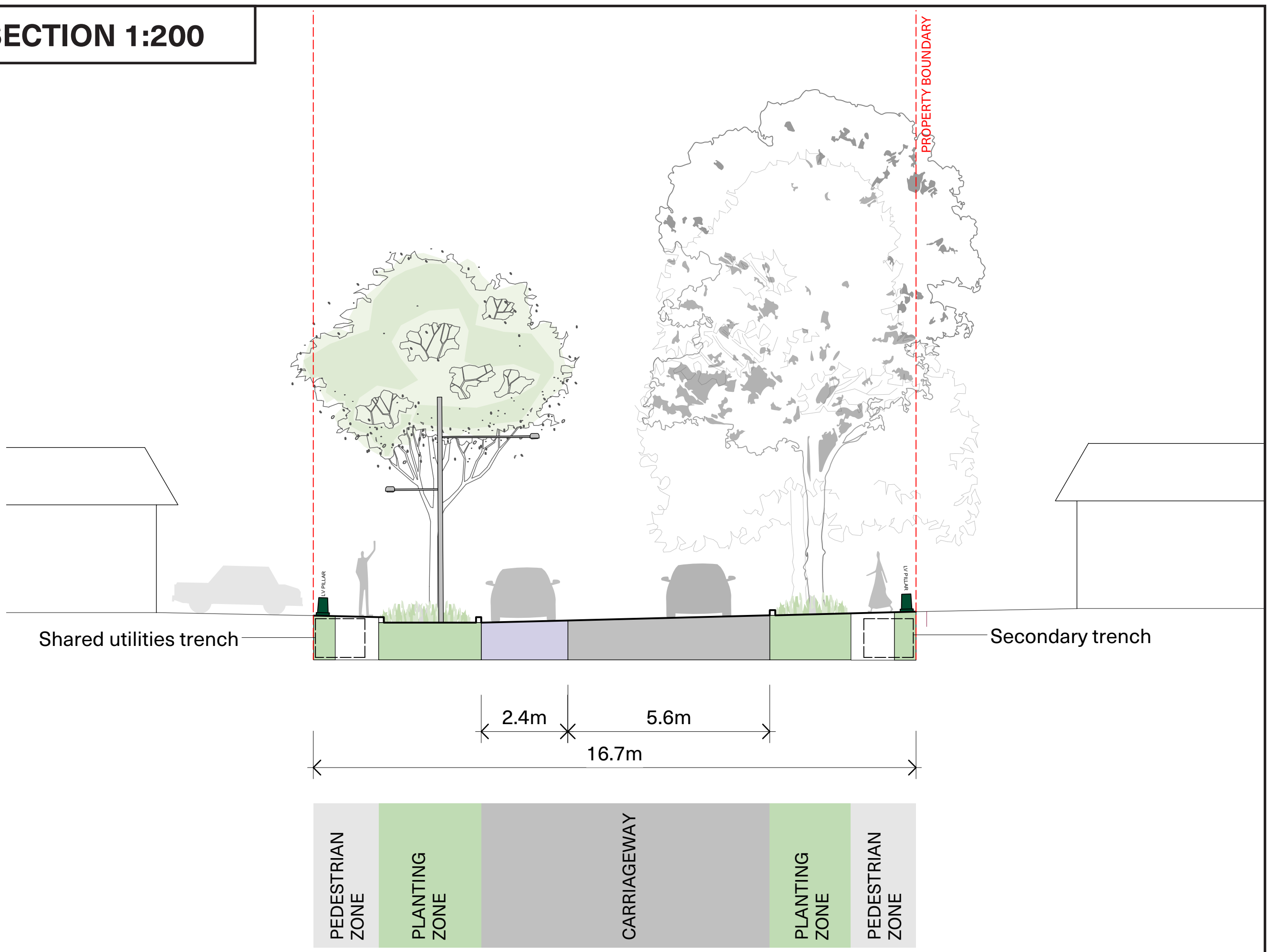
| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **YES** | **SHARED ZONE** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**Case Study**

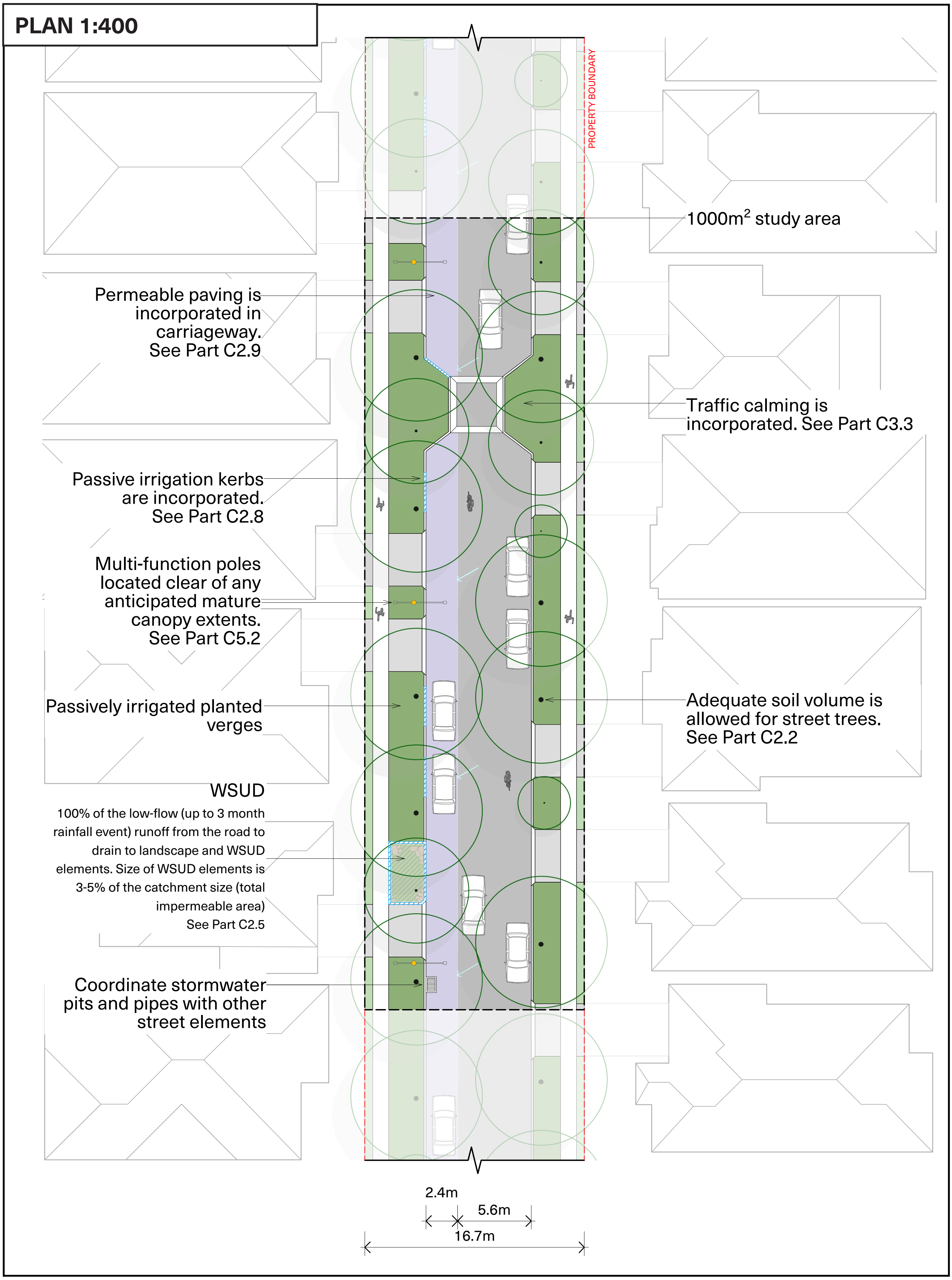
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
|---|---|---|---|---|---|---|
| 15 | 76% | 43% | YES | YES | n/a | YES |

## SECTION 1:200



# **B3.2 Local Street** Type 2

Yield street, Residential Neighbourhood



## B3.3 LOCAL STREET TYPE 3

Dual carriage and footpaths - Low Density

### Overview

Local Street Type 3 are slow-speed streets within low density residential areas. They are designed to be quiet and able to accommodate low levels of through traffic.

They provide dedicated carriageways with on-street parking bays interspersed with street trees, WSUD elements, and typical barrier kerbs to delineate the verge.

### Street Priorities

- Footpaths are provided on both sides of street for continuous and universal accessibility
- A slow street environment is designed which allows cyclists to safely use the vehicle travel zone
- Active travel infrastructure facilitates connectivity to nearby public transport stops
- Street tree planting provides a continuous tree canopy at maturity
- Low–flow runoff passively irrigates street trees and planting.
- Maximise WSUD elements to ensure neighbourhood–scale WSUD performance outcomes
- On-street vehicle parking is appropriately integrated into the streetscape
- Permeability of parking bays is maximised and interspersed with street trees and WSUD elements

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | 15 – 22m |
| **Context** | Residential neighbourhood |
| **Built Form** | Detached/semi–detached dwellings |
| **Typical Lot Width** | 10 – 12m |
| **Typ. Lots Served** | ≈ 10—15 |
| **ACTIVE TRANSPORT** | |
| **Cycling** | Travel zone shared with vehicles |
| **VEHICLES** | |
| **Lot Access** | Front–loaded |
| **Buses** | Typical - No bus route |
| **Design Vehicle** | B85 Car |
| **Check Vehicle** | Garbage Truck (11m) |
| **Behavioural Speed** | ≤ 30 km/h |
| **Indicative Traffic** | ≤ 500 |
| **Max Length** | ≈ 100m |
| **Typical Driveway Width** | 2.5m – single access<br>4.5m – double access |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Traffic calming, trees<br>WSUD and parking<br><br>Refer Part C: 3.3, 2.1, 2.2, 2.4, 2.5, 2.6, 3.5 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Min 1.2m path both sides |
| **VEHICLES** | |
| **Travel Lane Widths** | 2.8 – 3.0m |
| **Parking Lane Widths** | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | Required |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale<br><br>Refer Part C: 2.8, 2.7 |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **11** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area


**PRECEDENT // MARATHON AVENUE, NEWINGTON**
A narrow carriageway combined with abundant street tree planting increases shading of the road surface.
Image - (ASPECT Studios)

**PRECEDENT // LAKELAND CIRCUIT, HARRINGTON PARK**
A narrow carriageway with kerbside parking provides incidental traffic calming without inhibiting service vehicle access.
Image - (ASPECT Studios)

# **B3.3 Local Street** Type 3 | Case Study A
Dual carriage and footpaths – Low Density

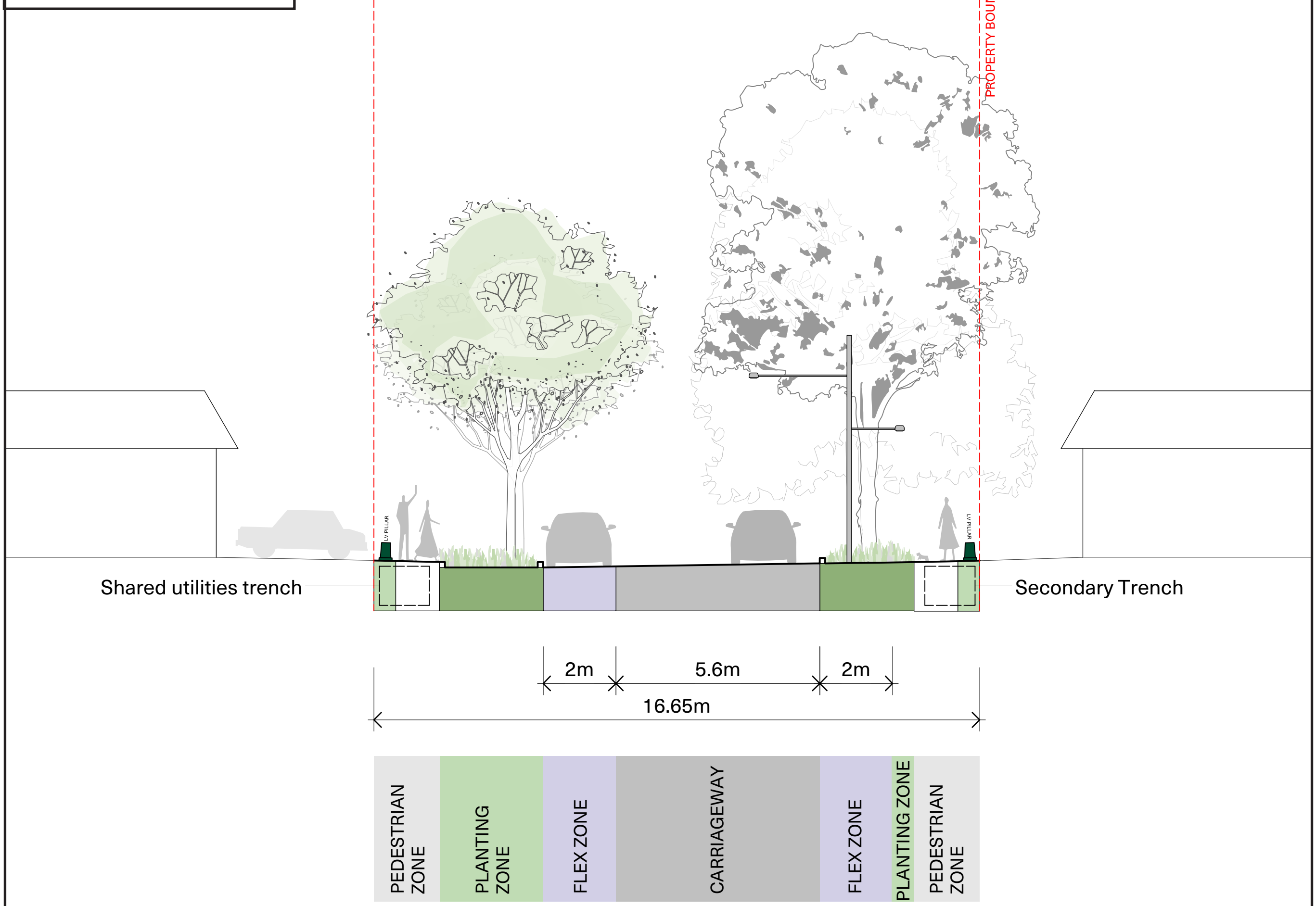
## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **11** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

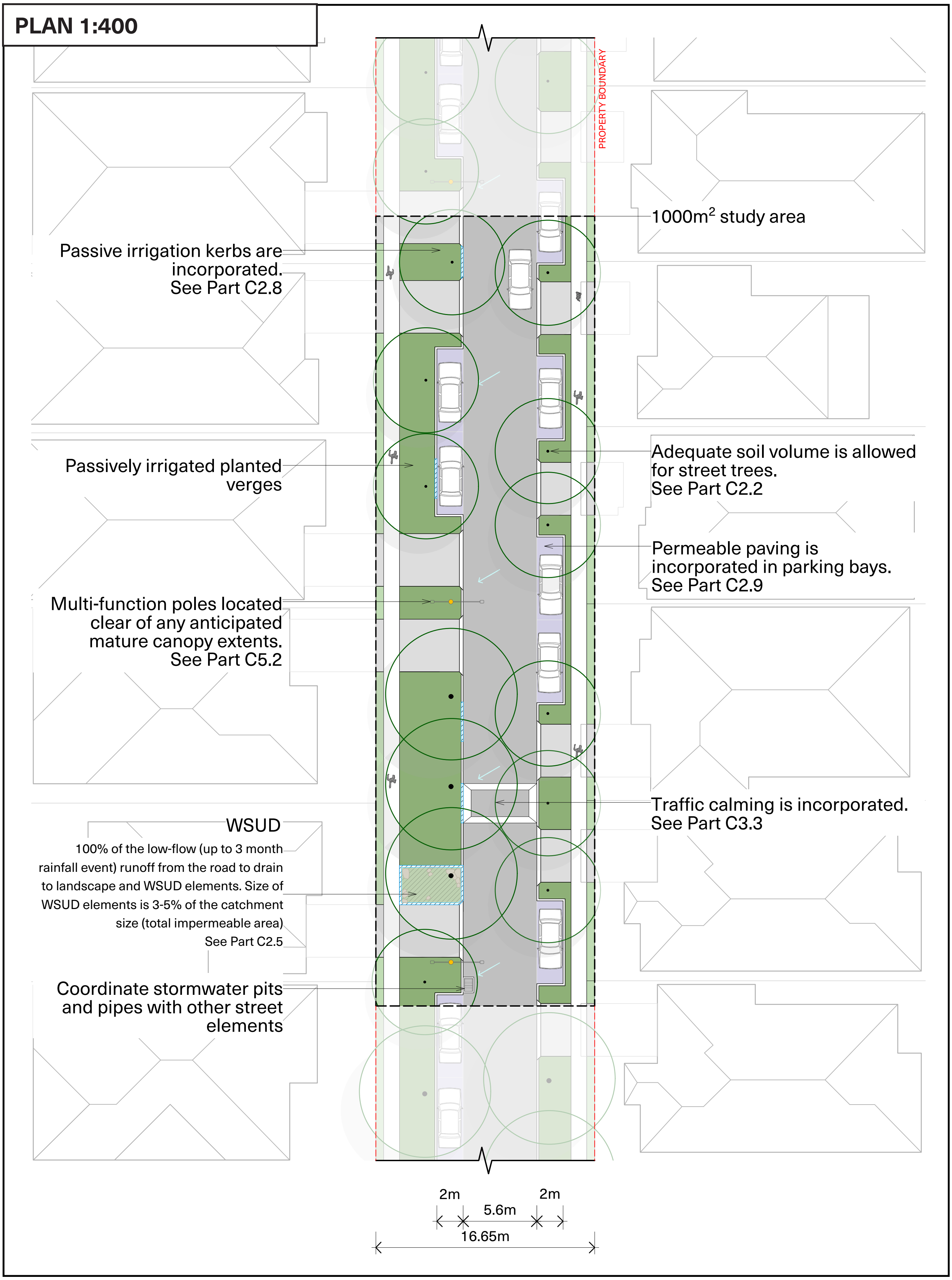
| Case Study A | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 17 | 70% | 36% | YES | YES | n/a | YES |

## SECTION 1:200



# **B3.3 Local Street** Type 3 | Case Study A

Dual carriage and footpaths – Low Density



# **B3.3 Local Street** Type 3 | Case Study B
## Dual carriage and footpaths – Low Density

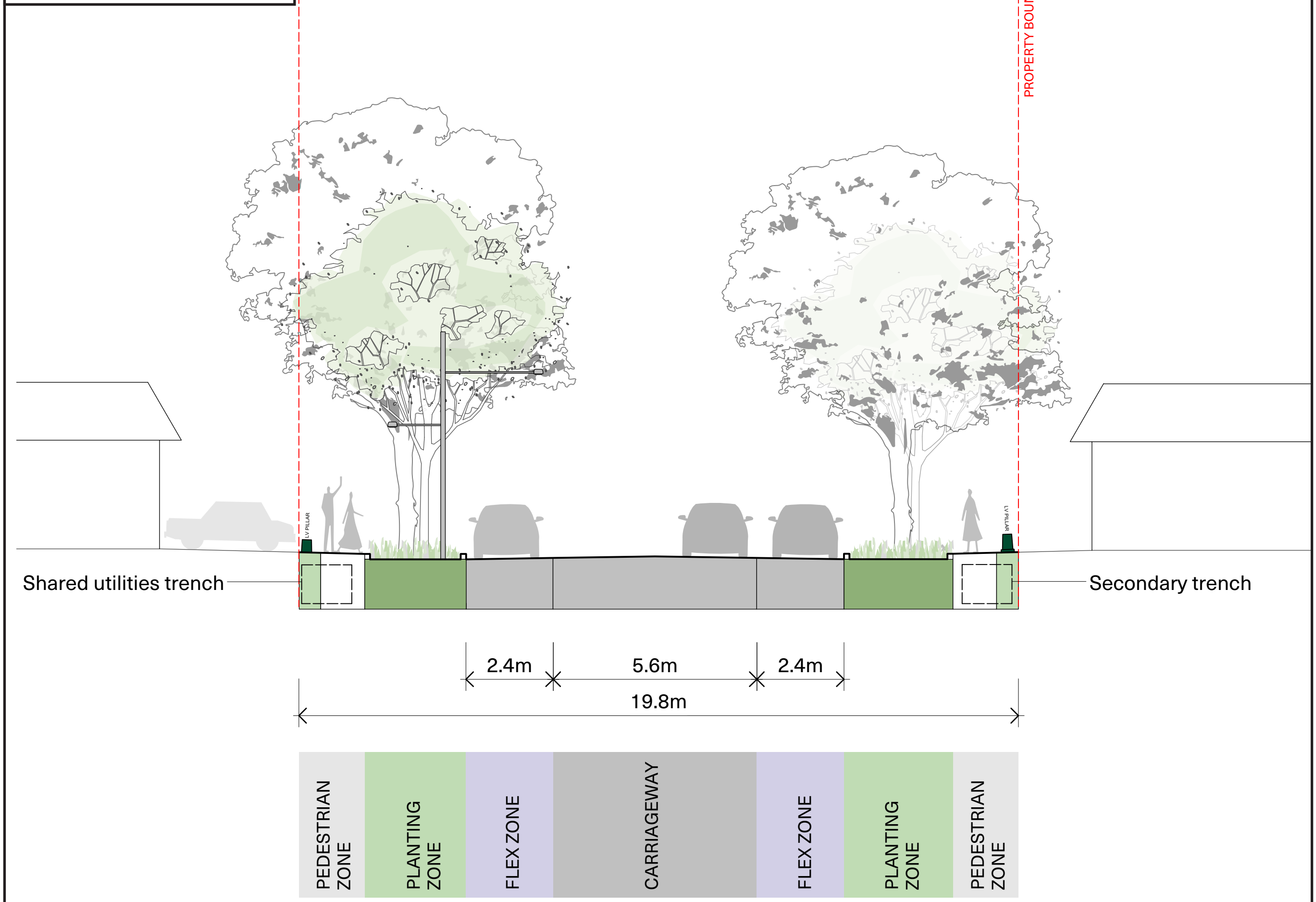
### DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **11** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

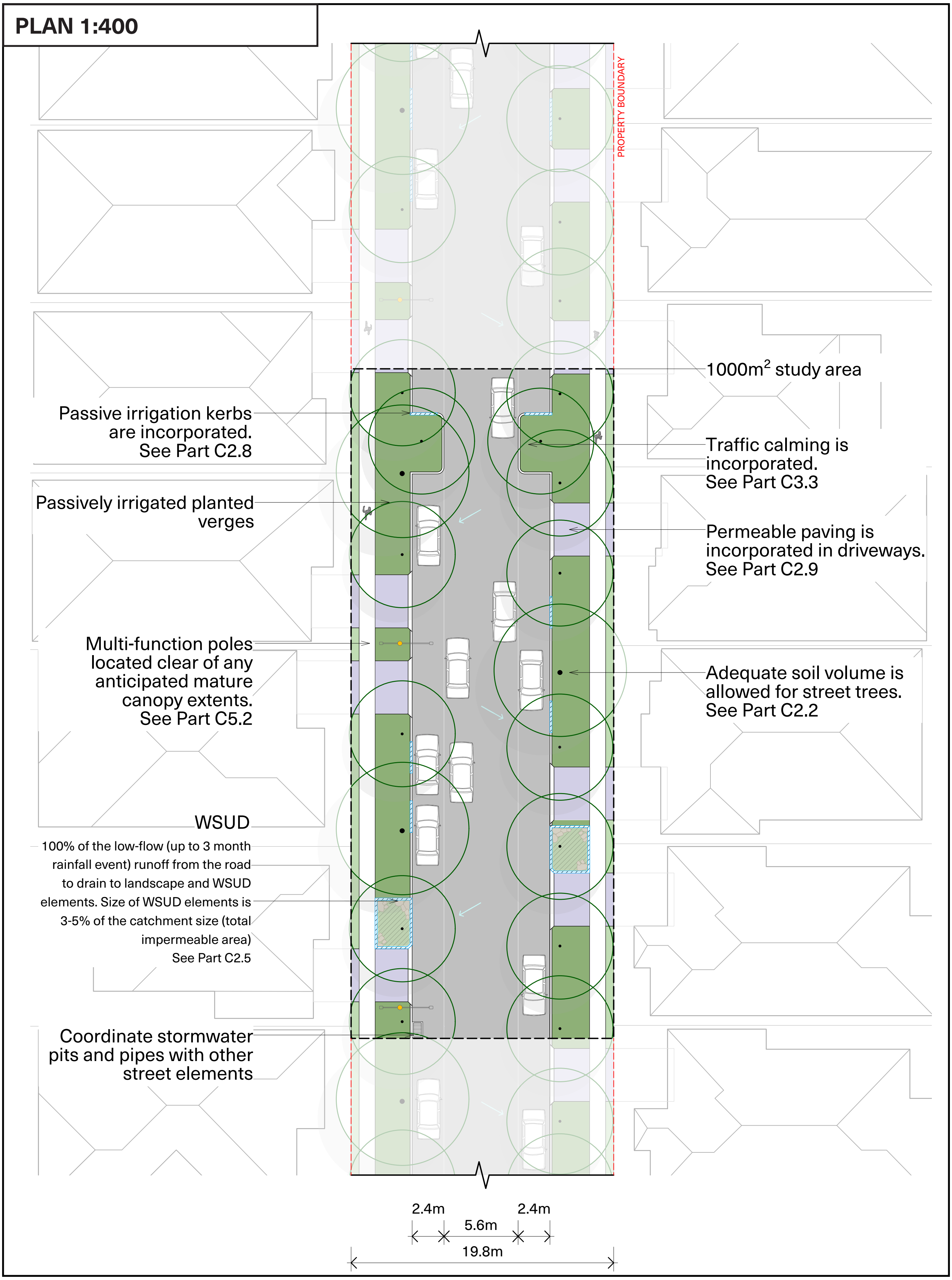
| Case Study B | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 15 | 71% | 36% | YES | YES | n/a | YES |

### SECTION 1:200



# **B3.3 Local Street** Type 3 | Case Study B

Dual carriage and footpaths – Low Density



## B3.4 LOCAL STREET TYPE 4
Dual carriage and footpaths - Medium Density

### Overview

Local Street Type 4 are slow-speed streets within medium density neighbourhoods which are designed to be quiet and accommodate low levels of through traffic.

The serve higher levels of pedestrian traffic due to their multi-residential nature from which traffic calming measures and adequate pedestrian & cyclist infrastructure is vital.

Street Trees line either side of the narrowed carriageway and verges give space to various environmental and community uses.

### Street Priorities

- Footpaths are provided on both sides of street for continuous and universal accessibility
- Provide a slow street environment that allows for cyclists of all ages to safely use the vehicle travel zone
- Active travel infrastructure facilitates connectivity to nearby public transport stops
- Street tree planting provides a continuous tree canopy at maturity
- Low–flow runoff passively irrigates street trees and planting
- WSUD elements are maximised to ensure neighbourhood–scale WSUD performance outcomes
- On-Street parking is appropriately integrated within the streetscape
- Permeability of parking bays is maximised and interspersed with street trees and WSUD elements

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | 15m – 23m |
| **Context** | Residential neighbourhood |
| **Built Form** | Detached/semi–detached dwellings, multi–unit residential buildings |
| **Typical Lot Width** | 10m + |
| **Typ. Lots Served** | Varies |
| **ACTIVE TRANSPORT** | |
| **Cycling** | Travel zone shared with vehicles<br>**Consider bicycle paths or shared paths when appropriate to local context** |
| **VEHICLES** | |
| **Lot Access** | Front–loaded |
| **Buses** | Typical - No bus route |
| **Design Vehicle** | B85 Car |
| **Check Vehicle** | Garbage Truck (11m) |
| **Behavioural Speed** | ≤ 30 km/h |
| **Indicative Traffic** | ≈ 3000 |
| **Max Length** | As required for local access |
| **Typical Driveway Width** | 2.5m – single access<br>4.5m – double access<br>≤ 6m – multi-residential buildings |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Traffic calming, trees<br>WSUD and parking<br><br>Refer Part C: 3.3, 2.1, 2.2, 2.4, 2.5, 2.6, 3.5 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Min 1.2m path both sides |
| **VEHICLES** | |
| **Travel Lane Widths** | 2.8 – 3.0m |
| **Parking Lane Widths** | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | Required |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale<br><br>Refer Part C: 2.8, 2.7 |

## DESIGN REQUIREMENTS

**STREET FEATURES**

| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // PENNYROYAL BOULEVARD, DENHAM COURT**
Incorporating landscape elements within the Flex Zone can reduce the perceived width of the carriageway and encourage slower travel speeds.
Image - (ASPECT Studios)

**PRECEDENT // PENNYROYAL BOULEVARD, DENHAM COURT**
The Flex Zone allows for a significant increase in tree and understorey planting.
Image - (ASPECT Studios)

**PRECEDENT // UNION PLACE, ROZELLE**
Kerbside parking can be interspersed with raingardens within the Flex Zone to improve the amenity and environmental performance of the street.
Image - Union Place, ASPECT Studios (Florian Groehn)

# **B3.4 Local Street** Type 4 | Case Study A

Dual carriage and footpaths – Medium Density

## DESIGN REQUIREMENTS

**STREET FEATURES**

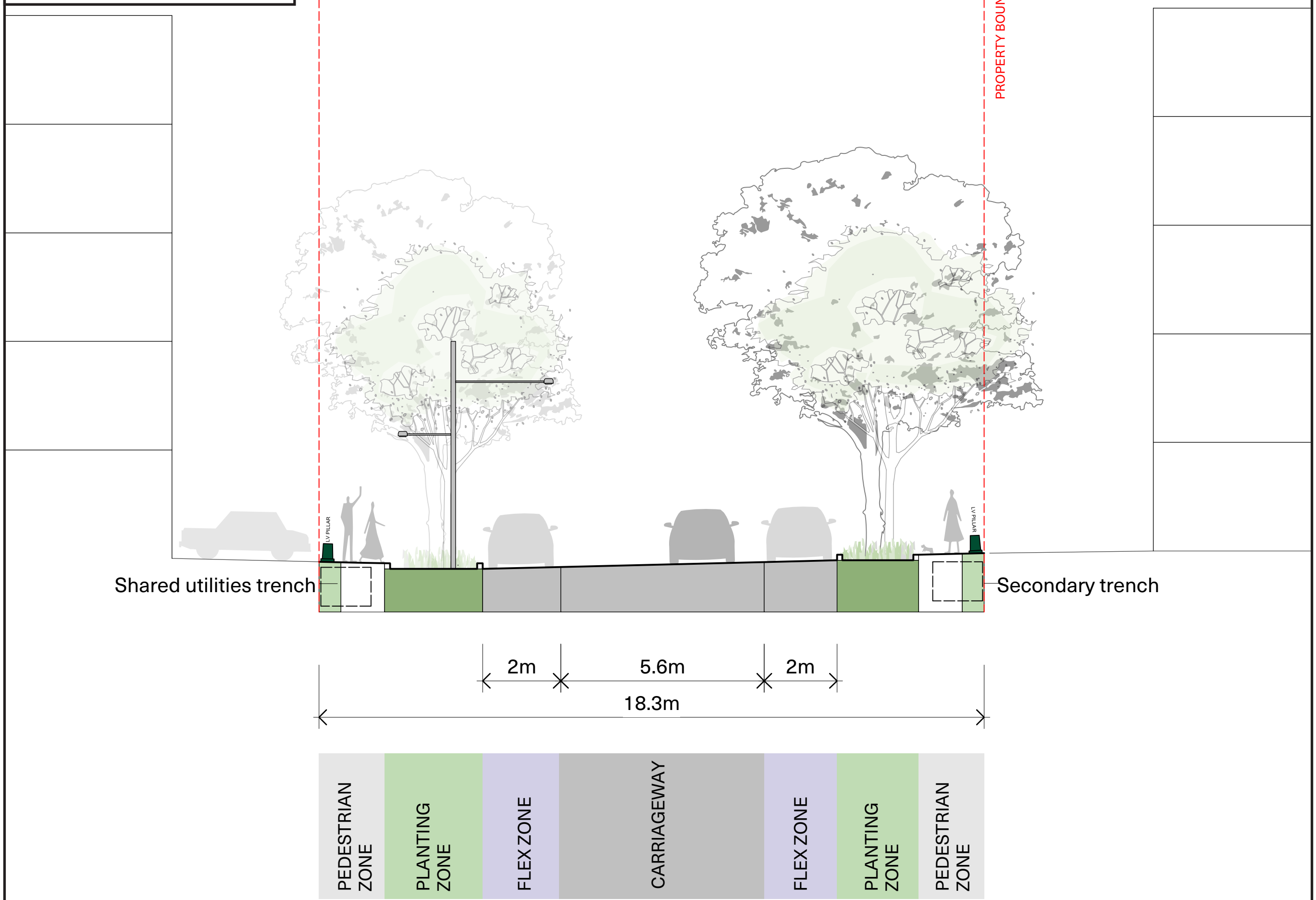
| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**Case Study A**

| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
|---|---|---|---|---|---|---|
| 14 | 78% | 37% | YES | YES | n/a | YES |

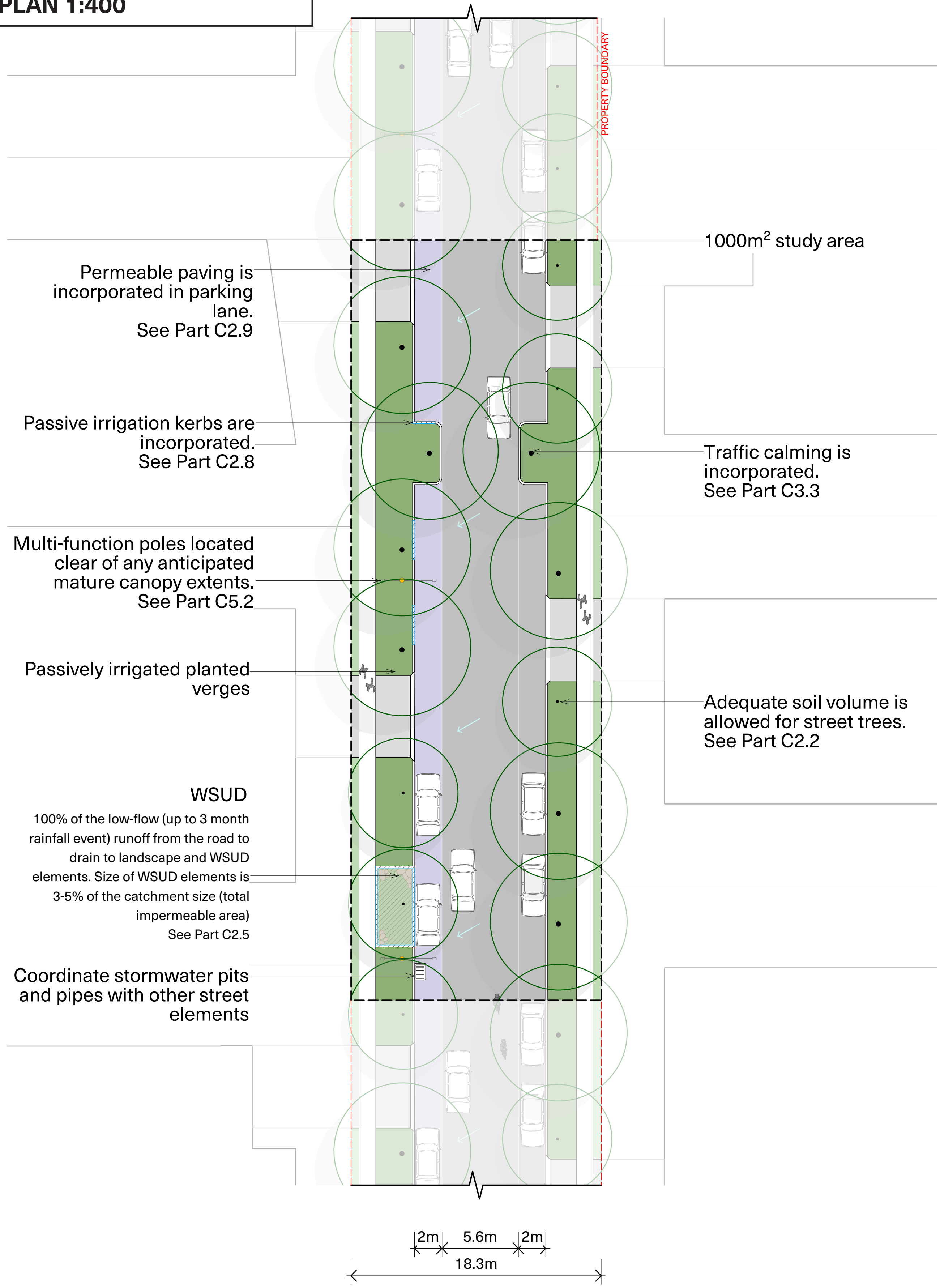
## SECTION 1:200



## **B3.4 Local Street** Type 4 | Case Study A

Dual carriage and footpaths – Medium Density

**PLAN 1:400**



# **B3.4 Local Street** Type 4 | Case Study B

Dual carriage and footpaths – Medium Density

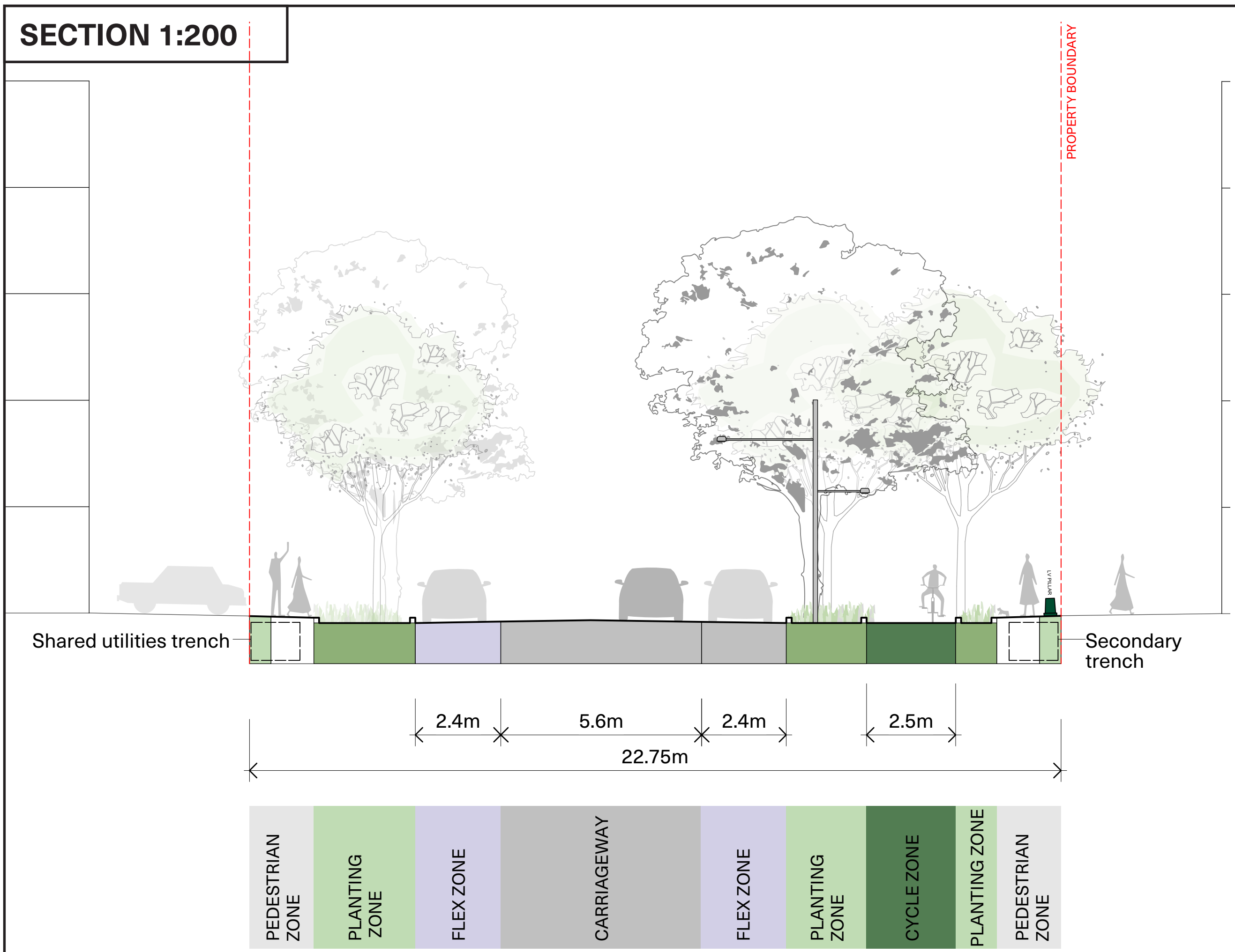
## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

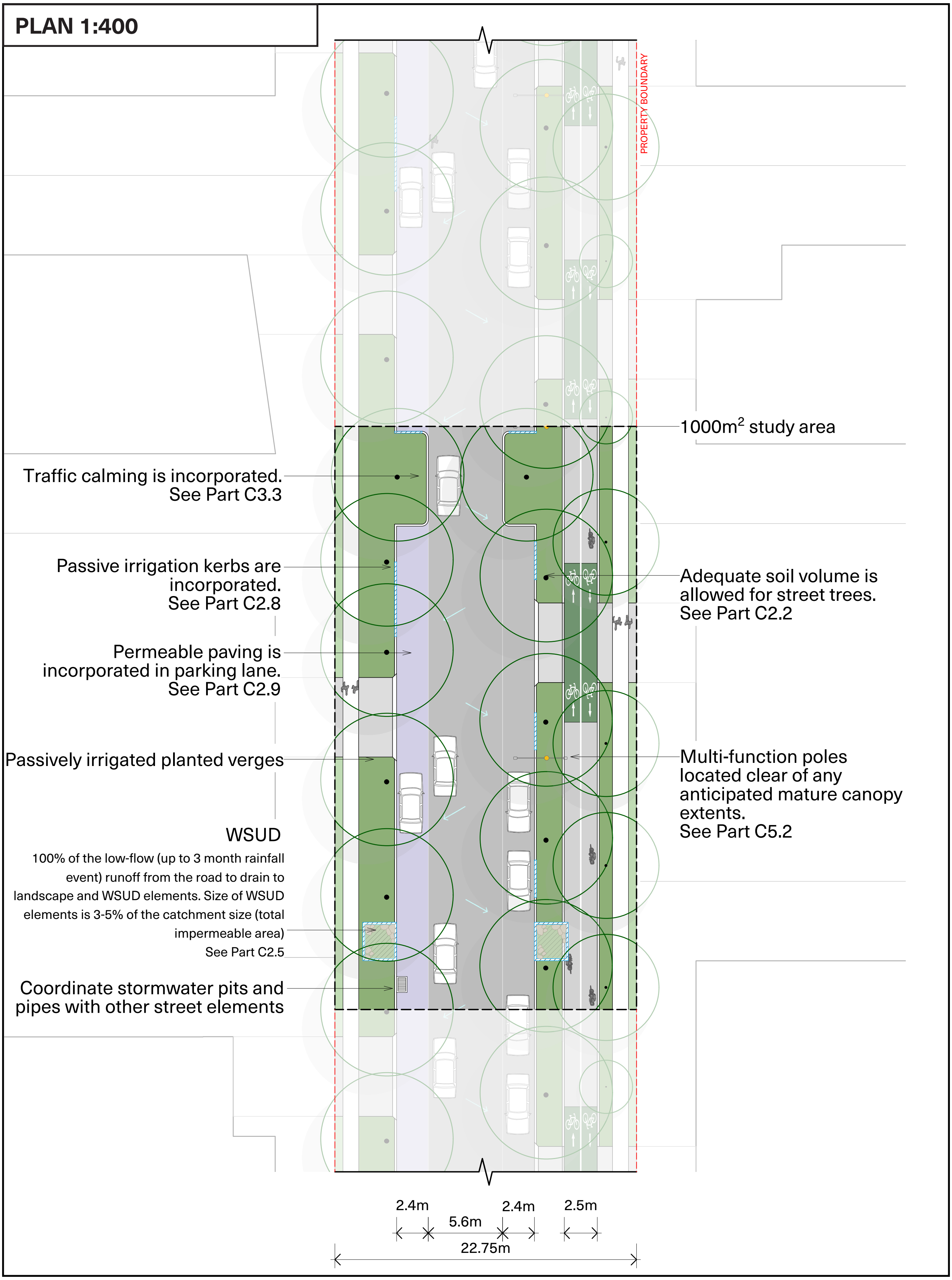
| Case Study B | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 14 | 73% | 35% | YES | YES | YES | YES |

## SECTION 1:200



# **B3.4 Local Street** Type 4 | Case Study B

Dual carriage and footpaths – Medium Density



# B3.5 RESIDENTIAL LANEWAY

Residential Laneway

## Overview

Residential Laneways provide access to the rear of dwellings. They are designed to be very slow, shared environments that allows for incidental community uses and placemaking by adjoining residents.

These streets are designed to accommodate safe pedestrian and cycle access. Elements such as planting, seating and lighting where applicable, ensure a safe shared zone where vehicle calming measures provide access to local access and service vehicles only.

## Street Priorities

— A very slow street environment is provided which allows for safe and accessible movement of all pedestrians

— A very slow street environment is provided which allows for cyclists to safely use the vehicle travel zone

— Street tree planting is integrated into the street design to provide shade and enhance the character of the residential laneway

— Low–flow runoff passively irrigates street trees and planting

— WSUD elements are maximised to ensure neighbourhood–scale WSUD performance outcomes

— Access to garages and private parking is facilitated from the laneway however parking within the laneway is discouraged

## DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve (nom.)** | 5.5m– 8.5m |
| **Context** | Residential neighbourhood |
| **Built Form** | Detached/semi–detached dwellings |
| **Typical Lot Width** | 8 –12m |
| **Typ. Lots Served** | ≈ 5–10 |
| **ACTIVE TRANSPORT** | |
| **Cycling** | Travel zone shared with cyclists and vehicles |
| **VEHICLES** | |
| **Lot Access** | Rear–loaded |
| **Buses** | No bus route |
| **Design Vehicle** | B85 Car |
| **Check Vehicle** | Garbage Truck (11m) |
| **Behavioural Speed** | ≤ 10 km/h |
| **Indicative Traffic** | ≤ 300 |
| **Max Length** | ≈ 150m |
| **Typical Driveway Width** | n/a |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | n/a |

## DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Shared Zone |
| **VEHICLES** | |
| **Travel Lane Widths** | 5.5m one-way shared space |
| **Parking Lane Widths** | n/a |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | n/a |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: pits and pipes solution<br><br>Refer Part C: 2.8 |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **SHARED ZONE** | **SHARED ZONE** | **–** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // CRESSWICK WALK, MOOREBANK**
A kerbless environment with narrow carriageway and continuous landsscape elements encourages slow travel speeds.
Image - (ASPECT Studios)

**PRECEDENT // LANEWAY, CRACE ACT**
Laneways provide additional opportunities for tree planting within urban environments.
Image - (Google)

# B3.5 Residential Laneway

Residential Neighbourhood

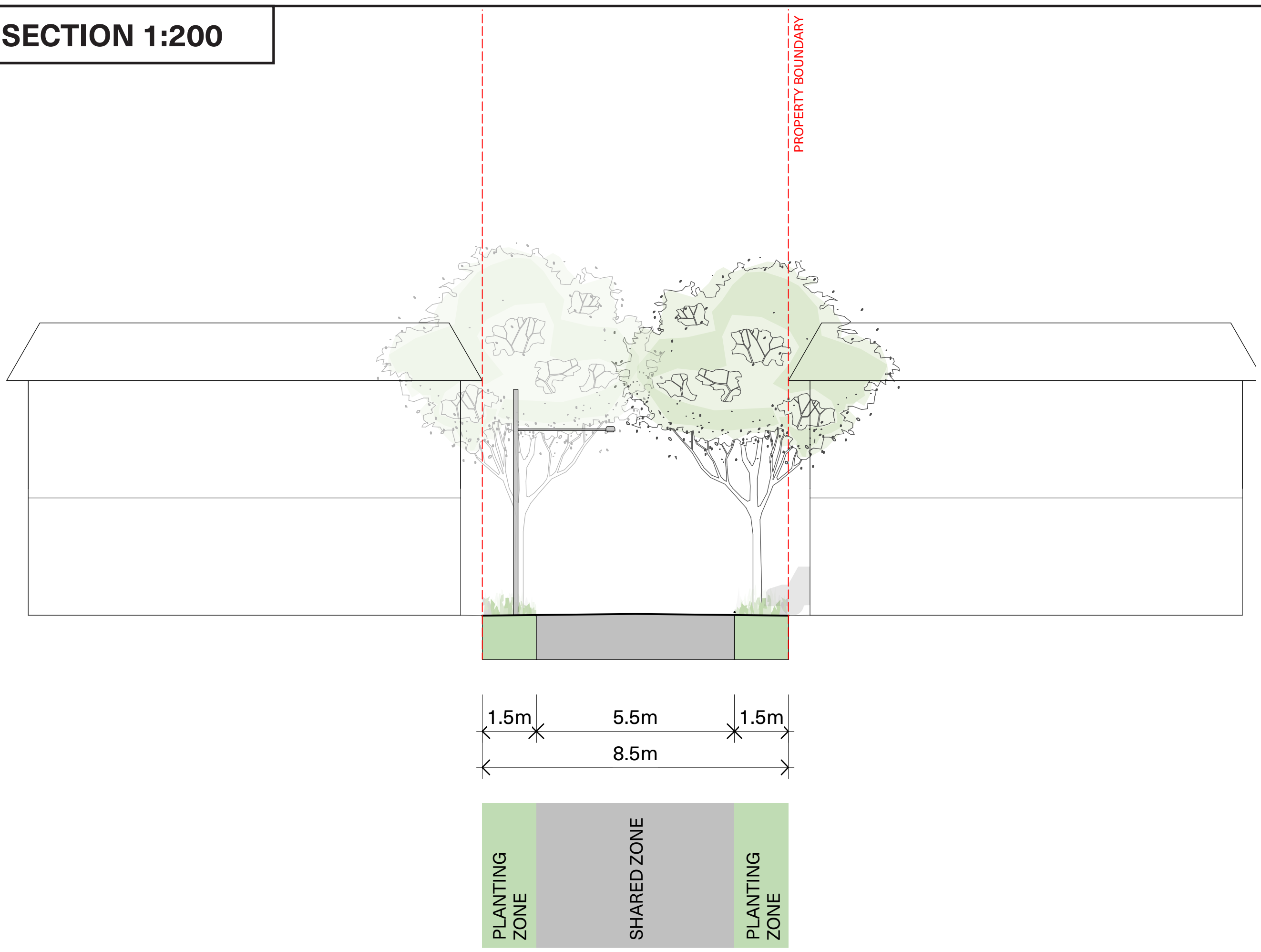
## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **SHARED ZONE** | **SHARED ZONE** | **–** |

Note: Typical measurements per 1000m2 of road reserve area

| Case Study | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 20 | 71% | 35% | YES | n/a | n/a | YES |

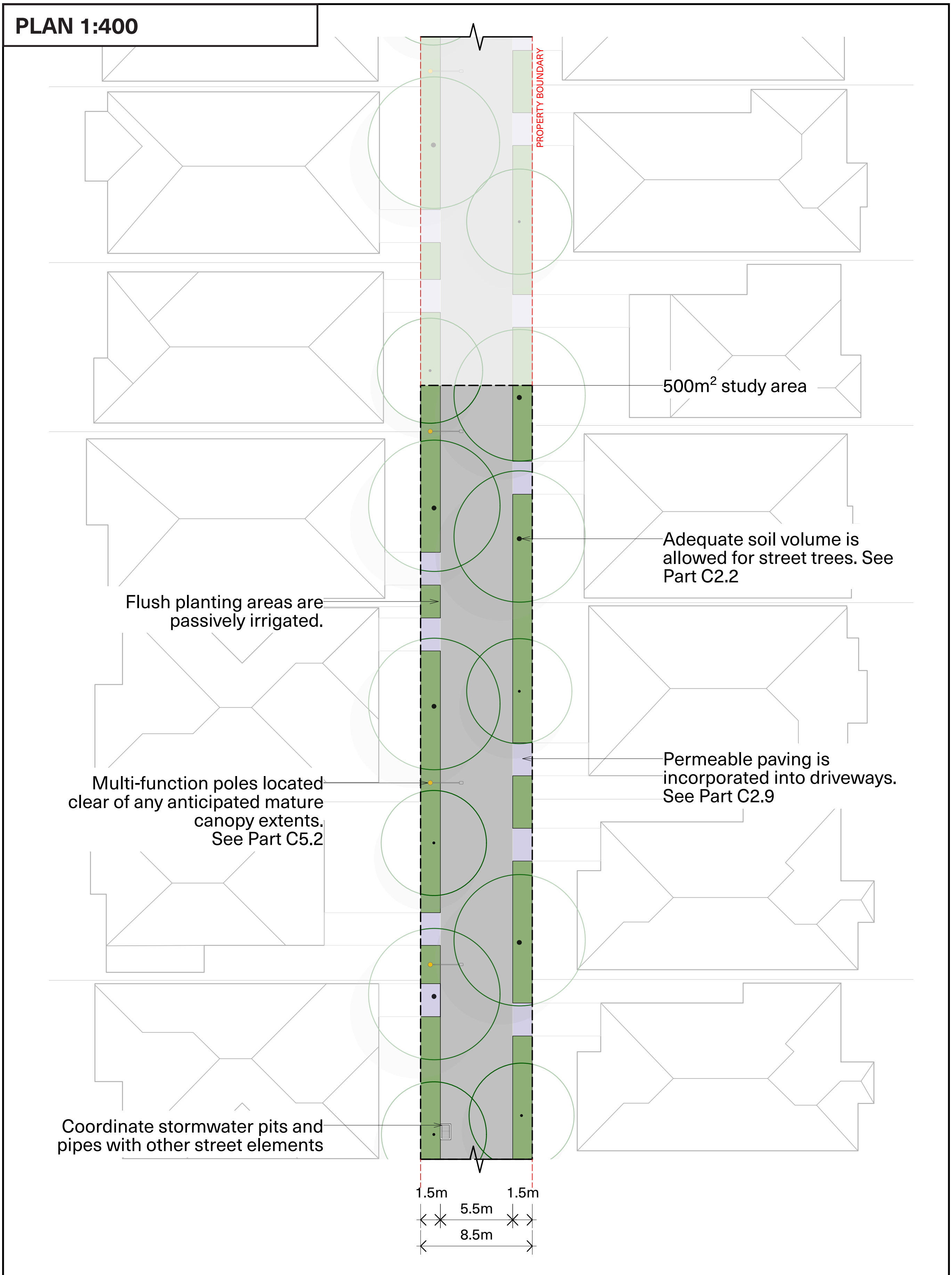
## SECTION 1:200



# B3.5 Residential Laneway

Residential Neighbourhood

**PLAN 1:400**



## B3.6 LOCAL COLLECTOR
Residential Neighbourhood

### Overview

Local Collector streets typically form the primary thoroughfare route into and through residential neighbourhoods. They provide important connections within and between neighbourhoods to key local destinations.

The character of Local Collectors is important to neighbourhood legibility and sense of place. Environment and local life predominate, and improved amenity is encouraged over the use of vehicles. High quality walking, cycling and public transport facilities are all prioritised within these streets.

### Street Priorities

- Dual footpaths are provided for continuous and universal accessibility
- Separated cycling facilities to achieve a neighbourhood–wide cycle network if Collector forms part of the broader cycle strategy
- Vehicle lanes allow for local bus routes
- 'in-line'' bus stops are provided to maintain bus priority and continuity of verge arrangement
- Street tree planting provides a continuous tree canopy at maturity
- A median and accompanying median street trees are provided if space allows
- Low–flow runoff passively irrigates street trees and planting
- WSUD elements are maximised to ensure neighbourhood–scale WSUD performance outcomes
- On-street vehicle parking is effectively integrated within the streetscape
- Permeability of parking bays in maximised with street trees and WSUD features integrated

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | 18.5m – 24m |
| **Context** | Residential neighbourhood |
| **Built Form** | Residential dwellings and occasional commercial ground floor uses |
| **Typical Lot Width** | 10m + |
| **Typ. Lots Served** | Varies |
| **ACTIVE TRANSPORT** | |
| **Cycling** | See design requirements |
| **VEHICLES** | |
| **Lot Access** | Front & rear–loaded |
| **Buses** | Yes |
| **Design Vehicle** | B85 Car |
| **Check Vehicle** | Single unit truck/bus (12.5m) |
| **Behavioural Speed** | ≤ 40 km/h |
| **Indicative Traffic** | ≈ 3000 - 6000 |
| **Max Length** | As required for neighbourhood access |
| **Typical Driveway Width** | 2.5m – single access<br>4.5m – double access<br>≤ 6m – multi-residential buildings |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Bicycle path, traffic calming, trees, WSUD and parking, bus stop, micro–mobility parking<br>Refer Part C: 1.7, 4.4, 3.3, 2.1, 2.2, 2.4, 2.5, 2.6, 3.5, 3.11, 1.10 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Min 1.5 m path both sides |
| **Cycling** | Separated cycle way |
| **VEHICLES** | |
| **Travel Lane Widths** | 3.2m – 3.5m |
| **Parking Lane Widths** | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | Required |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale<br><br>Refer Part C: 2.8, 2.7 |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **YES** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // BOURKE STREET, SURRY HILLS**
Priority between pedestrians, bicycle riders and motorists needs to be clearly communicated in areas of potential conflict.
Image - Bourke Street Cycleway, City of Sydney (Simon Wood)

**PRECEDENT // NEWINGTON BLVD, NEWINGTON**
Cycleways provide safe routes for bicycle riders separate from other road users such as pedestrians and motor vehicles.
Image - (ASPECT Studios)

**PRECEDENT // ARGYLE STREET, CAMDEN**
Central medians provide an opportunity to increase tree planting and shading within the street.
Image - (ASPECT Studios)

# **B3.6 Local Collector** | Case Study A
## Residential Neighbourhood

### DESIGN REQUIREMENTS

**STREET FEATURES**

| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **YES** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

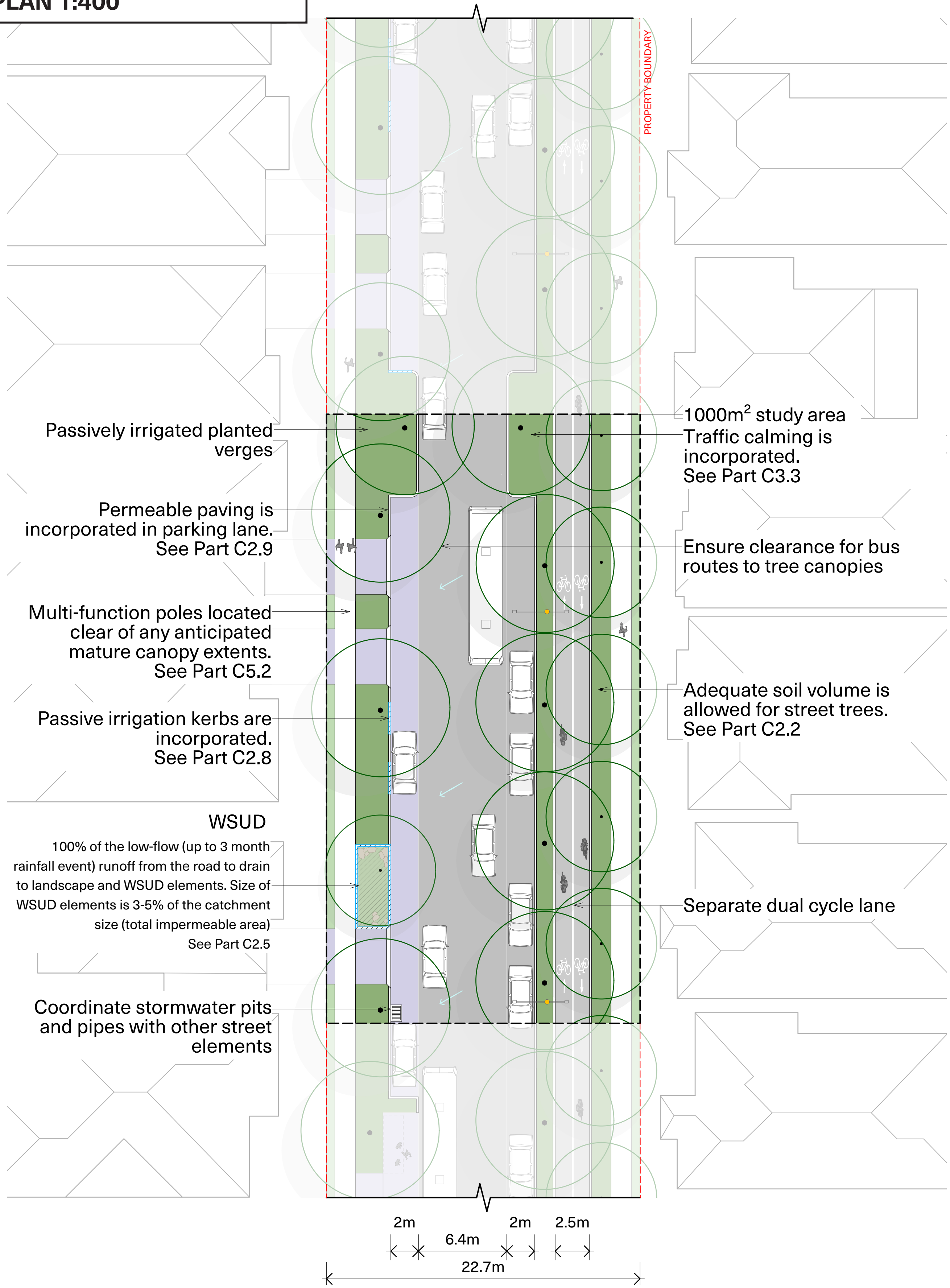
**Case Study A**

| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
|---|---|---|---|---|---|---|
| 13 | 74% | 35% | YES | YES | YES | YES |

### SECTION 1:200

# **B3.6 Local Collector**| Case Study A
Residential Neighbourhood

**PLAN 1:400**



# **B3.6 Local Collector** | Case Study B
Residential Neighbourhood

## DESIGN REQUIREMENTS

**STREET FEATURES**

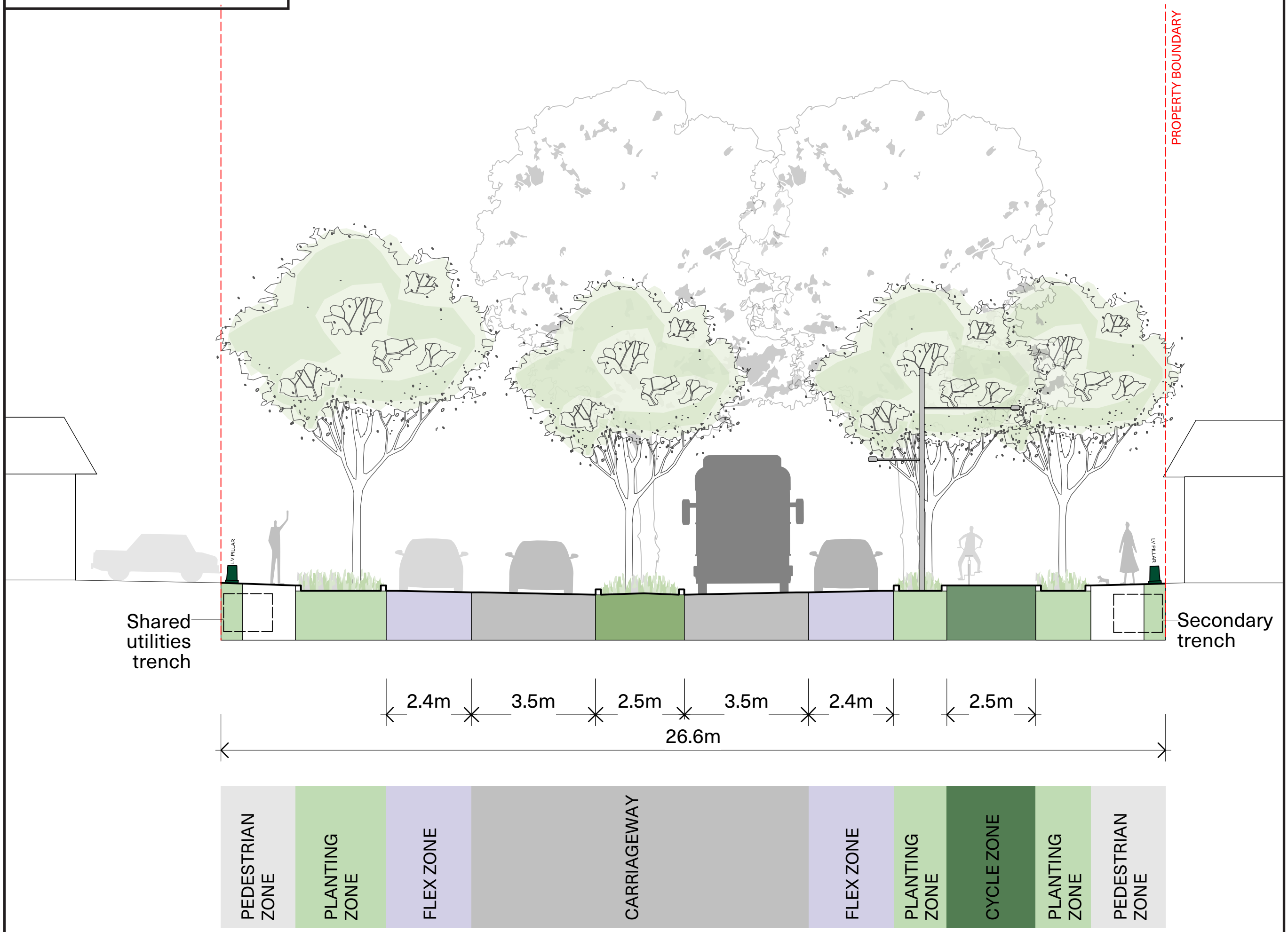
| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **YES** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**Case Study B**

| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
|---|---|---|---|---|---|---|
| 16 | 83% | 37% | YES | YES | YES | YES |

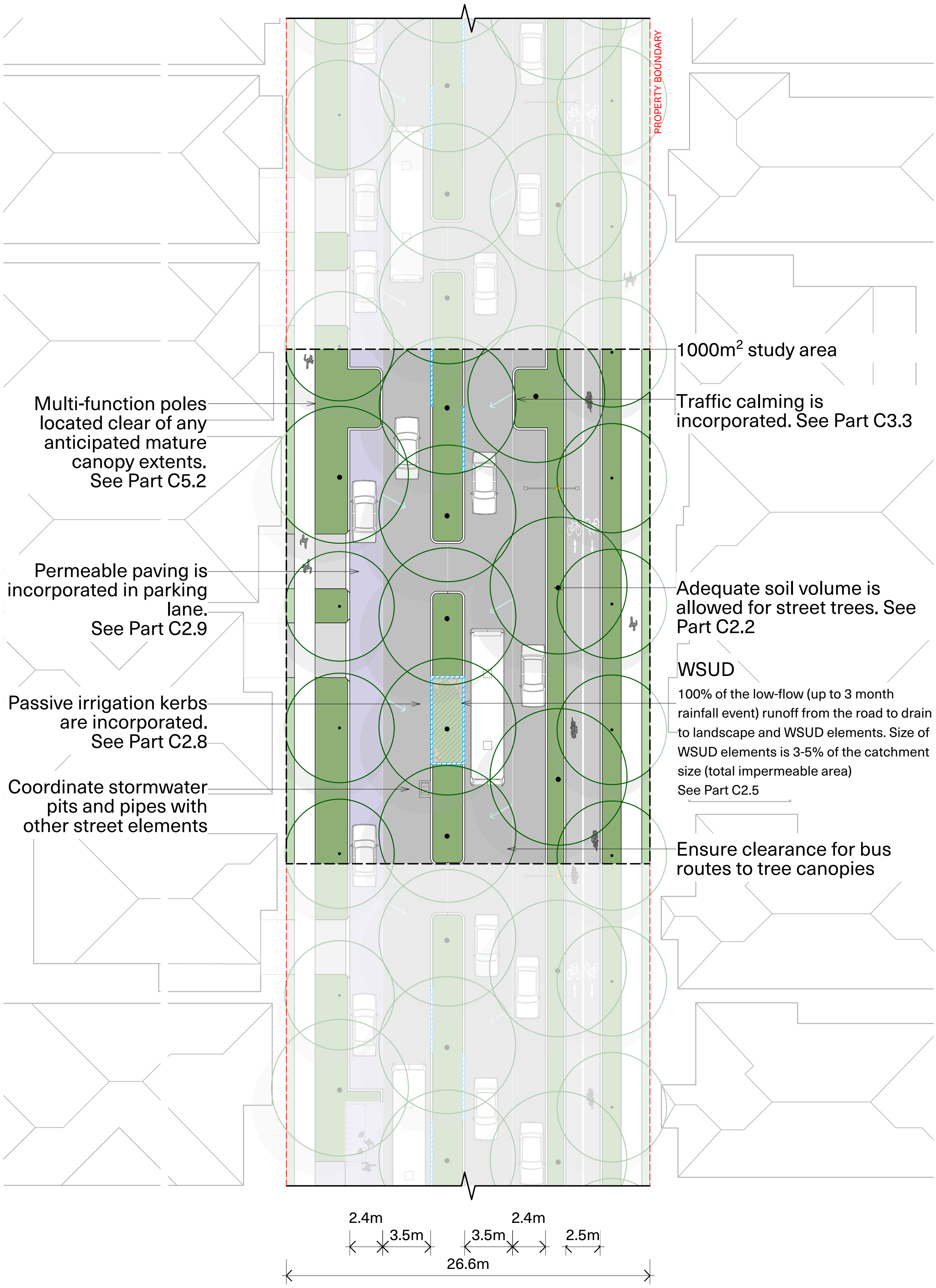
## SECTION 1:200



# **B3.6 Local Collector** | Case Study B

Residential Neighbourhood

**PLAN 1:400**



## B3.7 HIGH STREET

Rear-loaded via laneway or Front-loaded - Commercial Centre

### Overview

High Streets are unique to commercial centres. High quality public amenity and generous verge space is crucial to the various environmental and community uses unique to High Streets.

High Streets are designed to foster street life and activity. Pedestrian amenity is prioritised and assembling in the street is encouraged. Footpaths are designed to accommodate high pedestrian traffic alongside other footpath uses such as seating and retail spill out.

Depending on the local area, some high streets will be front loaded, whilst others will have service access via the rear. This will create different conditions along the High Street itself. Where loading occurs from the street, there will be a higher volume of service vehicles resulting in a larger Design Vehicle for the street type. Although kerb extensions at intersections are unlikely in this scenario, a range of street components such as Continuous Footpaths (see **Part C1.2**) and mid-block kerb extensions (see **Part C1.5**) should be used in order to create the level of pedestrian amenity required of these street types.

When feasible, rear-loading should be prioritised as this will allow for a smaller design vehicle and the full use of traffic calming elements to be incorporated throughout the street – both along its length and at intersections.

### Street Priorities

- Footpaths are generous and wide. Continuous footpaths provided when possible
- A very slow street environment is provided which allows for cyclists to safely use the vehicle travel zone
- Street components like kerb extensions are incorporated mid-block and at intersections
- Vehicle lanes allow for local bus routes. 'In-line' bus stops are provided to maintain bus priority and continuity of verge arrangement
- Street tree planting provides a continuous tree canopy at maturity, and minimise conflict between mature canopy and shop awnings
- WSUD elements are maximised to ensure neighbourhood–scale WSUD performance outcomes
- On-street vehicle parking is effectively integrated into the streetscape
- Permeability of parking bays is maximised with street trees and raingardens interspersed

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | 16m – 25m |
| **Context** | Commercial centre |
| **Built Form** | Mixed–use with active ground floor uses |
| **ACTIVE TRANSPORT** | |
| **Cycling** | Travel zone shared with vehicles. Consider separated bicycle paths when appropriate to local context |
| **VEHICLES** | |
| **Lot Access** | Rear–loaded/loading bays |
| **Buses** | Yes |
| **Design Vehicle** | Rear-loaded: B85 Car<br>Front-loaded: Service Vehicle (8.8m) |
| **Check Vehicle** | Single unit truck/bus (12.5m) |
| **Behavioural Speed** | ≤ 30 km/h |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Outdoor dining, bike parking, micro mobility parking, bus stops, traffic calming, trees, WSUD and parking<br><br>Refer Part C: 1.9, 1.8, 1.10, 3.11, 3.3, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.4 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Generous footpaths with multiple uses |
| **VEHICLES** | |
| **Travel Lane Widths** | 3.2m – 3.5m |
| **Parking Lane Widths** | 2.0m – 2.4m |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | Rear-loaded: required<br>Front-loaded: - |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation / raingardens<br>Higher flow: pits and pipes solution<br><br>Refer Part C: 2.8, 2.7 |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **20%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // HIGH STREET, PENRITH**
In narrow High Streets, car parking can be interspersed within street tree planting to improve the amenity of footpath areas.
Image - (Greater Sydney Commission)

**PRECEDENT // HIGH STREET, PENRITH**
High Streets should provide adequate footpath widths to allow for areas of outdoor dining or other elements for dwelling within the street.
Image - (Google)

**PRECEDENT // OLD NORTHERN ROAD, CASTLE HILL**
Raised mid-block pedestrian crossings improve the permeability of High Streets while calming traffic.
Image - (ASPECT Studios)

# B3.7 High Street
## Commercial Centre

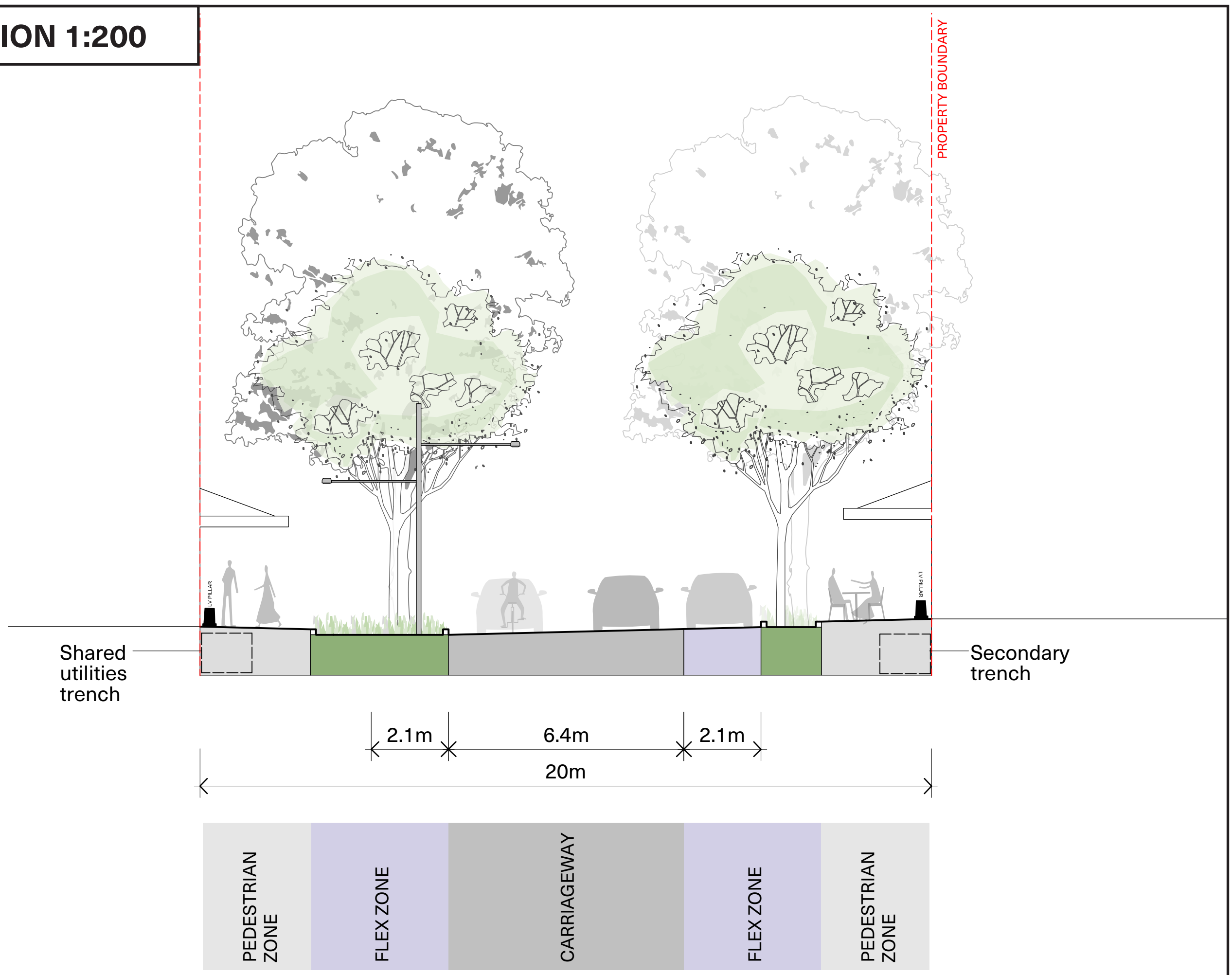
### DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **20%** | **YES** | **YES** | **–** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

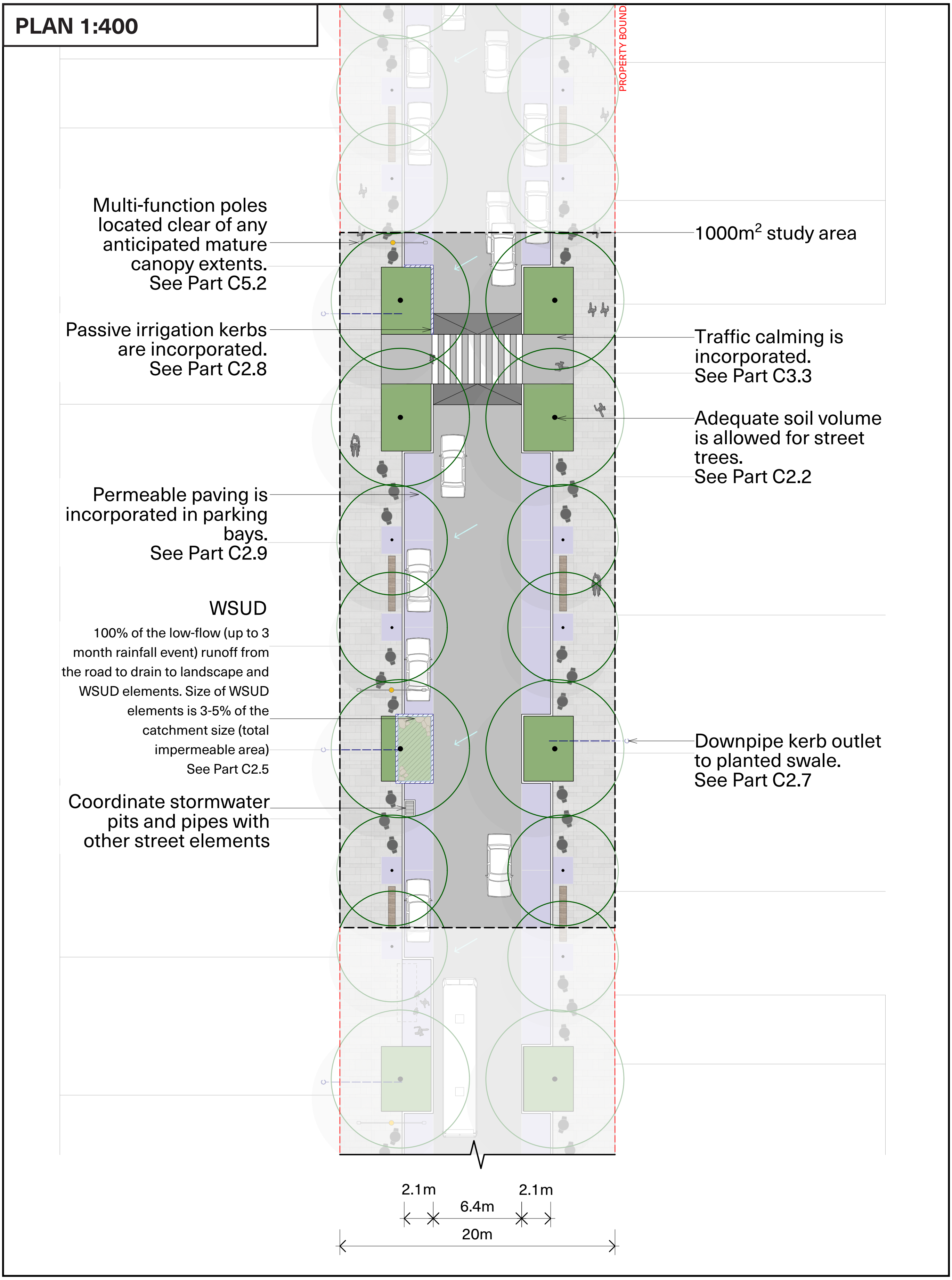
| Case Study | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 12 | 73% | 27% | YES | YES | n/a | YES |

### SECTION 1:200



## B3.7 High Street

Commercial Centre



## B3.8 INDUSTRIAL STREET

Industrial and Commercial Precincts

### Overview

Industrial Streets serve commercial and industrial precincts. They cater to buses and heavier vehicles with particular design requirements, alongside general traffic using these spaces.

An increased width allows opportunities for environmental and community uses, such as understorey planting the verge space and street trees in the carriageway to combat urban heating.

### Street Priorities

- Footpaths are provided on both sides of the street
- Cycle infrastructure is provided on all Industrial Streets to provide safety for cyclists, and achieve a neighbourhood-wide cycle network
- Vehicle lanes allow for local bus routes
- 'in-line' bus stops are provided to maintain bus priority and continuity of verge arrangement
- Street tree planting provides a continuous tree canopy at maturity
- Low–flow runoff passively irrigates street trees and planting
- WSUD elements are maximised ensure neighbourhood–scale WSUD performance outcomes
- Parking bays allow for heavy vehicle movements and parking requirements

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | ≈ 22m |
| **Context** | Industrial and commercial precincts |
| **Built Form** | Large industrial and commercial buildings, typically setback from the road corridor boundary |
| **ACTIVE TRANSPORT** | |
| **Cycling** | See design requirements |
| **VEHICLES** | |
| **Lot Access** | Front–loaded |
| **Buses** | Yes |
| **Kerb Extensions at Intersections** | Recommended |
| **Design Vehicle** | Prime mover and semi-trailer (19m) |
| **Check Vehicle** | B-Double (25m) |
| **Behavioural Speed** | ≤ 40 km/h |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Bicycle path, traffic calming, trees, WSUD, parking and bus stops<br><br>Refer Part C: 1.7, 4.4, 3.3, 2.1, 2.2, 2.4, 2.5, 2.6, 3.4, 3.11 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Min 1.2m path both sides |
| **Cycling** | Provide cycle infrastructure |
| **VEHICLES** | |
| **Travel Lane Widths** | 3.5m |
| **Parking Lane Widths** | 2.0 – 2.4m |
| **Kerb Return Radius** | Based on swept path analysis |
| **Kerb Extensions at Intersections** | n/a |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation<br>Higher flow: swale or pits and pipes solution<br><br>Refer Part C: 2.8. 2,7 |

## DESIGN REQUIREMENTS

### STREET FEATURES

| GREEN | | BLUE | | STREET SAFETY | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **YES** | **YES** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // BOURKE ROAD, ALEXANDRIA**
Industrial precincts should encourage active travel with separated cycleways and footpaths shaded by street trees.
Image - (Google)

**PRECEDENT // BOURKE ROAD, ALEXANDRIA**
Large areas of soft landscape should be provided within Industrial Streets to encourage significant tree growth and maximise shading.
Image - (Google)

# B3.8 Industrial Street

## Industrial and Commercial Precincts

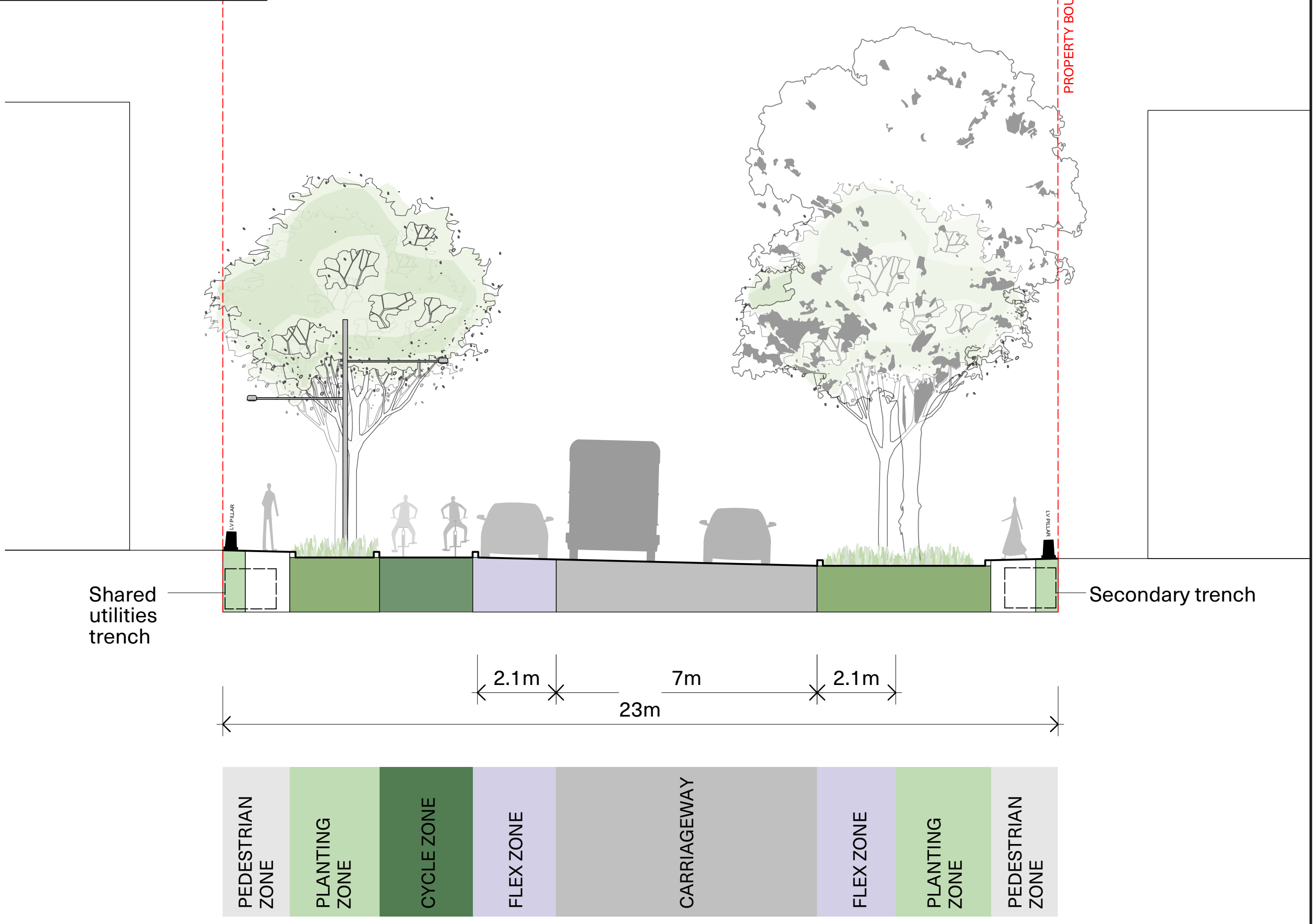
### DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **YES** | **YES** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

| Case Study | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 13 | 71% | 38% | YES | YES | YES | YES |

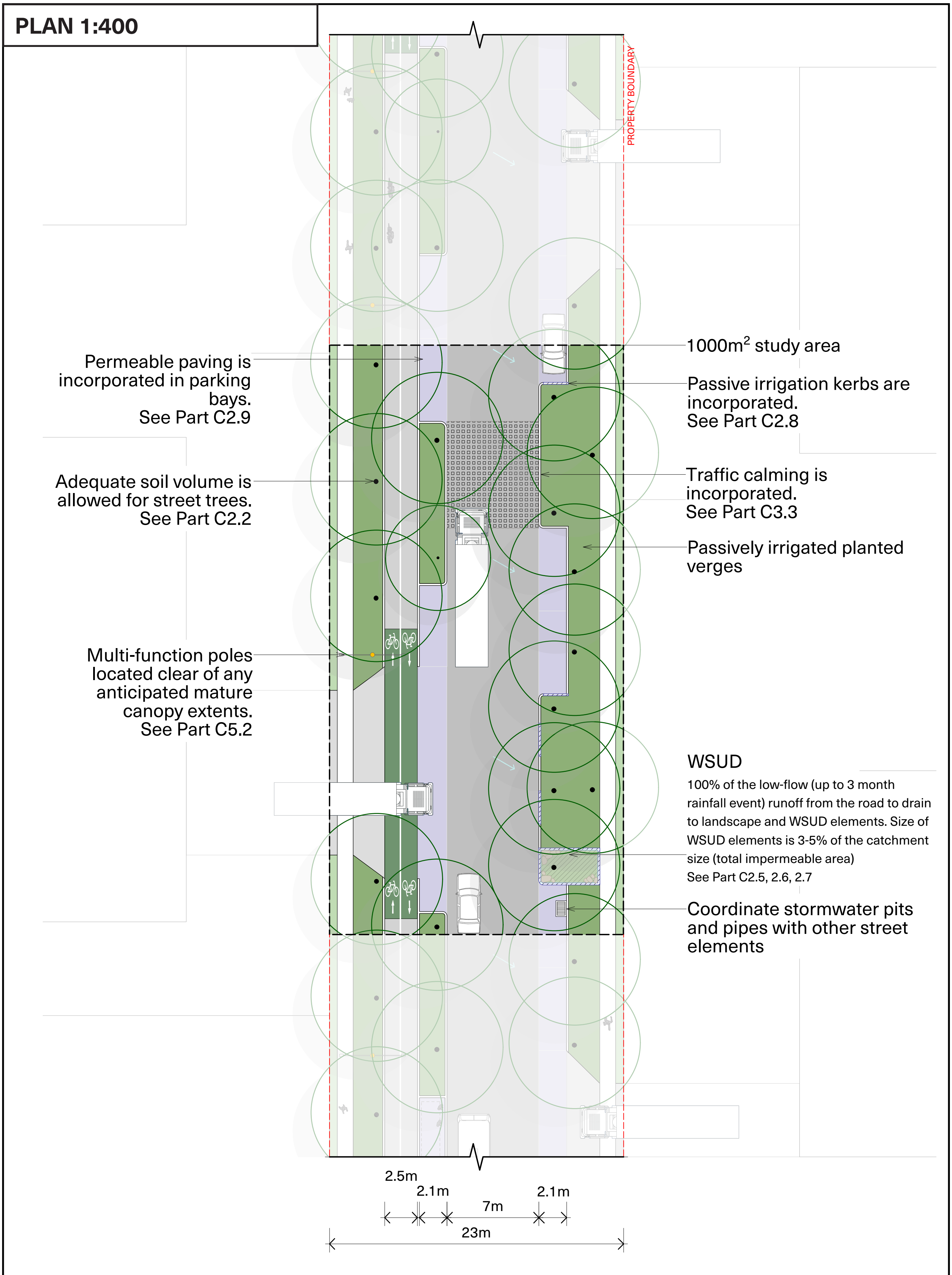
## SECTION 1:200



## B3.8 Industrial Street

Industrial and Commercial Precincts

**PLAN 1:400**



## B3.9 RETAIL LANEWAY
Commercial Centre

### Overview

Retail Laneways are designed as very slow, shared environments. They balance the active, social functions of a laneway with the service-related functions of delivery and basement access to retail tenancies. Retail Laneways are first and foremost high quality public spaces which offer vibrancy within local street networks.

Retail laneways are designed to accommodate pedestrian and cyclist safety with elements such as planting, seating, and lighting where applicable. This ensures a safe shared zone where vehicle calming measures provide for local access and service vehicles only.

Timed access arrangements for larger service vehicles are a useful strategy to ensure minimal conflicts between the social and service-based requirements of a retail laneway.

### Street Priorities

- A very slow street environment is provided which allows the safe and accessible movement of all pedestrians
- A very slow street environment is provided which allows for cyclists to safely use the vehicle travel zone
- Street tree planting is integrated into the street design to provide shade and enhance the character of the retail laneway
- Low–flow runoff passively irrigates street trees
- WSUD elements are maximised to ensure neighbourhood–scale WSUD performance outcomes

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | ≈ 7m |
| **Context** | Commercial centre |
| **Built Form** | Mixed–use with active ground floor uses |
| **ACTIVE TRANSPORT** | |
| **Cycling** | Travel zone shared with pedestrians and vehicles |
| **VEHICLES** | |
| **Lot Access** | Rear-loaded via laneway |
| **Buses** | No |
| **Design Vehicle** | Service Vehicle (8.8m) |
| **Check Vehicle** | Garbage Truck (11m) |
| **Behavioural Speed** | ≤ 10 km/h |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | Trees, WSUD<br><br>Refer Part C: 2.2, 2.3, 2.4, 2.5, 2.6 |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Shared-zone |
| **VEHICLES** | |
| **Travel Lane Widths** | 6m – 8.5m shared one-way |
| **Parking Lane Widths** | n/a |
| **Kerb Return Radius** | 7.5m |
| **Kerb Extensions at Intersections** | n/a |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Low flow: passive irrigation of street trees, or permeable paving for groundwater infiltration<br>Higher flow: pits and pipes solution<br><br>Refer Part C: 2.3, 2.9, |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **SHARED ZONE** | **SHARED ZONE** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // KENSINGTON STREET, CHIPPENDALE**
Retail laneways should clearly communicate pedestrian priority with flush paved surfaces, street furniture and tree planting.
Image - Kensington Street, Turf Design Studio (Kensington Street)


**PRECEDENT // YORK LANE, SYDNEY**
Laneways in town centres provide an opportunity for retail to organically grow, inhabit unique spaces, and supplement High Street retail activity.
Image - (Jugernauts)

# B3.9 Retail Laneway

## Commercial Centre

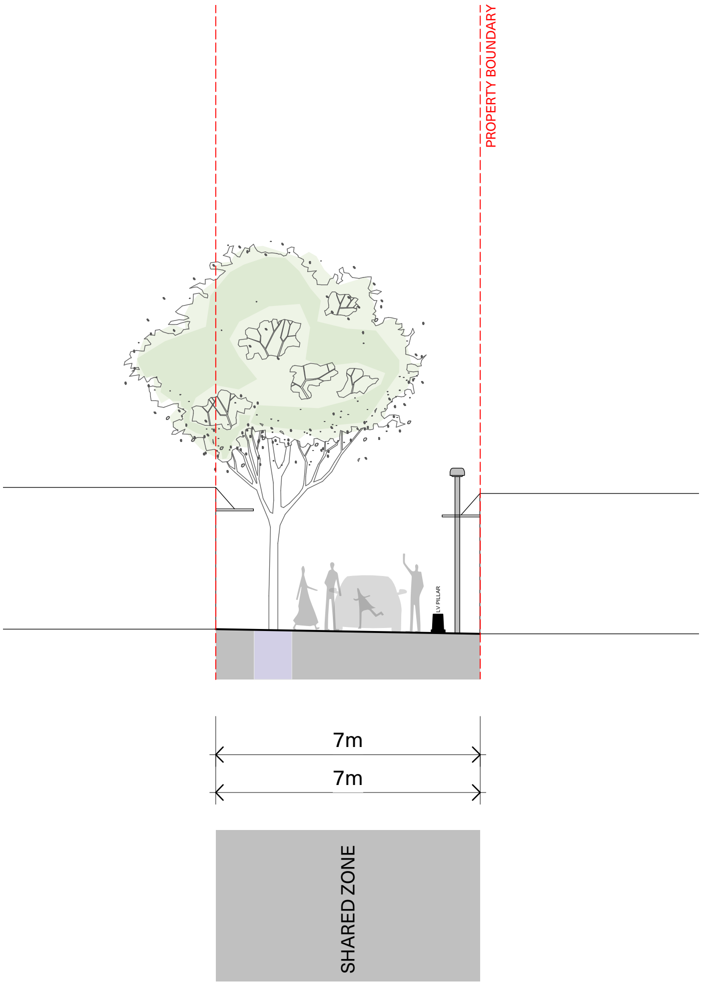
### DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **12** | **70%** | **35%** | **YES** | **SHARED ZONE** | **SHARED ZONE** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

| Case Study | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 12 | 71% | 36% | YES | n/a | n/a | YES |

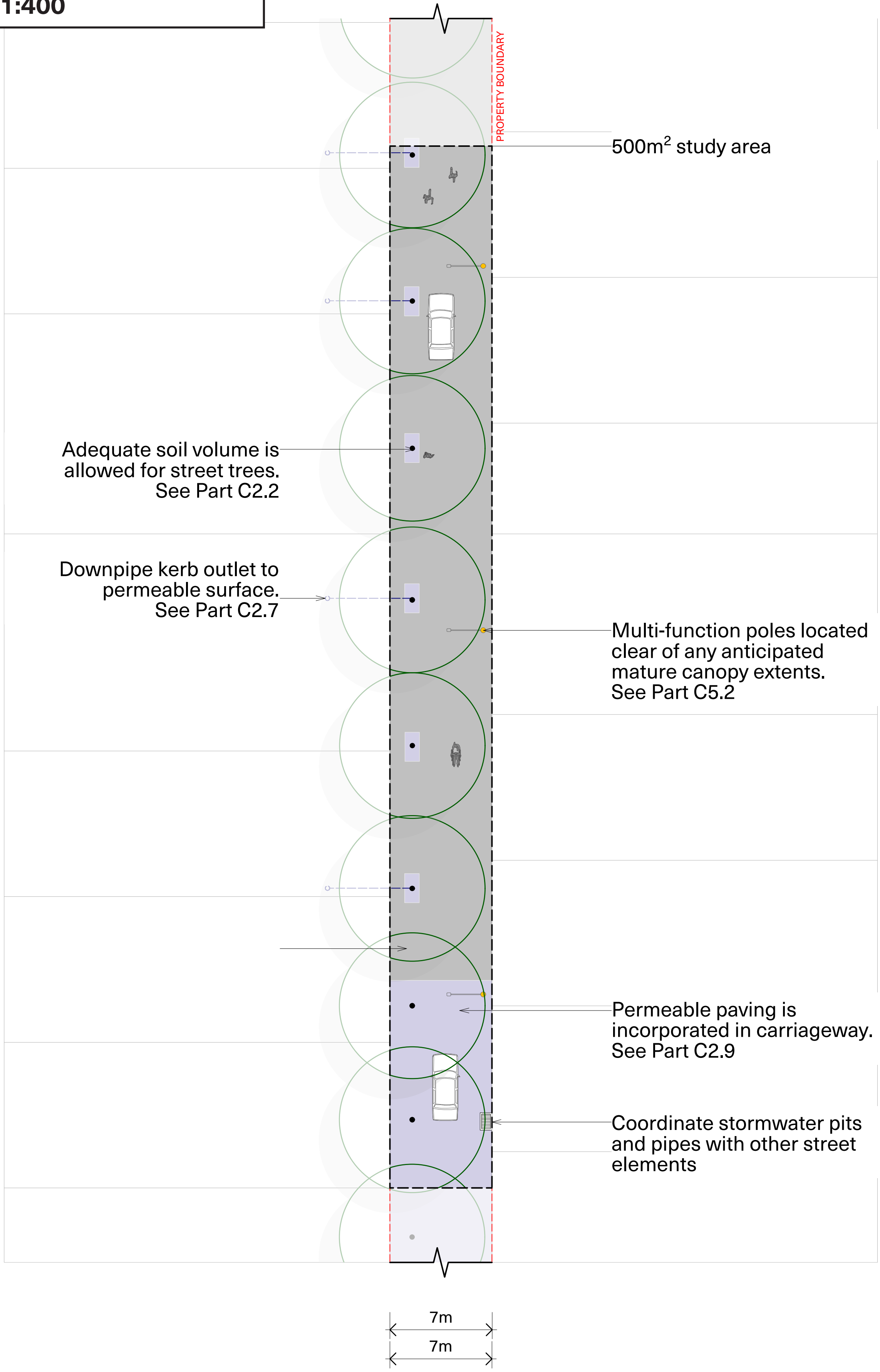
### SECTION 1:200



# B3.9 Retail Laneway

Commercial Centre

## PLAN 1:400



## B3.10 SUB-ARTERIAL ROAD
Context varies

### Overview

Sub-Arterial Roads are designed as higher-order neighbourhood streets which typically facilitate the connection of the arterial road network to local street networks. Sub-Arterial Roads support vehicular and public transport activity alongside providing safe pedestrian and cycle movement.

### Street Priorities

- Footpaths are provided on both sides of the street
- Provide separated cycling facilities on all Sub–Arterial Roads to achieve a neighbourhood–wide cycle network
- Cycle infrastructure on all Sub-Arterial roads is provided to achieve a neighbourhood-wide cycle network
- Vehicle lanes allow for local bus routes
- 'In-line' bus stops are provided to maintain bus priority and continuity of verge arrangement
- Street tree planting provides a continuous tree canopy at maturity
- Low–flow runoff passively irrigates street trees and planting
- WSUD elements are maximised to ensure neighbourhood–scale WSUD performance outcomes
- Timed parking may be provided during off–peak periods, but is typically not provided during peak periods

### DESIGN GUIDANCE

| STREET DETAILS | |
|---|---|
| **GENERAL** | |
| **Road Reserve** (nom.) | ≈ 27m |
| **Context** | Varies |
| **Built Form** | Varies |
| **ACTIVE TRANSPORT** | |
| **Cycling** | See design requirements |
| **VEHICLES** | |
| **Lot Access** | Front or rear–loaded |
| **Buses** | Yes |
| **Design Vehicle** | Prime mover and semi-trailer (19m) |
| **Check Vehicle** | B-Double (25m) |
| **Behavioural Speed** | Equal to speed limit |
| **SAFETY + ENVIRONMENT** | |
| **Flex Zone Uses** | n/a |

### DESIGN REQUIREMENTS

| STREET DETAILS | |
|---|---|
| **ACTIVE TRANSPORT** | |
| **Walking** | Min. 1.2m path both sides |
| **Cycling** | Separated cycleway |
| **VEHICLES** | |
| **Travel Lane Widths** | 3m – 3.5m |
| **Parking Lane Widths** | n/a |
| **Kerb Return Radius** | Based on swept path analysis |
| **Kerb Extensions at Intersections** | n/a |
| **SAFETY + ENVIRONMENT** | |
| **WSUD** | Pits and pipes solution |

## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **YES** | **–** |

Note: Typical measurements per 1000m2 of road reserve area

**PRECEDENT // CRAWFORD STREET, QUEANBEYAN**
Expanded footpaths with street trees and narrowed carriageways contribute to the street's amenity and environmental performance.
Image - Crawford Street Redevelopment, ELM Building Group

**PRECEDENT // DOONSIDE ROAD, DOONSIDE**
Sub-arterial Roads still provide opportunities for median street tree planting.
Image - (Google)

# B3.10 Sub–Arterial Road

Context varies

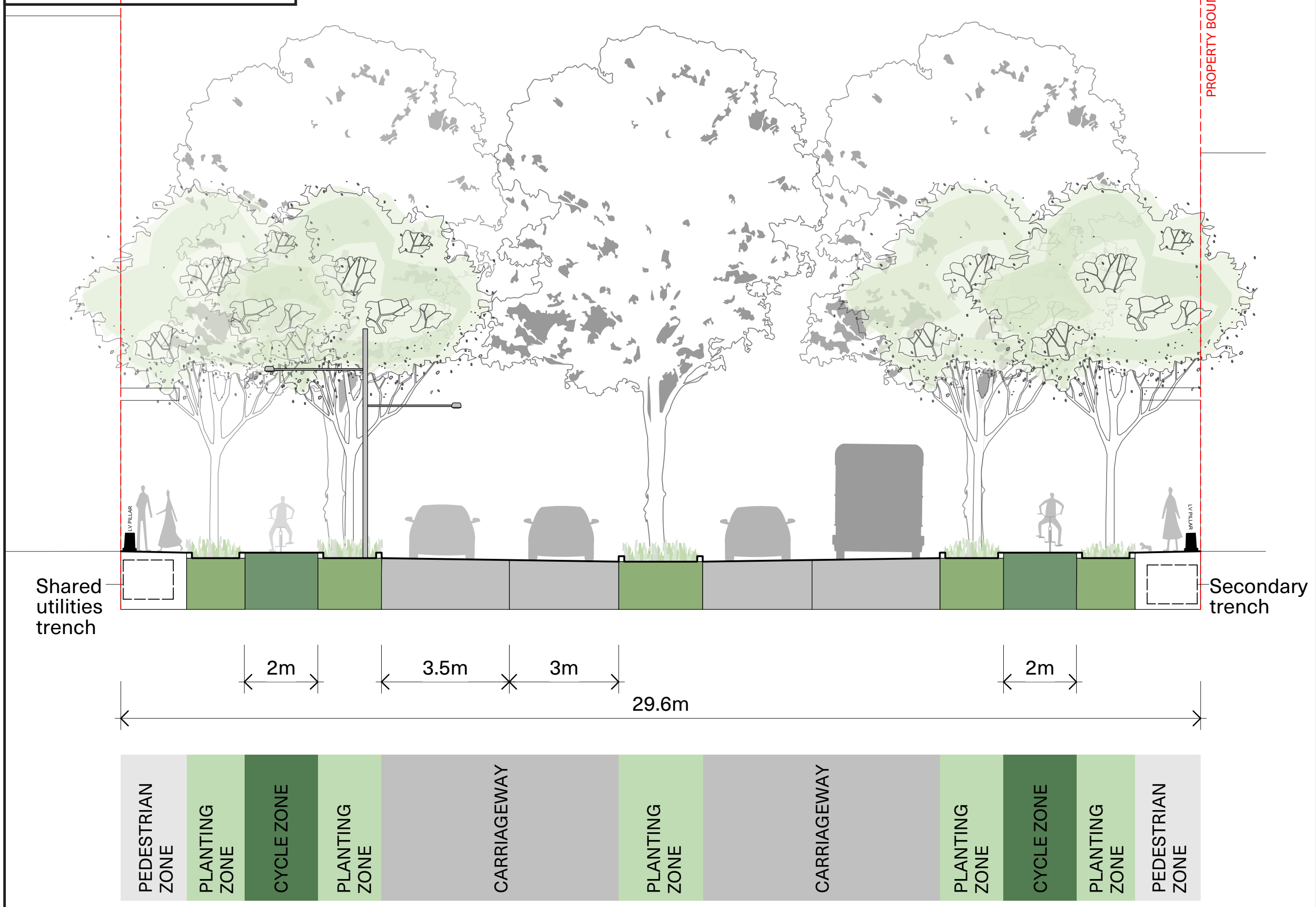
## DESIGN REQUIREMENTS

| STREET FEATURES | | | | | | |
|---|---|---|---|---|---|---|
| GREEN | | BLUE | | STREET SAFETY | | |
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| **10** | **70%** | **35%** | **YES** | **YES** | **YES** | **YES** |

Note: Typical measurements per 1000m2 of road reserve area

| Case Study | | | | | | |
|---|---|---|---|---|---|---|
| Trees | Canopy Cover (@20yrs) | Permeable Surfaces | WSUD Elements | Dual Footpaths | Cycle Infrastructure | Traffic Calming |
| 19 | 95% | 35% | YES | YES | YES | YES |

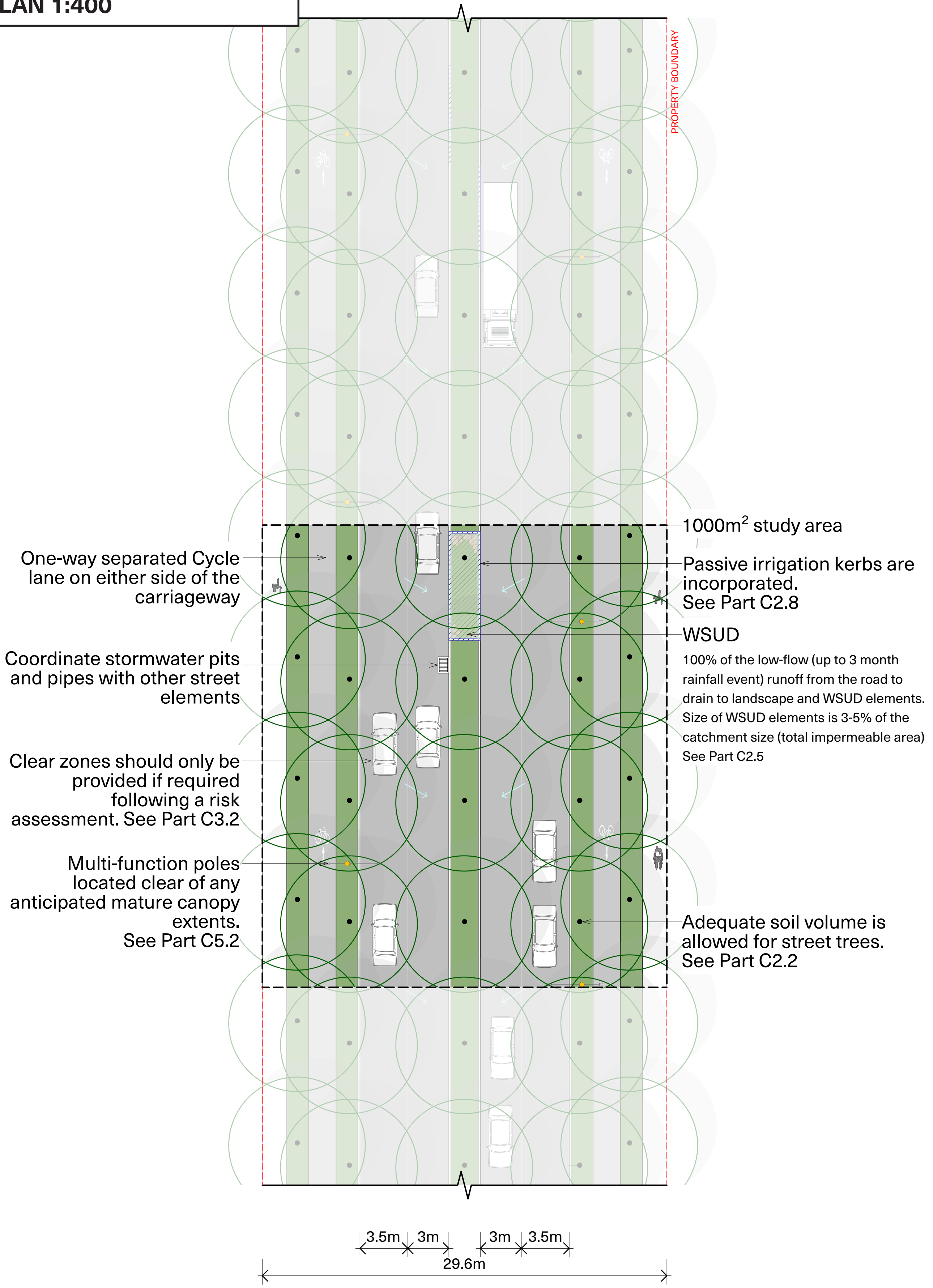
## SECTION 1:200



# B3.10 Sub–Arterial Road

Context varies

**PLAN 1:400**



# B4 INDICATIVE INTERSECTIONS

Well-designed intersections are crucial to creating safe, efficient and multinodal intersections.

Intersections should aim to reduce the risks of turning conflicts with fast moving vehicles by removing slip lanes where possible and extending kerbs to allow for reduced corner kerb radii.

This presents greater opportunity to enhance pedestrian safety by increasing pedestrian visibility, shortening crossing distances, slow turning vehicles, and visually narrowing the roadway.

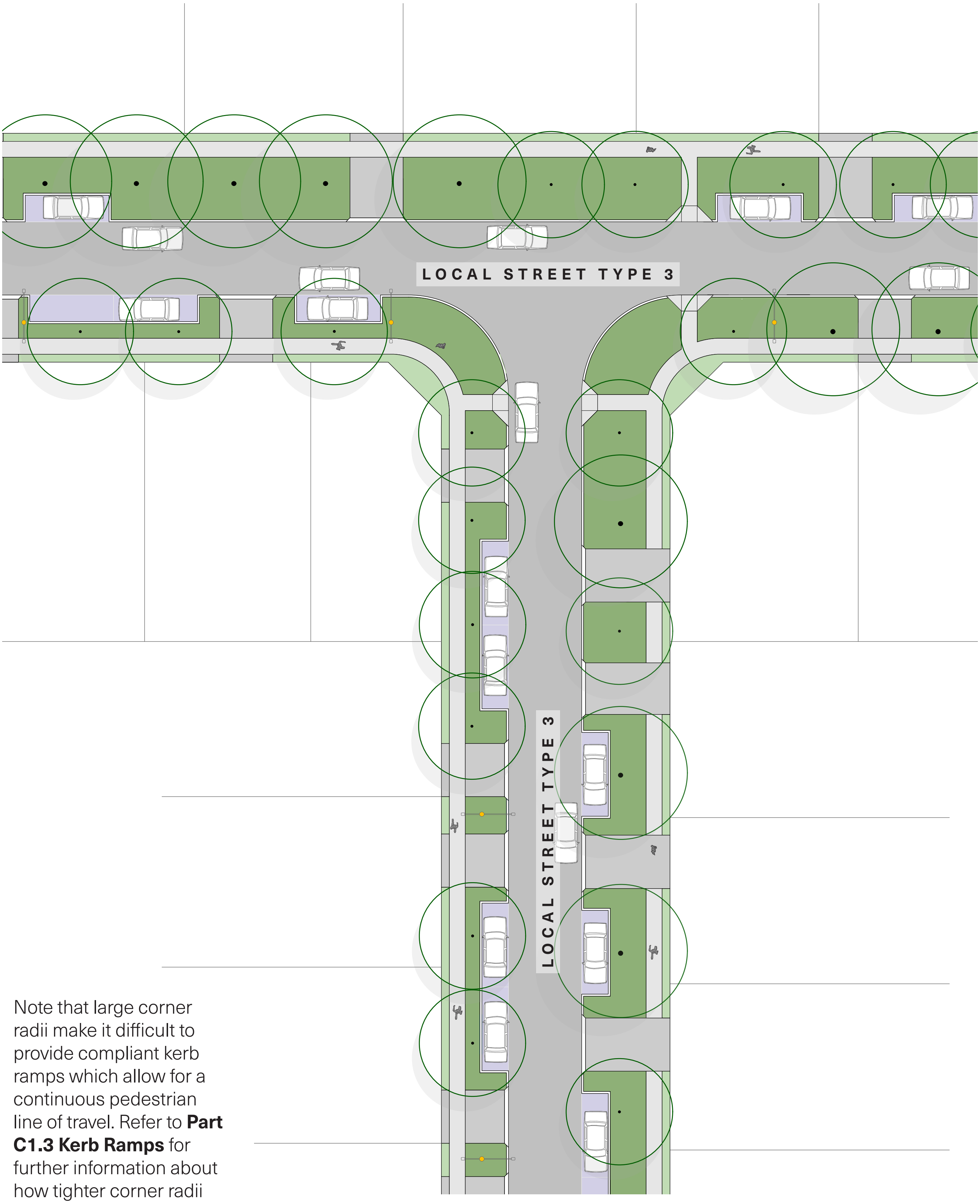
Changes in geometry can help to reduce traffic turning speeds and increase pedestrian comfort and safety. One of the key considerations is the location of pedestrian crossing kerb ramps and raised pedestrian crossings.

All upgrades or intersection geometry must be in accordance with the Australian Standards for Access as defined in AS 1428.1—1428.4 for pedestrian access on footpaths.

| INDICATIVE INTERSECTIONS |
|---|
| Local Street to Local Street |
| Local Street to Local Collector |
| Local Street to High Street |
| Local Collector to Sub-Arterial Road |
| Industrial Street to Sub-Arterial Road |

**B4.1 INDICATIVE INTERSECTION TYPE 1**

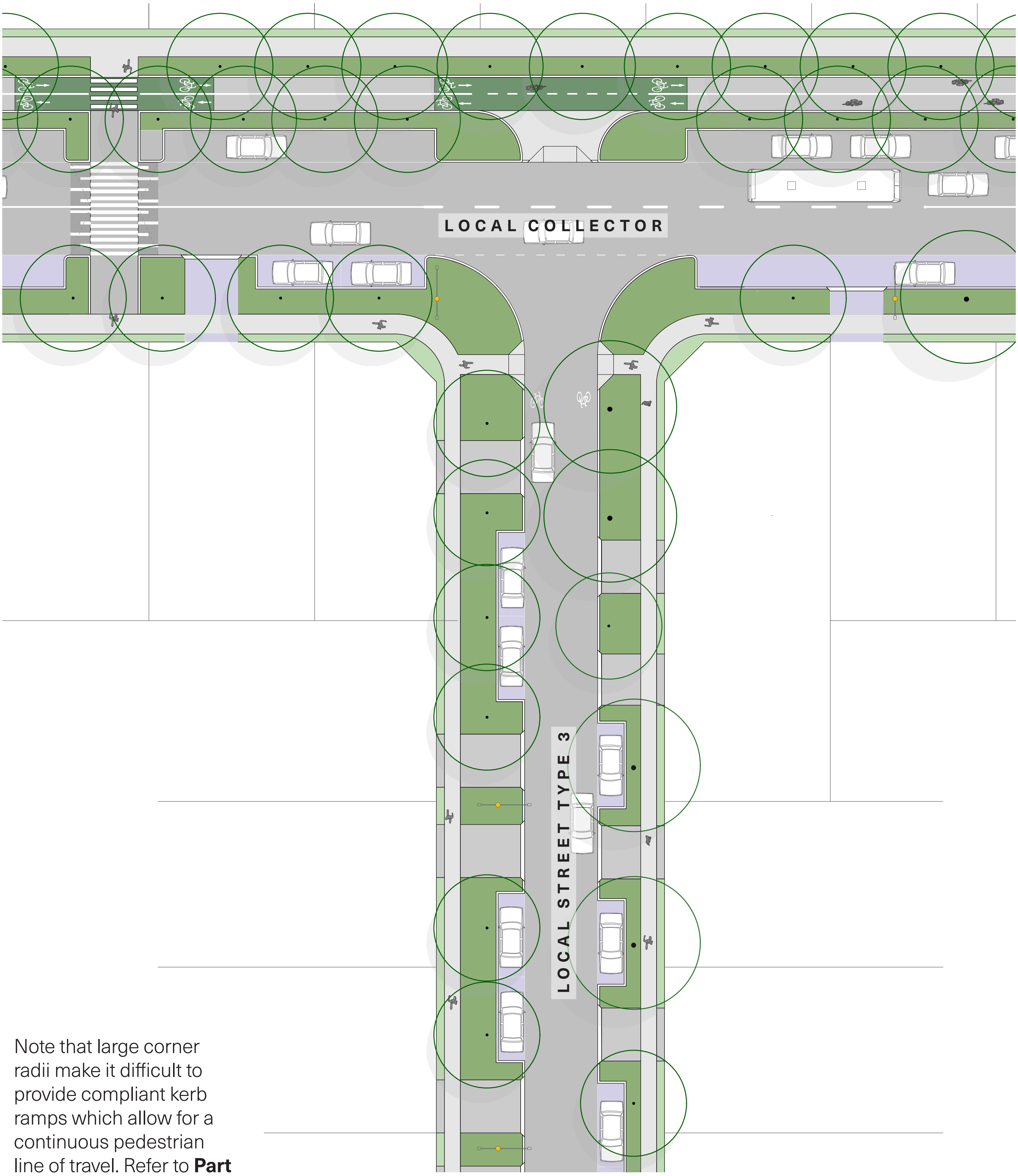
## Local Street to Local Street




Note that large corner radii make it difficult to provide compliant kerb ramps which allow for a continuous pedestrian line of travel. Refer to **Part C1.3 Kerb Ramps** for further information about how tighter corner radii can improve pedestrian amenity.

### B4.2 INDICATIVE INTERSECTION TYPE 2

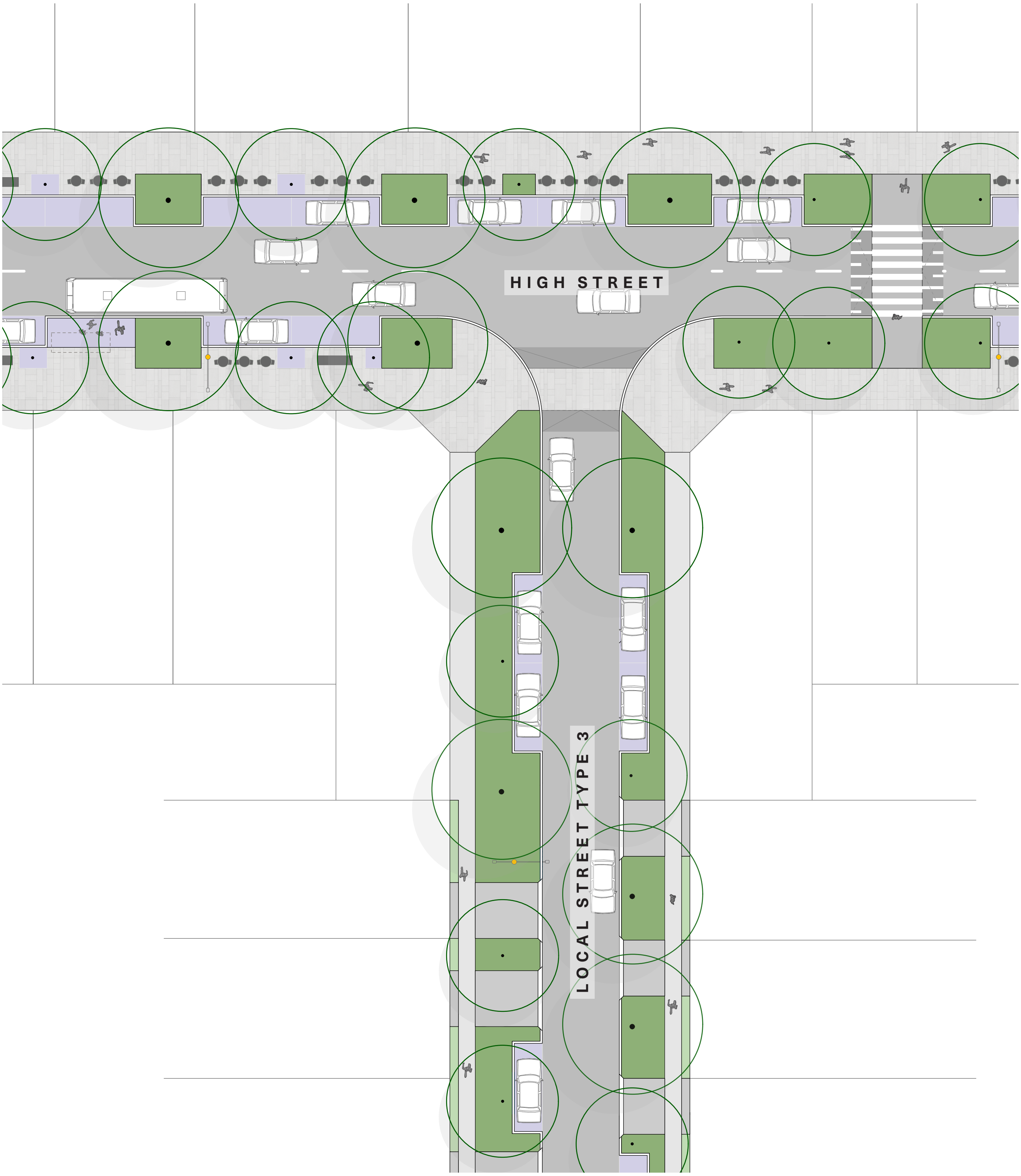
## Local Street to Local Collector




Note that large corner radii make it difficult to provide compliant kerb ramps which allow for a continuous pedestrian line of travel. Refer to **Part C1.3 Kerb Ramps** for further information about how tighter corner radii can improve pedestrian amenity.

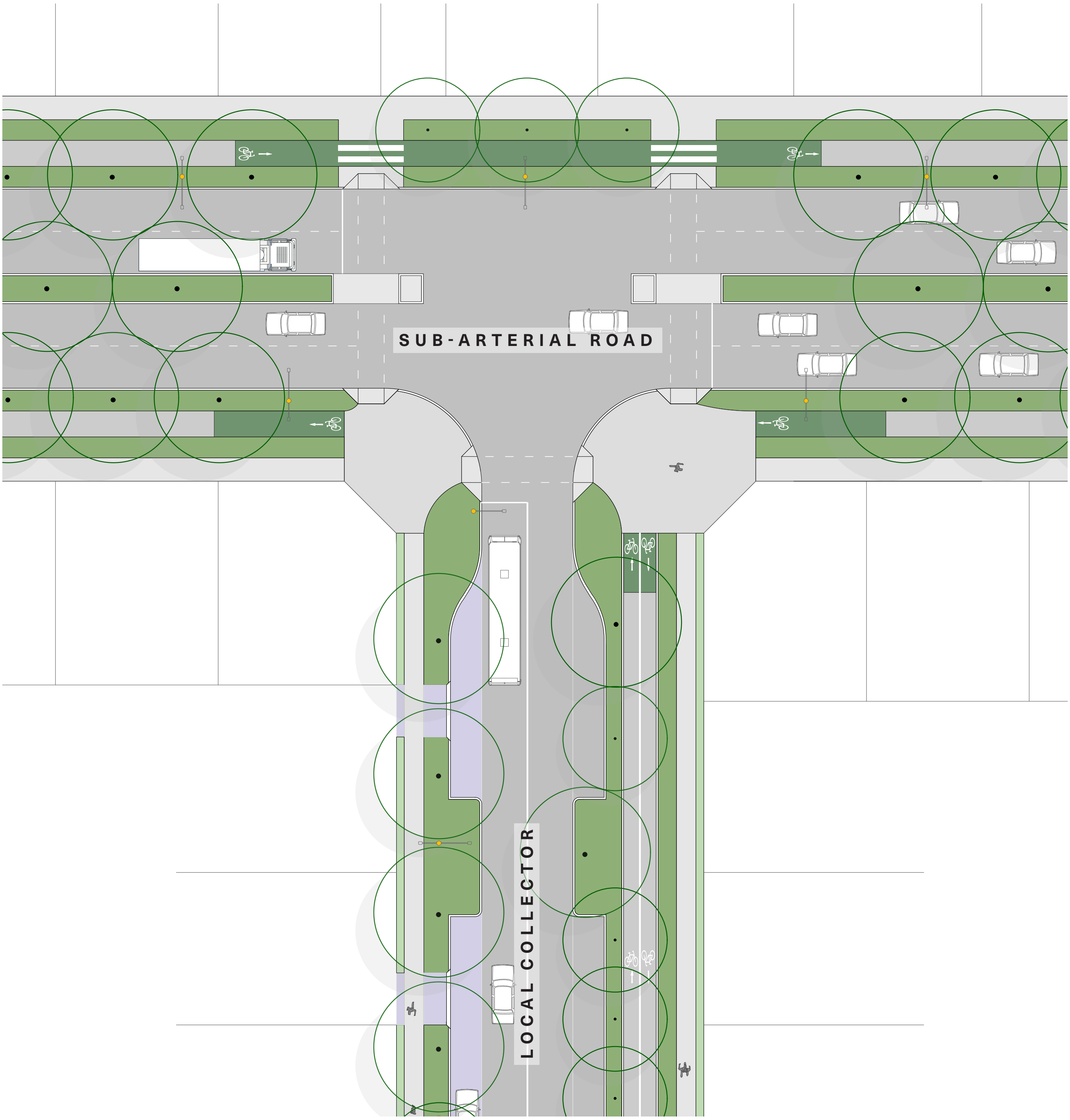
**B4.3 INDICATIVE INTERSECTION TYPE 3**

## Local Street to High Street



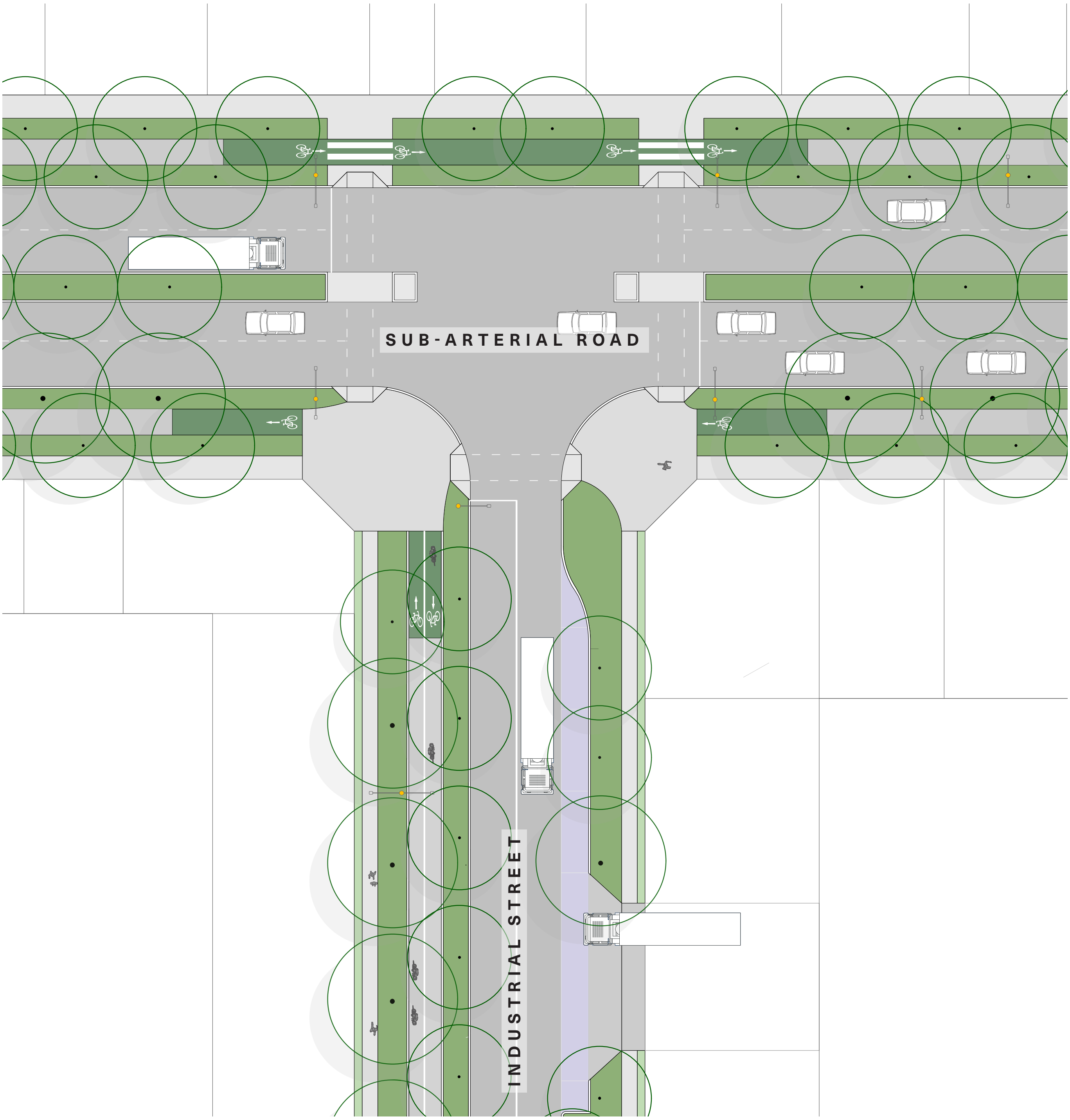
**B4.4 INDICATIVE INTERSECTION TYPE 4**

## Local Collector to Sub-Arterial Road



**B4.5 INDICATIVE INTERSECTION TYPE 5**

## Industrial Street to Sub-Arterial Road



# C

# Components of Great Streets

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# INTRODUCTION

Part C of The Guidelines covers the various components that need to be considered and coordinated throughout the planning, design, contruction and maintenance of streets.

Coordination of these elements is a significant factor in the quality and legibility of the public domain.

A high quality street design and considered arrangement of components:

— Ensures that the street's most vulnerable users are prioritised to create a safe environment for all

— Provides seamless integration of fixtures and elements within a structured and legible ground plane

— Coordinates critical components to avoid clashes that may produce adverse outcomes (above, at, or below ground level)

Street components included in Part C are arranged into the sections listed on the right.

Further Design Requirements may be found in the Engineering Design Manual for Western Sydney, as noted in each section.

**C1** PEDESTRIANS AND CYCLISTS

**C2** THE GREEN AND BLUE GRID

**C3** VEHICLES

**C4** INTERSECTIONS

**C5** UTILITIES

**C6** INNOVATION

# C1 PEDESTRIANS AND CYCLISTS

**Active transport is an integral part of livable cities. Government agencies at all levels and across all disciplines are aiming to increase the proportion of trips made on foot or by bike.**

The Guidelines has placed particular emphasis on the safety and amenity of the most vulnerable users of streets; pedestrians and cyclists. The amenity of drivers and vehicle movements is well represented in a range of other guidelines and policies. The Guidelines does not aim to replicate that information.

Part C1 Pedestrians and Cyclists aims instead to synthesise the objectives of the following government strategies into clear Design Guidance and Design Requirements that will make it easier for designers to create safe streets for all users:

- TfNSW Towards Zero Road Safety Plan 2021
- Walking, Riding and Access to Public Transport: Supporting Active Travel in Australian Communities (Ministerial Statement)
- NSW Healthy Planning Action Resource
    - Action Resource 2: Creating Walkable Neighbourhoods

Walking and cycling support better health outcomes. Creating streets which encourage these transport modes is a key way to supporting community health outcomes.

Many components will work together to achieve more livable streets in Western Sydney. For example, continuous shade provided by trees is imperative if walking or cycling to work, or local transport hubs, is to be a reality for the majority of Western Sydney. Most of Western Sydney is 6-9 degrees warmer than baseline, and much of the most built-up areas of Western Sydney suburbs exceeds 9 degrees over baseline. Green and blue infrastructure will greatly support components in Part C1.

A tree lined streetscape which encourages pedestrian and cyclist movement.
Image - Bourke Street Cycleway, City of Sydney (Simon Wood)

# PEDESTRIANS AND CYCLISTS

## C1.1 FOOTPATH TYPES

**Footpaths play a vital role in our communities.**

They provide continuous access for pedestrians of all abilities along the street, promote healthy lifestyles through active transport and provide space for all the informal activities that make suburbs and cities vibrant places to live.

Safe, accessible, and well-maintained footpaths are a fundamental and necessary investment for Western Sydney and have been shown to enhance public health and maximise social capital. (NACTO, 2016)

There are several points to consider when setting the width of a footpath. 1.2m is generally accepted as a suitable width for two people to walk side by side, or one wheelchair to move freely.

AS1428.1 notes the footprint of an A90 wheelchair as 800mm wide. For two such wheelchairs to pass, with a 200mm buffer between, a footpath would need to be 1.8m wide.

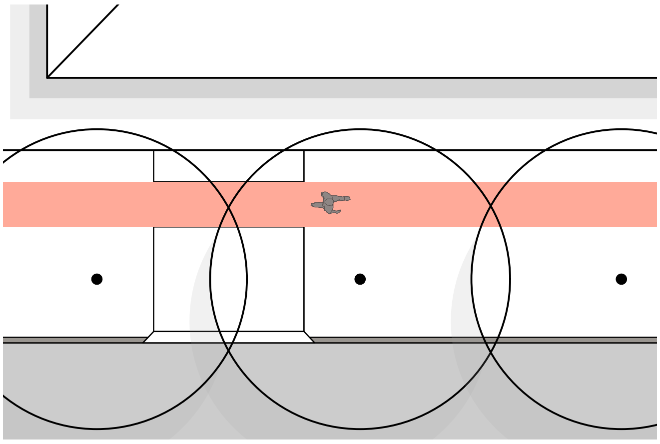
This is useful to consider in the context of parents with prams, parents walking alongside children on scooters or bikes, and other pedestrians using mobility aids.

The additional 0.5m of concrete footpath – which contributes overall to urban heating, as well as increased maintenance costs and embodied energy in materials, must be weighed carefully against the benefits gained and the likely volume of pedestrian traffic.

Additionally, consider changing the footpath width throughout a precinct to respond to a variety of requirements and create a hierarchical pedestrian network is a good use of different footpath widths.

**Local, Collector, and Sub-Arterial Footpaths**

Local Streets are used by pedestrians and cyclists for a variety of reasons. Although generally less activated than footpaths in mixed-use areas, footpaths on local streets play an important role in providing safe access paths and encouraging active transport.



Local, Collector, and Sub-Arterial Footpath

Street trees shade the footpaths of Minogue Crescent, Forest Lodge.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

Shaded footpath along Minogue Crescent, Forest Lodge.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

# PEDESTRIANS AND CYCLISTS

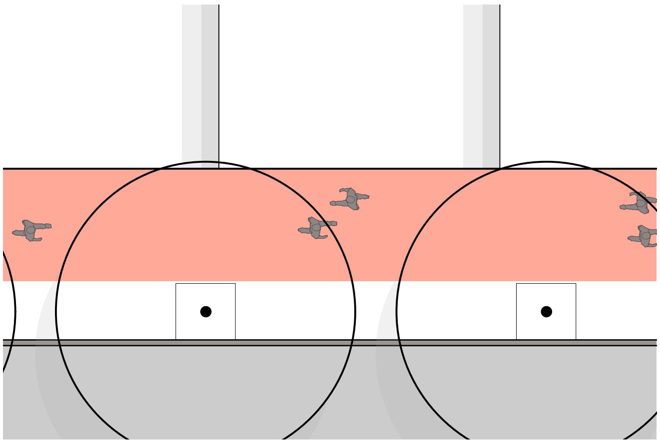
## C1.1 FOOTPATH TYPES

### High Street Footpaths

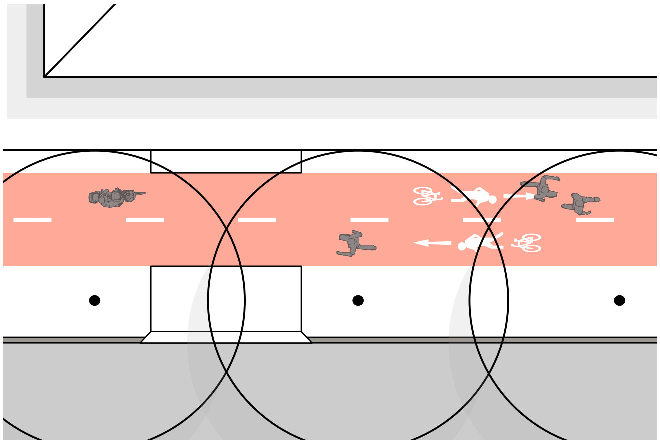
High Streets have wider footpaths to accommodate more pedestrian traffic alongside other footpath uses. The part of the footpath in the Pedestrian Zone allows for unobstructed travel whilst the footpath within the Flex Zone can be used for retail spill out, outdoor dining etc.

### Shared Paths

Shared Paths allow both cyclists and pedestrians to use the footpath. Shared Paths can be utilised where dedicated cycling facilities have been ruled out. Shared paths should adhere to the requirements of Austroads, including any minimum dimensions.



High Street Footpath



Shared Footpath


High Street footpath with street trees, furniture and outdoor dining.
Image - (ASPECT Studios)

Shared path on Brickmakers Drive, Moorebank.
Image - (ASPECT Studios)

# PEDESTRIANS AND CYCLISTS

## C1.2 CONTINUOUS FOOTPATHS

Continuous Footpaths refer to a continuation of footpath surfaces across intersections with lower order streets. They assist in clearly communicating that pedestrians have priority at intersections.

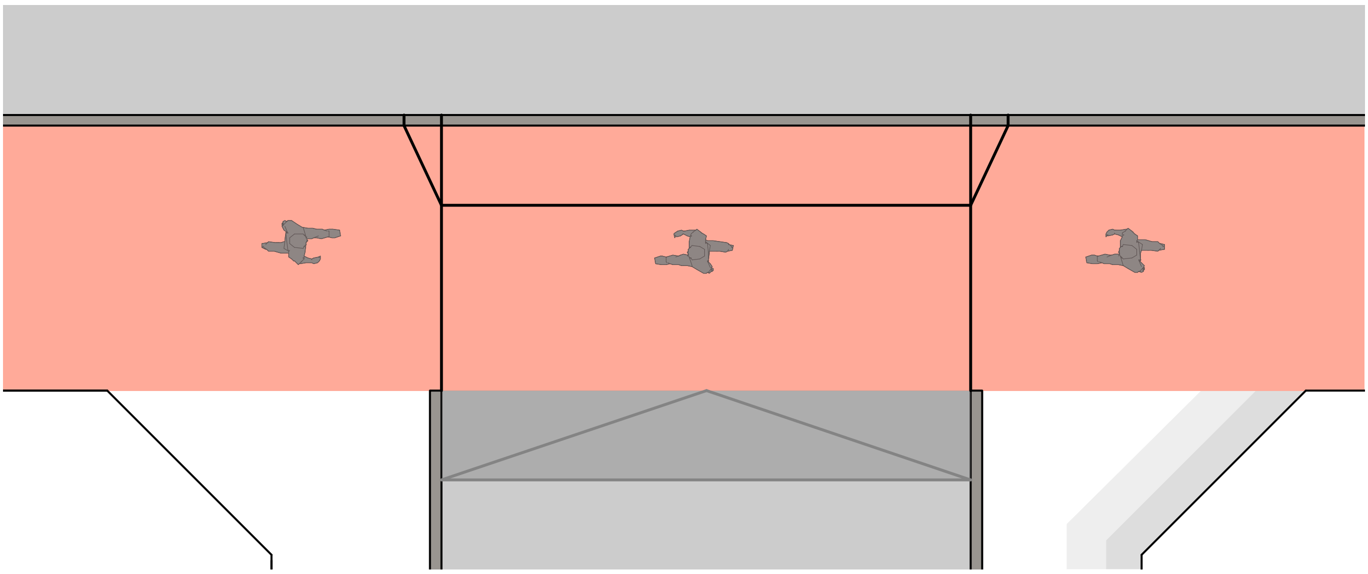
A continuous footpath allows for safer pedestrian travel.
Image - Foveaux Street, City of Sydney

### DESIGN GUIDANCE

Provide continuous footpaths where pedestrian priority is desired at intersections with lower order streets. Slight changes in size of unit pavers through the crossover may be used to highlight to pedestrians the potential interaction with vehicles

On continuous footpaths:

- Ensure paving in driveway is appropriate for weekly usage by garbage trucks
- Provide vehicle access through a dropped-kerb or similar kerb treatment, to slow vehicles and highlight the interaction with pedestrians
- Ensure clear sight lines for drivers and pedestrians is achieved when approaching and interacting in the crossover area
- Ensure the continuous footpath and adjacent infrastructure are configured to manage stormwater



Continuous Footpath

# PEDESTRIANS AND CYCLISTS

## C1.3 KERB RAMPS

**Kerb ramps are an important element in providing universal access through urban environments.**

They provide access between the level of the footpath and carriageway for pedestrians - particularly those using wheelchairs and other mobility aids, as well as people pushing prams or carts.

Large corner radii make it difficult to provide compliant kerb ramps which allow for a continuous pedestrian line of travel. Therefore, it is important to use the smallest practical kerb return radius, to ensure that a safe and continuous path of travel can be provided.

The diagrams below illustrate that whilst a smaller kerb return radius facilitates a continuous path of travel for pedestrians, a larger kerb return radius does not. This is undersirable as it does not prioritise active forms of transport such as walking, and is not the most intuitive path of travel, particularly for the visually impaired.

### DESIGN GUIDANCE

Install kerb ramps at all intersections, pedestrian crossings, and mid-block crossings

Minimise the length of a kerb ramp to avoid or reduce disruption to the path of travel on the footpath

### DESIGN REQUIREMENTS

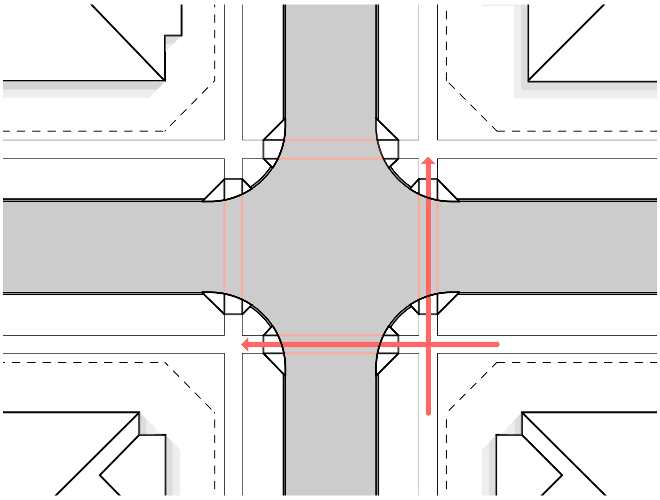
Match kerb ramp paving to adjoining footpath materials

Orientate kerb ramps in the direction of travel at all intersections and pedestrian crossings

Locate kerb ramps within the corner area of the footpath, typically aligned with the street wall or property boundary, at footpath corners and street intersections

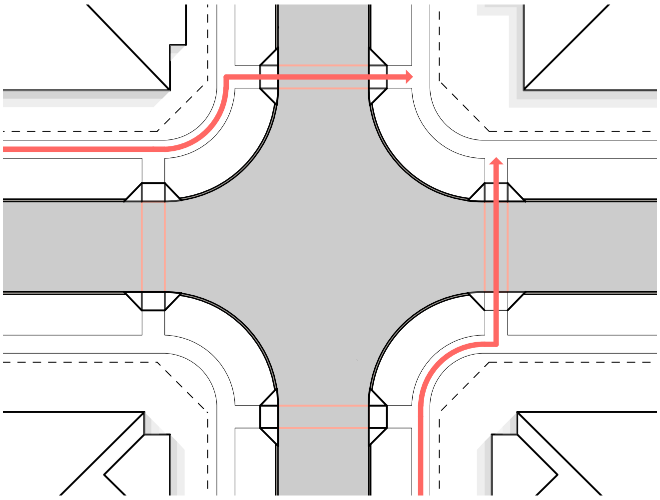
Relocate conflicting existing physical elements clear of the crossing point. Where this is not possible, align kerb ramps clear of obstructions and maintain a direct line of sight to the opposite side of the street

SMALLER KERB RETURN RADIUS - KERB RAMP IS ALIGNED WITH PATH OF TRAVEL



A smaller kerb return radius allows for safer Kerb ramp alignment at intersections.

LARGER KERB RETURN RADIUS - KERB RAMP IS OFFSET FROM PATH OF TRAVEL



A larger kerb return radius disrupts the pedestrian path of travel as kerb ramps are located offset from the adjoining footpath.

# PEDESTRIANS AND CYCLISTS

## C1.4 DRIVEWAY CROSSOVERS

**Driveway crossovers, also known as access driveways, are the section of a driveway which crosses the public footpath, verge, or kerb.**

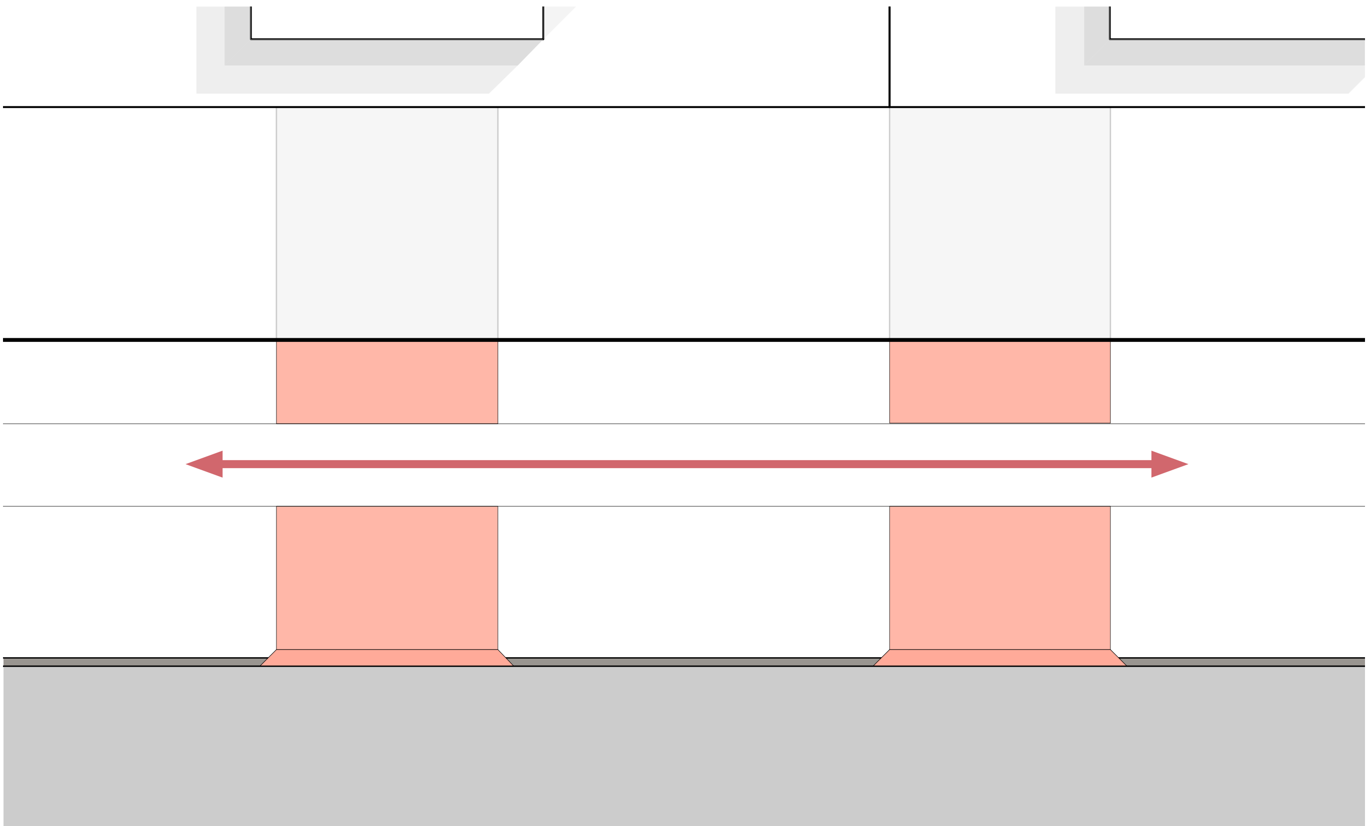
They should ensure vehicle access across the pedestrian path of travel in a way which does not compromise the quality of the street experience, including pedestrian safety, movement, and comfort.

### DESIGN GUIDANCE

- Reinforce pedestrian priority across driveway crossovers to reduce impact upon pedestrian movement along the street
- Consolidate the location of driveways along a street to maximise footpath continuity
- Use the narrowest recommended width for driveways in Part B of The Guidelines

### DESIGN REQUIREMENTS

- Maintain footpath levels and cross falls
- Continue the footpath paving and materials throughout the driveway crossover



Driveway Crossover

# PEDESTRIANS AND CYCLISTS

## C1.5 KERB EXTENSIONS

### PEDESTRIANS AT INTERSECTIONS

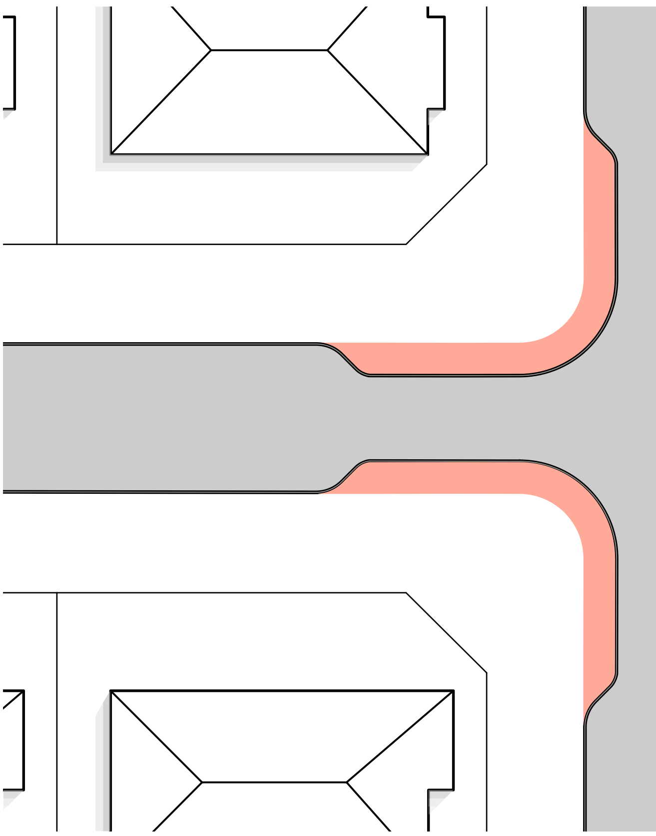
Well-designed intersections are crucial to create safe, efficient, and multimodal intersections.

Intersections should reduce the risks of turning conflicts with fast moving vehicles by removing slip lanes where possible and introducing kerb extensions to allow for reduced corner kerb radii.

This enhances pedestrian safety by increasing pedestrian visibility, shortening crossing distances, slow turning vehicles, and visually narrowing the carriageway.

Pedestrian comfort and safety is increased through changes in geometry which reduce traffic turning speeds alongside key considerations such as the location of pedestrian crossing kerb ramps and raised pedestrian crossings.

All upgrades or intersection geometry must be in accordance with the Australian Standards for Access as defined in AS 1428.1—1428.4 for pedestrian access on footpaths.



Kerb Extensions

### KERB EXTENSIONS

**Kerb extensions are traffic calming elements which locally widen the verge and kerb line, and narrow the carriageway.**

Kerb extensions improve street quality through traffic calming, improved pedestrian crossings, additional street tree and understorey planting, seating, outdoor dining, cycle parking and stormwater management.

For other examples of Traffic Calming, see Part **C3.3**.

#### DESIGN GUIDANCE

Include kerb extensions at corners or mid-block. Consider them as an integral part of the overall street design, considering relevant site and traffic issues

Design kerb extensions to enhance pedestrian safety by increasing pedestrian visibility, shortening crossing distances, slowing vehicles, and visually narrowing the carriageway

Facilitate pedestrian circulation and avoid elements which compromise it, such as railings, bollards, and barriers

#### DESIGN REQUIREMENTS

Design kerb returns perpendicular to the kerb, avoiding splayed returns

Select materials within kerb extensions which match the adjoining footpath material, when not planted

Consider stormwater drainage in the design of kerb extensions

Consider vehicle sightlines when designing planted verges at intersections

Planted kerb extensions along Crown and Cleveland Street, Surry Hills.
Image - Crown, Cleveland & Baptist Street Upgrade, Tract Consultants

CASE STUDY

## RETROFITTING CROWN STREET

CROWN STREET WAS UPGRADED IN 2015 WITH PUBLIC DOMAIN IMPROVEMENTS BETWEEN DEVONSHIRE STREET AND CLEVELAND STREET. KERB EXTENSIONS WERE INTRODUCED AT CROWN STREET'S INTERSECTION WITH LANSDOWNE STREET TO REDUCE CROSSING DISTANCES AND IMPROVE AMENITY IN CONJUNCTION WITH A NEW PEDESTRIAN CROSSING.



Image - (Nearmap)

# PEDESTRIANS AND CYCLISTS

## C1.6 PEDESTRIAN CROSSINGS

**Pedestrian crossings provide safe and designated points for people to cross the street.**

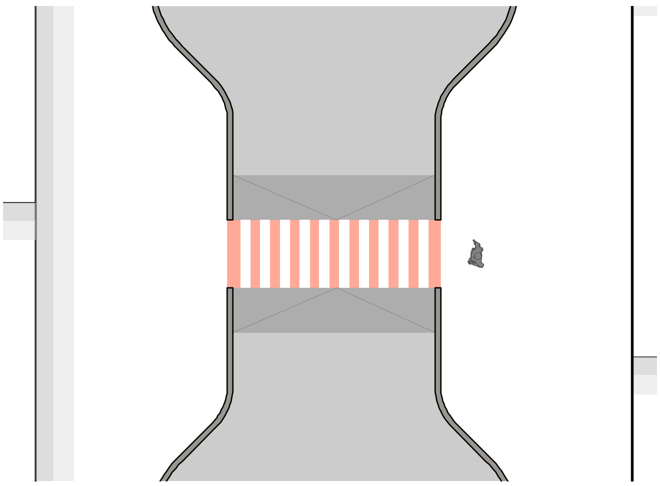
Good pedestrian crossings also improve drivers' awareness of intersections and enhance visibility of people as they cross the street.

### DESIGN GUIDANCE

- Adopt kerb extensions at pedestrian crossings to reduce the crossing width and calm traffic
- Use raised pedestrian crossings to emphasise crossing points, particularly at unsignalized midblock crossing locations
- Adopt a change in paving unit or colour to enhance the contrast between the carriageway and crossing

### DESIGN REQUIREMENTS

- Maintain sight lines at crossing points to avoid conflicts and allow adequate space for people to use the crossing safely
- Utilise street elements such as lighting, street trees and landscaping to assist with visually narrowing and compressing the street at crossing locations
- Minimise corner radii to assist with creating appropriate vehicle speeds, reducing crossing distances, and minimising potential conflicts between street users



Pedestrian crossing


Raised pedestrian crossing on George Street, Redfern.
Image - (ASPECT Studios)

Flush pedestrian crossing on Macquarie Street, Liverpool.
Image - (ASPECT Studios)

# PEDESTRIANS AND CYCLISTS

## C1.7 CYCLING

It is important to provide safe ways for cyclists to use streets. The type of facilities provided will depend on many different factors, including the space available, likely vehicular traffic, anticipated and desired number of bicycle trips and lastly the overall local cycle network.

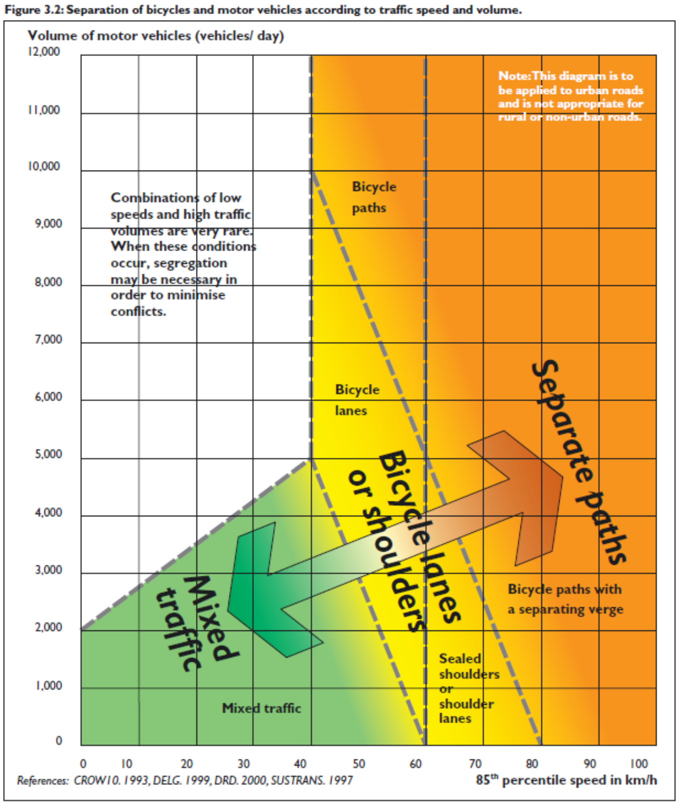
Designers should take the Design Guidance into consideration along with all statutory road regulations and requirements. This includes considering any potential conflicts between other road users, and any new or proposed cycle infrastructure.

### DESIGN GUIDANCE

**Recommended Cycle Infrastructure by Street Type**

| Street Type | One-way cycle paths with physical separation | Two-way bicycle path with physical separation | One-way on road bicycle lane | On-road slow mixed traffic (no dedicated cycle path) | Shared footpath (min 2.5m wide) |
|---|---|---|---|---|---|
| Sub–Arterial Road | ● | | | | |
| Industrial Street | ● | ● | | | ● |
| High Street | ● | ● | ● | ● | |
| Local Collector | ● | ● | | | |
| Local Street | | | ● | ● | ● |
| Laneways | | | | ● | |

**Figure 3.2: Separation of bicycles and motor vehicles according to traffic speed and volume.**

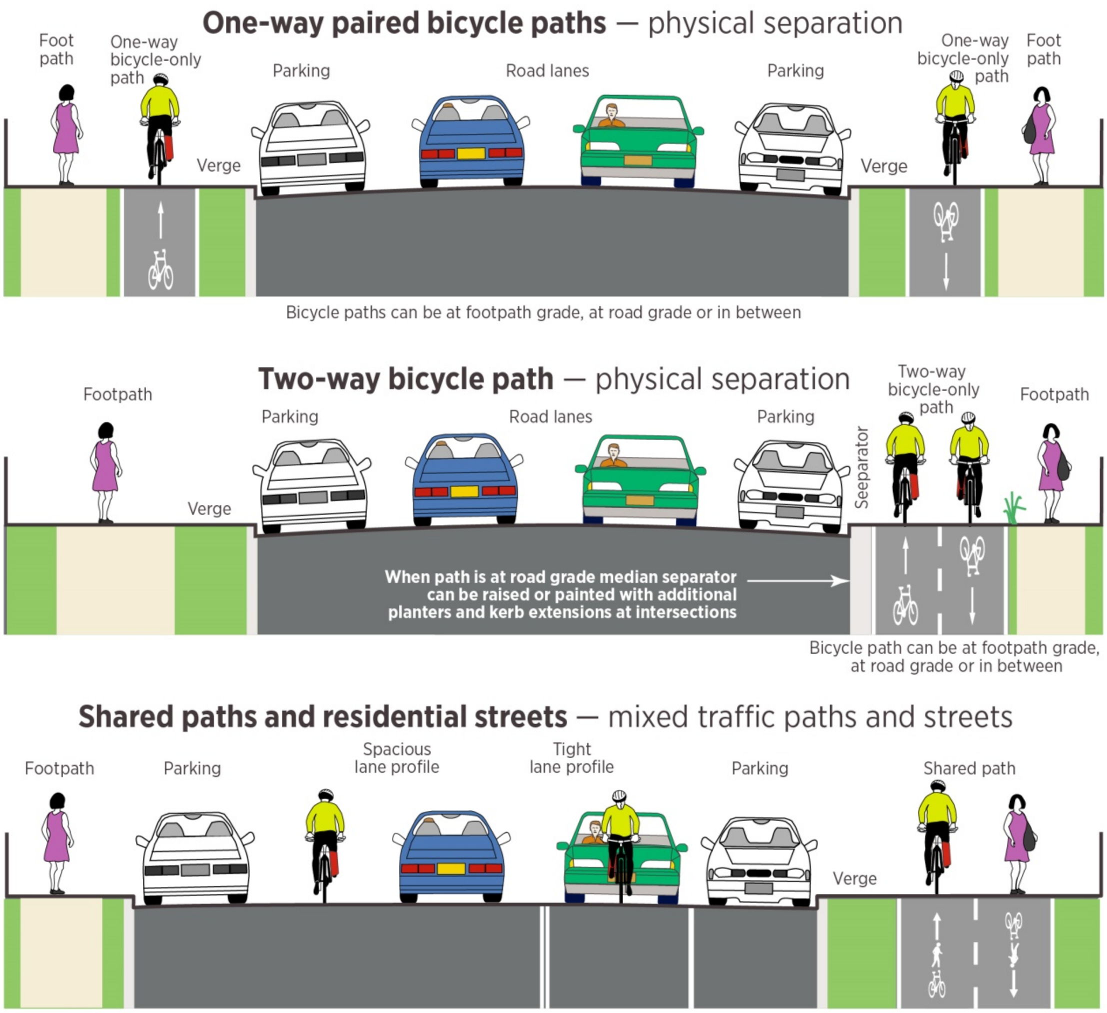



Separation of bicycles & motor vehicles according to traffic speed and volume.
Source - NSW Bicycle Guidelines, RTA

Two–way cycleway on Scotsman Street, Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

# PEDESTRIANS AND CYCLISTS

## C1.7 CYCLING




Types of bicycle facilities and methods of separation, presenting generally in order of preference.
Source - Transport for NSW


McGrath
1P

# PEDESTRIANS AND CYCLISTS

## C1.8 STREET FURNITURE

**Street furniture is the collective term for elements installed along the street, such as seats, rubbish bins, bicycle racks, bollards, drinking fountains, parking meters, utility poles, and traffic and parking signage.**

Street furniture provides amenity and function for a variety of uses within the street.

### DESIGN GUIDANCE

Consider Street furniture as a family of elements thoughtfully coordinated to contribute to the identity and character of the streetscape

Co-locate Street elements as often as possible in a way that contributes to street amenity and function. For example, seating should be located under street trees, or rubbish bins located near traffic signals at pedestrian crossings

### DESIGN REQUIREMENTS

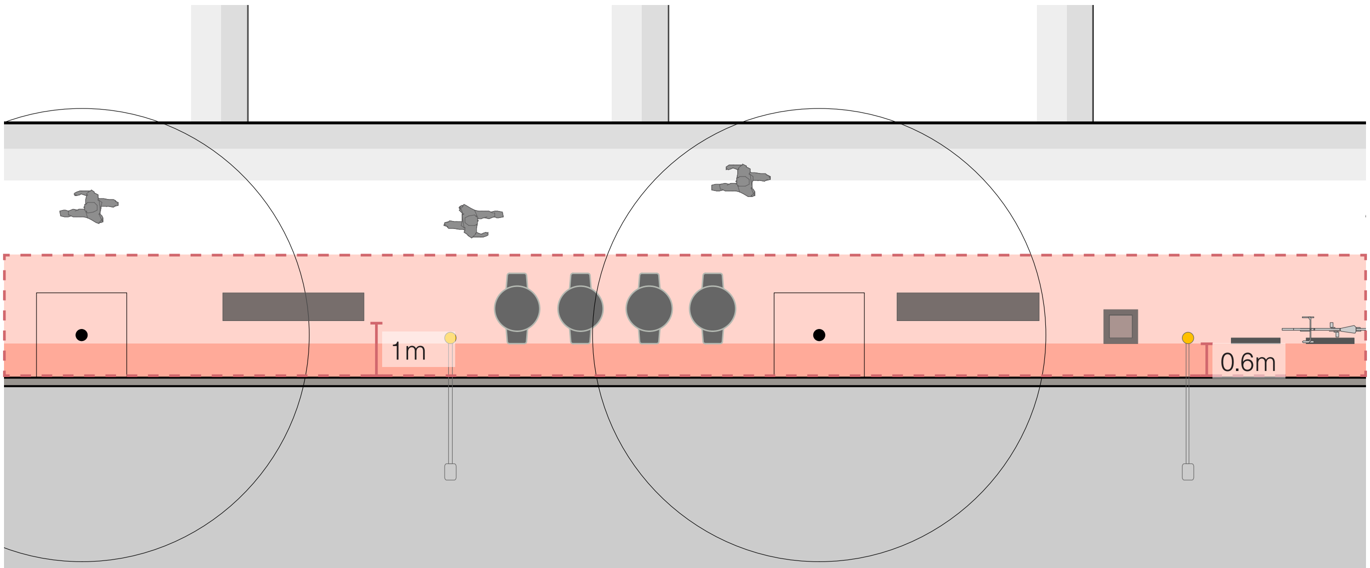
Locate street furniture within the Flex Zone or within kerb extensions in the Flex Zone

Ensure Street furniture is clear of pedestrian paths of travel and does not inhibit desire lines

Locate all street furniture a minimum of 0.6m from the face of adjacent kerb, except for seating for which it is preferable to locate 1m from the face of kerb

Place bicycle racks in clusters clear of pedestrian paths of travel and where they do not inhibit desire lines

Street furniture along the pathway, Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)




Street furniture

# PEDESTRIANS AND CYCLISTS

## C1.9 OUTDOOR DINING

**Outdoor dining provides an opportunity to activate streets and maximise trading opportunities for local businesses typically trading within adjoining buildings.**

Outdoor dining encourages social use of the street space, activates public spaces and supports ground floor retail by providing additional trading space in the street.

### DESIGN GUIDANCE

Activate the street with comfortable outdoor dining spaces

Locate outdoor dining areas to not have negative impact on adjoining footpath areas or introduce roadside hazards for passing cyclists and motorists

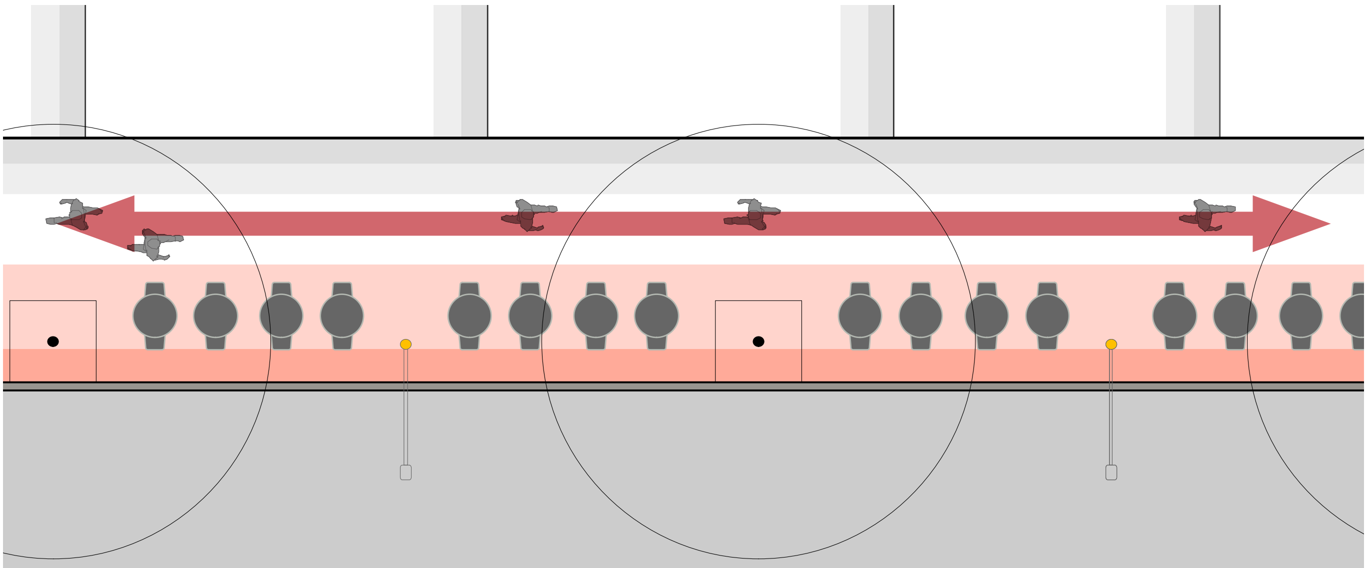
Maximise street tree planting to provide amenity for outdoor dining areas

### DESIGN REQUIREMENTS

Footpaths are a minimum 3m in width to allow pedestrian path of travel pass outdoor dining areas

Provide a clear, unobstructed footpath zone

Outdoor dining on High Street, Penrith.
Image - (Google)



Outdoor dining


Flush pedestrian crossing on Crown Street, Surry Hills.
Image - Crown, Cleveland & Baptist Street Upgrade, Tract Consultants

# PEDESTRIANS AND CYCLISTS

## C1.10 SHARED MICROMOBILITY

**Shared micromobility refers to shared-use fleets of small, partially or fully human powered vehicles, such as bikes, e-bikes and e-scooters, where customers share vehicles via mobile apps that provide cost and location information.**

### Purpose

Shared micromobility programs offer new transportation options for a range of potential users within the public domain. They extend beyond the reach of existing transit systems, make one-way trips possible, and eliminate traditional barriers to cycling such as bicycle ownership, access to storage space, maintenance costs, and concerns about theft.

### DESIGN GUIDANCE

Combine bike share programs with adequate infrastructure and comprehensive cycle networks

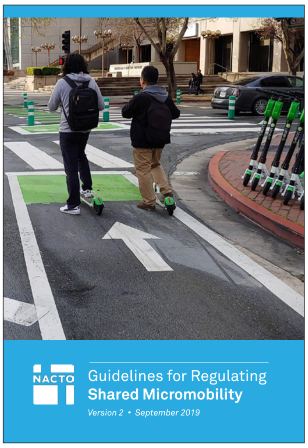
Allow shared micromobility programs to promote cycling and scootering within appropriate urban areas

### DESIGN REQUIREMENTS

Local councils and public landholders to nominate preferred parking areas in high demand locations

Locate share bike parking adjacent to traditional bicycle racks with rack space left free for regular bicycles that need to be locked to a fixed point

### FURTHER READING




**Guidelines for Regulating Shared Micromobility**
NACTO, 2019

Dockless share bikes on York Street, Sydney.
Image - (Bike Radar)

# C2 THE GREEN AND BLUE GRID

## C2.1 STREET TREES

**Street trees are critical to achieving the Street Objectives.**

When properly selected, located, planted, and maintained street trees can completely transform an urban environment. Trees are important visually – by unifying and coordinating streets and precincts. Trees also provide critical health and wellbeing benefits by providing comfortable streets to walk and cycle on, and cleaning the air. Perhaps most importantly for Western Sydney, street trees are an effective way to mitigate urban heat island effect. In addition to the aesthetic and climate benefits trees bring, there are a number of ways in which trees bring economic uplift. These include increased property prices in streets with mature trees, reduced electricity costs, and reduced road maintenance costs, as the shading of bitumen extends its life compared with bitumen in full sun.

Planting a mixture of tree species in a street enables appropriate species to be selected to suit the local microclimate, underlying soils and physical constraints. The use of a mixture of deciduous and local native species is highly recommended in order to achieve a balance of maximised summer shade as well as solar access during winter. In order to maximise the longevity and health of trees, provision of generous soil volumes in verges needs to be accounted for during the design of streets. In areas where soil volumes are constrained, smaller species will be required to ensure the mature tree form is suitable for the available soil. A mixture of wide canopy species to create shade over the road surface, with narrower canopy species in constrained verges will create an attractive and climate-appropriate urban canopy. Mixing deciduous and local native species will also assist in meeting bushfire management considerations in areas adjoining bushland. Recent research has identified lists of both Australian and introduced tree species that are fire retardant and will greatly assist in reducing fire impact to properties.

Understory planting beneath trees provides another important ecological layer and can create habitat for insects, small birds and small fauna. Whilst turf verges assist in creating permeable surfaces around trees, a more diverse selection of understory planting can assist in lowering maintenance (reduced mowing) as well as bring both visual interest and increased biodiversity to streets. This is a particular focus for streets that are identified as 'Green Links' or 'Wildlife corridors' where connections between bushland areas and parks are required to allow safe movement of fauna.

Street trees providing shade and comfort on high pedestrian traffic streets.
Image - ANU

Street tree planting, Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

# THE GREEN AND BLUE GRID

## C2.1 STREET TREES

The following Design Guidance and Requirements refer to all tree types. We have also outlined additional metrics for trees by their type and application, be it in a verge or in a kerb extension.

### DESIGN GUIDANCE

Select street tree species which are appropriate for local soil and climate conditions, balance the need for summer shade and winter sun, maximise biodiversity, and incorporate bushfire protection requirements

Space street trees to create a continuity of tree canopy along the corridor, providing a visually attractive setting. Adjacent land uses may influence the pattern of spacing to accommodate active street entries and areas of parallel parking for access

Spacing of street trees must consider the distance from other street elements, such as lighting, driveways and waste collection areas

Consider the impacts of climate change and the suitabilty of any new tree selections in a changed climate

### DESIGN REQUIREMENTS

Design streets to provide soil volumes, permeable surfaces and passive irrigation appropriate for the establishment of healthy and resilient street trees

Ensure permeable surfaces surround the base of the tree (see **Part C2.3**, **2.4** and **2.6**)

Refer to **Part C3 Vehicles** for clear zone considerations in relation to street tree planting

Not all local councils use root barriers. For those that do, the following additional Design Guidance has been supplied.

### DESIGN GUIDANCE

Tree root barriers are to be applied to a maximum of two sides of a tree pit. When root barrier is installed as two parallel sides,  a minimum distance of 1.5m between each side should be maintained

Tree root barriers should prioritise the protection of utility assets - not the constriction of tree roots - and should be located to maximise access for tree roots to adjacent areas of soil

Maximum depth of tree root barriers is 300mm when applied to protect pavement, and 900mm when applied to protect in-ground utilities

Canopy cover calculations for street types must consider the potential stunting effect of tree root barriers.

Refer to Part C2.2 Street Tree Volume for indicative sections showing the application of root barriers in a tree pit

Street tree planting on Christiansen Boulevard, Moorebank.
Image - (ASPECT Studios)

# THE GREEN AND BLUE GRID

## C2.1 STREET TREES

### STREET TREES – IN VERGES

**Verge street trees are typically located to the rear of the near-side kerb, on both sides of the street, forming the primary alignment continuous lines of street trees.** Verge street trees provide continuous canopy cover over the road corridor, including both the carriageway and verge areas. They also provide shade, amenity and comfort for footpaths and cycleways.

#### DESIGN GUIDANCE

Refer to **Part C2.1** for general Street Tree Design Guidance

Implement a continuous row of street trees on both sides of the street to assist in achieving canopy coverage and street amenity for all street users

Continuous rows of street trees should not rely on tree planting in kerb extensions or medians to achieve street tree planting and canopy cover

Locate trees to avoid buses along bus routes

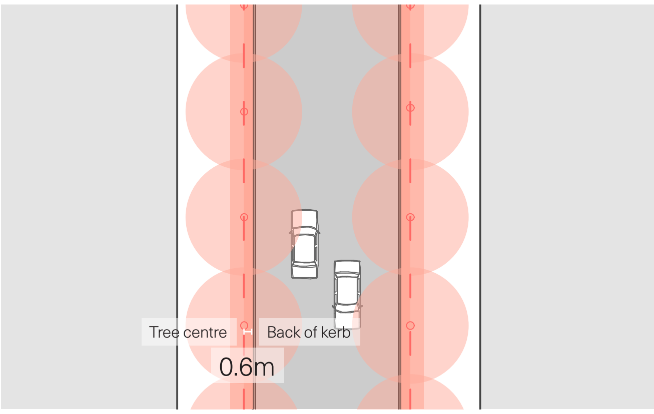
#### DESIGN REQUIREMENTS

Refer to **Part C2.1** for general Street Tree Design Requirements

Provide a verge design (including provision of utilities, footpaths, cycleways, and driveways) that allows for a continuous row of verge street trees on both sides of the street

Locate verge street trees as near as possible to the rear of the kerb to a minimum of 600mm from back of kerb

Where trees are planted in coordination with parallel parking bays, the size of the tree pit and the location of tree planting must consider car overhangs and allow for enough space so as not to disturb the tree




Street trees in verges to be planted a minimum of 600mm from back of kerb

Verge tree planting on Minogue Crescent, Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

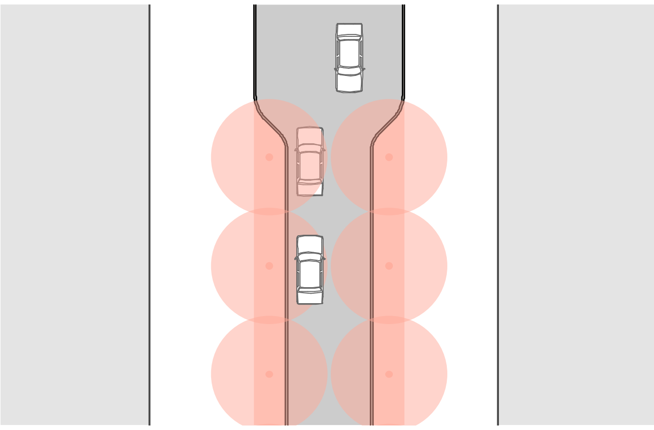
Verge tree planting in Marsden Park.
Image - (ASPECT Studios)

# THE GREEN AND BLUE GRID

## C2.1 STREET TREES

### STREET TREES – IN KERB EXTENSIONS

**Trees in kerb extensions are planted in line with kerbside car parking to increase street tree planting.** Street trees in kerb extensions provide an opportunity to increase street tree canopy cover of streets by supplementing kerbside street trees with additional tree planting.



Street trees in kerb extensions

Street tree planting in kerb extension, Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

#### DESIGN GUIDANCE

Refer to **Part C2.1** for general Street Tree Design Guidance

Plant street trees in kerb extensions to provide traffic calming by narrowing the perceived width of the carriageway for motorists moving along the street

Provide street trees in kerb extensions to increase species variation, biodiversity, and variations in colour, form, and scale

Locate trees to avoid buses along bus routes

Select tree species with regard to mature form, upright and fastigiate branching trees will minimise con-flicts with tall vehicles

#### DESIGN REQUIREMENTS

Refer to **Part C2.1** for general Street Tree Design requirements

Street tree planting in kerb extension, Nagurra Place, Rozelle.
Image - Union Place, ASPECT Studios (Florian Groehn)

# THE GREEN AND BLUE GRID

## C2.1 STREET TREES

### STREET TREES – IN THE CARRIAGEWAY

**Trees planted within the carriageway are planted in line with kerbside car parking to increase street tree planting.**

Trees planted in the carriageway increase canopy cover and shading of road surfaces. They are particularly useful for retrofitting streets as they can keep works to existing kerbs and related stormwater infrastructure to a minimum.

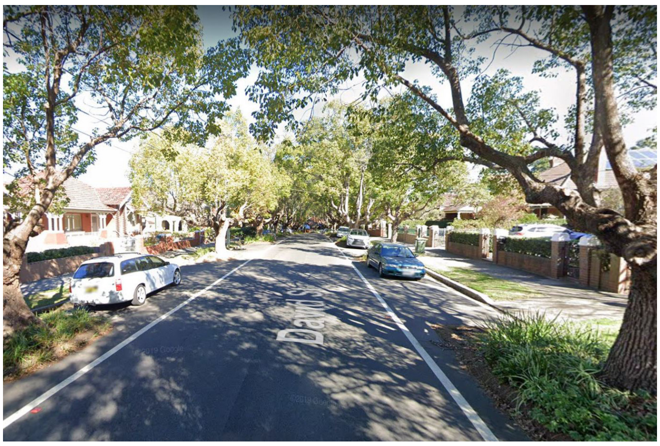
Tree planting in carriageways can be retrofitted to streets to allow permeable ground surfaces to be added to older streets. This can be a low-cost way of introducing WSUD elements to streets in addition to the benefits of increasing tree canopy.

#### DESIGN REQUIREMENTS

Refer to **Part C2.1** for general Street Tree Design Requirements

Avoid trees in the carriageway where conflicts with buses are likely to preclude the provision of local bus routes

Street trees in the carriageway on Singleton Avenue, Kellyville.
Image - (Google)



Street trees in the carriageway, David Street, Marrickville.
Image - (Google)

#### DESIGN GUIDANCE

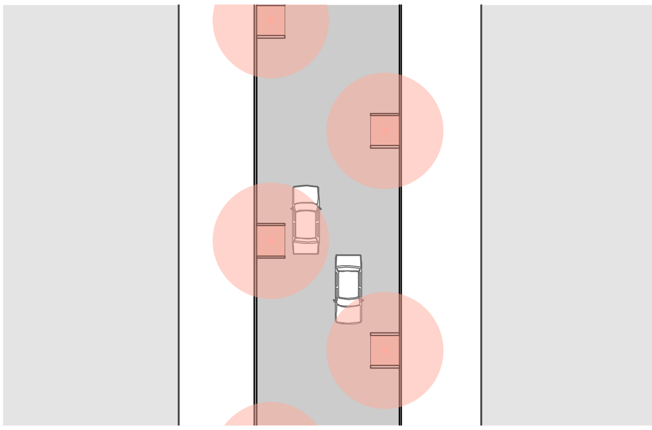
Refer to **Part C2.1** for general Street Tree Design Guidance

Plant street trees in the carriageway to provide traffic calming by narrowing the perceived width of the carriageway for motorists moving along the street

Provide street trees within the carriageway to increase species variation, biodiversity, and variations in colour, form, and scale

When street trees are retrofitted, a site-specific soil calcuation can be used instead of soil volumes provided in C2.2.

When street trees are new, soil volumes (imported soil mixes and structural soil) can continue below the adjacent road surface.



Street trees planted in the carriageway

Street trees in the carriageway on Pennyroyal Boulevard, Denham Court.
Image - (ASPECT Studios)


McGrath
1P
1P

# THE GREEN AND BLUE GRID

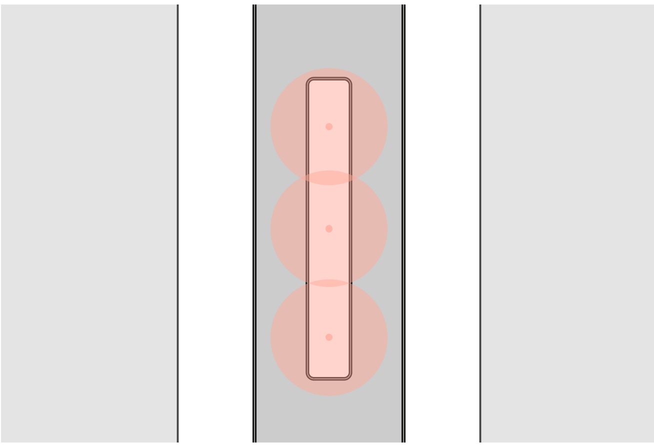
## C2.1 STREET TREES

### STREET TREES – IN MEDIANS

**Median street trees are planted within landscape medians in the centre of the carriageway.**

Street trees in medians provide an opportunity to increase street tree canopy cover of the carriageway as well as strengthening the landscape character of streets where appropriate.

Adding street trees to central medians visually narrows the width of a street and creates a slower speed environment. This can be an effective way of reducing traffic speed in local streets with wide road surfaces and no line marking. Central street tree planting can be in swales or raingardens or in medians with a raised kerb.



Street trees planted in central median

**DESIGN GUIDANCE**

Refer to **Part C2.1** for general Street Tree Design Guidance

Implement median street trees to reduce the scale of overly wide carriageways, including retrofitting existing wide streets

Utilise street trees in medians as traffic calming measures in streets where space allows medians without sacrificing other desired street uses such as outdoor dining space or separated cycling infrastructure

Ensure the planting of street trees in medians allows for sight lines to intersections and pedestrian/bicycle crossings

Ensure street tree canopies do not create conflicts along local bus routes

**DESIGN REQUIREMENTS**

Refer to **Part C2.1** for general Street Tree Design Requirements

Median street trees in Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

Retrofitting median street trees in Primrose Avenue, Rosebery.
Image - (ASPECT Studios)

CASE STUDY

## RETROFITTING PRIMROSE AVENUE, ROSEBERY

PRIMROSE AVENUE WAS PLANTED WITH NEW MEDIAN STREET TREES TO IMPROVE SAFETY BY SLOWING TRAFFIC AND PROVIDE NEW TREES AND SHRUBS FOR MORE SHADE.


Image - (Nearmap)

# THE GREEN AND BLUE GRID

## C2.2 STREET TREE SOIL VOLUME

**Tree soil volume refers to the volume of available growing media available to support the growth of street tree roots.** Sufficient soil volume needs to be provided for all new street trees to ensure they are able to grow at a reasonable rate, reach maximum canopy size, and maintain vitality for the duration of their useful life.

### DESIGN GUIDANCE

Optimum soil volumes are a priority for all streets

Soil volume can be calculated by considering the availability of soil of suitable quality, and can include existing site soils in areas adjoining street tree planting and beyond adjacent property boundaries

The environmental and economic benefits of street trees increase substantially if they remain viable for greater than 50 years

Structural cells can maximise subsurface soil volumes in urban areas
Image - (CityGreen)

### DESIGN REQUIREMENTS

Meet minimum soil volume requirements for street trees as per **Table C2.2**. Where assumptions vary from those included in the table, refer to the provided resource to calculate project-specific soil requirements

Tree roots typically grow within the top 500-600mm of soil depth and may occasionally grow to a greater depth. Do not include soil below a depth of 1000mm within soil volume calculations

Adjacent site soil can be included in soil volume calculations if it can be demonstrated that tree roots have unrestricted access to it

Consider the alignment, space occupied and possible restriction of natural root spread and development of service trenches when calculating available soil volumes

**Table C2.2**

| Tree Size | Typical Height | Recommended Min. Soil Volume | |
|---|---|---|---|
| | | Per Tree In In-Dividual Tree Pit | Per Tree In Shared Trench (Typ. Up To 3 Trees) |
| Small | to 4 m high | 8.65 $m^3$ | 5.80 $m^3$ |
| Small/ medium | 4–9 m high | 13.80 $m^3$ | 9.20 $m^3$ |
| Medium | 7–10 m | 21.40 $m^3$ | 14.25 $m^3$ |
| Tall | 9–12 | 32.65 $m^3$ | 21.80 $m^3$ |
| Tall & wide | 8 m+, canopy 14 m+ wide | 43.70 $m^3$ | 29.15 $m^3$ |

a) Assume climatic growing conditions are dry, unreliable and / or hot or extreme conditions

b) Assume soil suitability is not particularly fertile or effective

c) Assume there is no maintenance, with no fertiliser applications, no mulch, no supplementary irrigation

Refer https://www.elkeh.com.au/soils/ for bespoke tree soil volume calculations

# THE GREEN AND BLUE GRID

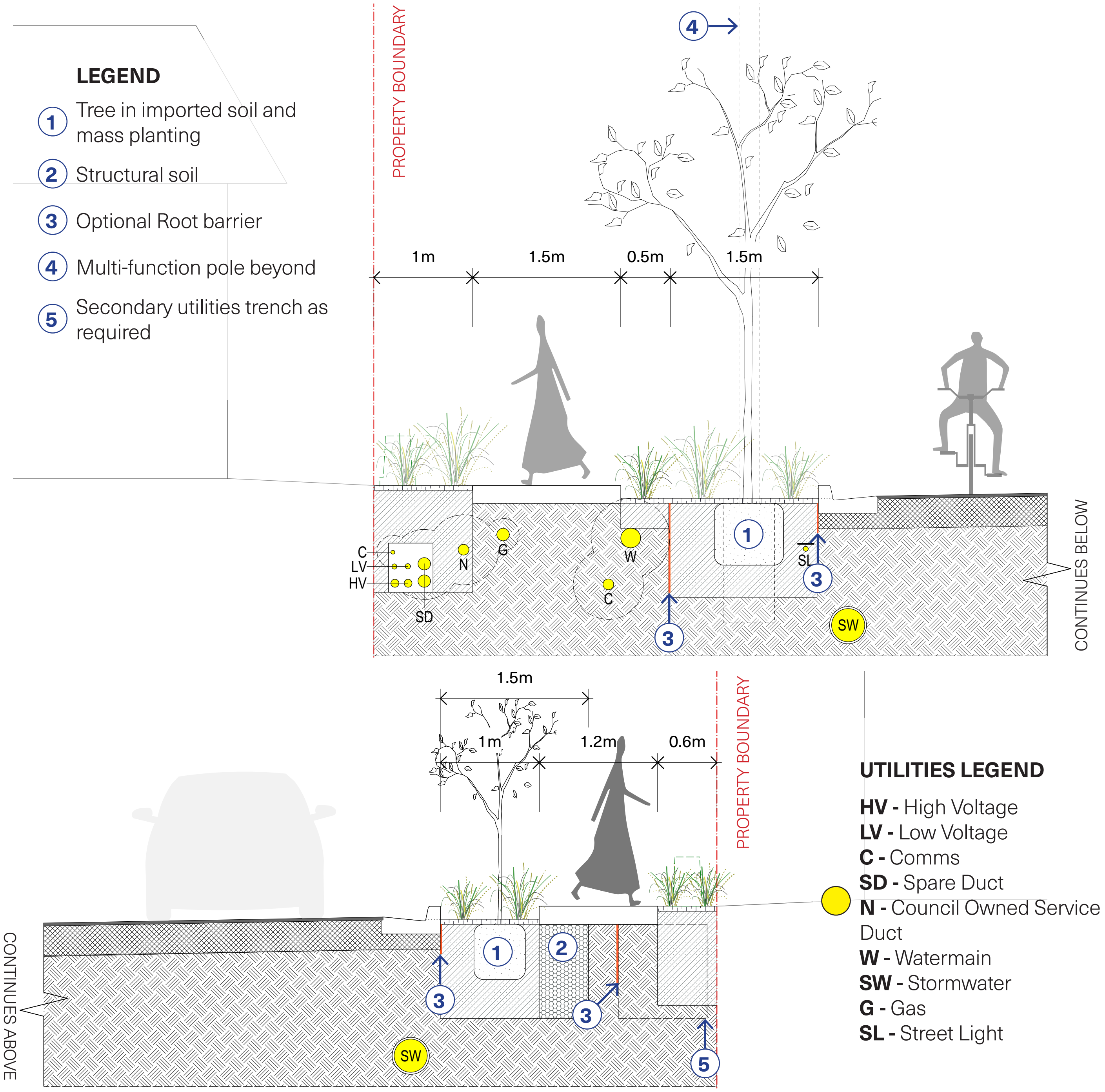
## C2.2 STREET TREE SOIL VOLUME

**Conflicts with street trees and their soil volumes should be avoided in the design of streets. Careful planning of streets should take all street elements into consideration, along with tree planting.**

In some areas verge widths will be constrained by other street elements and in these cases structural soil beneath adjacent footpaths should be provided to ensure trees have adequate soil volumes.

The minimum planting zone width acceptable is 1m when adjacent a footpath under which structural soil can be provided. A minimum of 1.5m width of soil (tree pit + structural) should be provided.

In these constrained soil situations, tree species selection should carefully consider the mature tree canopy and the ability of the tree to remain stable in the longer term. This will require smaller tree species to be planted in the areas of constrained soil.




Indicative utilities and tree pit section highlighting required soil area

# THE GREEN AND BLUE GRID

## C2.3 PAVED TREE PITS

**Paved Tree Pits refers to the planting of street trees in areas of paving which extends to the base of the tree and soil volumes are provided under adjoining paved surfaces.**

Paved tree pits use hard surfaces around the base of street trees in constrained or urban environments, where alternate uses such as outdoor dining need to be prioritised.

Different examples of paved tree pit materials include bound granites or gravels, tree grates and permeable pavers. Ultimately – the paving finish to the base of the tree should tie in with the adjacent footpath, and therefore should be coordinated with council palettes.

### DESIGN GUIDANCE

Provide paved tree pits on high streets where space under and around trees can be used for alternate uses

### DESIGN REQUIREMENTS

Ensure minimum subsurface soil volumes are provided (see **Part C2.2**)

Maximise use of permeable pavers in paved areas around tree pits to provide water infiltration to subsurface soil

Tree pit Terrabond
Image - (Resin Drives)

Tree pit in Terrabond
Image - (Google)

# THE GREEN AND BLUE GRID

## C2.4 PLANTED TREE PITS + UNDERSTOREY PLANTING

**Understorey planting refers to low mass planting within verges, kerb extensions, and medians. Planted tree pits are tree pits which utilise planting to further enhance the visual and environmental amenity of street tree plantings.**

Understorey planting expands the provision of planting in the streets which increases visual interest, biodiversity and fauna habitat. Including understory planting in streets can reduce maintenance activities, such as mowing turf. In areas where verges are swales or raingardens, understory planting plays a role in assisting in removing pollutants from the soil and water.

In high pedestrian activity areas, understorey planting can direct pedestrian movements to dedicated crossing points instead of fences and other barriers and in commercial centres, understorey planting can improve the amenity of the streetscape, especially adjacent areas of outdoor dining.

Some local councils have policies that encourage residents to take ownership of the verges in front of their properties to allow residents to utilise the space for growing edible or biodiversity species. Examples include bee/insect attracting planting, small fauna habitat planting, or herbs/vegetables. In general, measures that encourage residents to have a sense of ownership and pride for the planting adjacent their properties should be encouraged. Planting selections should avoid environmental weeds and plants that can grow higher than 800mm, to prevent creation of sight line issues.

### DESIGN GUIDANCE

Consider the ongoing maintenance requirements of understorey planting during the design phase to ensure the sustainability and longevity of planted areas

Consider access to parked cars from footpaths

### DESIGN REQUIREMENTS

Ensure understorey planting adheres to best practice CPTD principles

Ensure traffic visibility and clear sight lines are maintained


Planted verges give opportunity to grow herbs and vegetables
Image - (Bianca Pineda)

A biodiversity verge attracts native flora such as bees and insects
Image - (Gerald Moscarda)

# THE GREEN AND BLUE GRID

## C2.5 WSUD FEATURES

**Water sensitive urban design (WSUD) is an important feature for streets.**

There are many ways of achieving WSUD in built up areas. In streets, the objective is to capture, slow and filter polluted stormwater to reduce the strain on existing waterways and stormwater infrastructure. WSUD can effectively treat the pollutants from low flows which account for 90-95% of the total annual runoff volume. Further to this, WSUD contributes to street tree health, a cooler environment through evapotranspiration, and can contribute to biodiversity in streets.

Broadly, WSUD aims to reduce the quantity of water entering the stormwater system and to improve the quality of this water.

The Guidelines sets a target of WSUD on every street, to a total size of 3-5% of impervious area (e.g. asphalt roadways, non-permeable paving). This specifically targets the water quality objectives of WSUD. The WSUD sizing target has been derived from MUSIC modelling (Planning Institute of Australia, 2016). This modelling shows that for an area which is 50% effective impervious area (such as in private lots in housing areas) the ideal size of WSUD features is 2%.

As The Guidelines' street types tend to be less permeable (65% impermeable), and often more polluted, a higher target of 3-5% has been set for WSUD features in The Guidelines. It is critical to allow space for WSUD feature in streets, and this allowance will allow designers to meet the more detailed water quality targets in DCPs, SEPPs and EPAs.

Part C provides two key WSUD elements which will help all streets meet their WSUD Design Requirements;

- **C2.6** WSUD Tree Pits
- **C2.7** Raingardens and Swales

Although many other elements contribute to water-sensitive streets, such as Permeable Paving **(C2.9)** and Passive Irrigation Kerbs **(C2.8)**, they do not contribute to the overall WSUD Design Requirement as they do not provide a significant capacity to filter stormwater. Irrespective, Permeable Paving and Passive Irrigation Kerbs are still critical components to any holistic WSUD

### DESIGN GUIDANCE

Integrate WSUD within other street elements such as kerb extensions and verges, as much as possible

### DESIGN REQUIREMENTS

Design WSUD features ensuring that 100% of low flows of the road catchment run-off flows into the feature, and is on average between 3-5% of the catchment size (total impervious area)

Refer to the Engineering Design Manual for Western Sydney for further design requirements on WSUD elements and their application

Ensure WSUD is stable (scour and mobilisation of material) in high flows

# THE GREEN AND BLUE GRID

## C2.6 WSUD TREE PITS

An integrated WSUD street tree pit enables numerous objectives to be achieved in one space and maximises the benefit to street tree health.

In all instances, a WSUD tree pit must be connected to the stormwater system to allow for passive irrigation, to optimise tree health and capture urban stormwater for reuse and nutrient take up

### DESIGN GUIDANCE

Refer to **Part C2.1** for general Street Tree Design Guidance

Design water inlets to control flows and enable maintenance

### DESIGN REQUIREMENTS

Refer to **Part C2.1** for general Street Tree Design Requirements

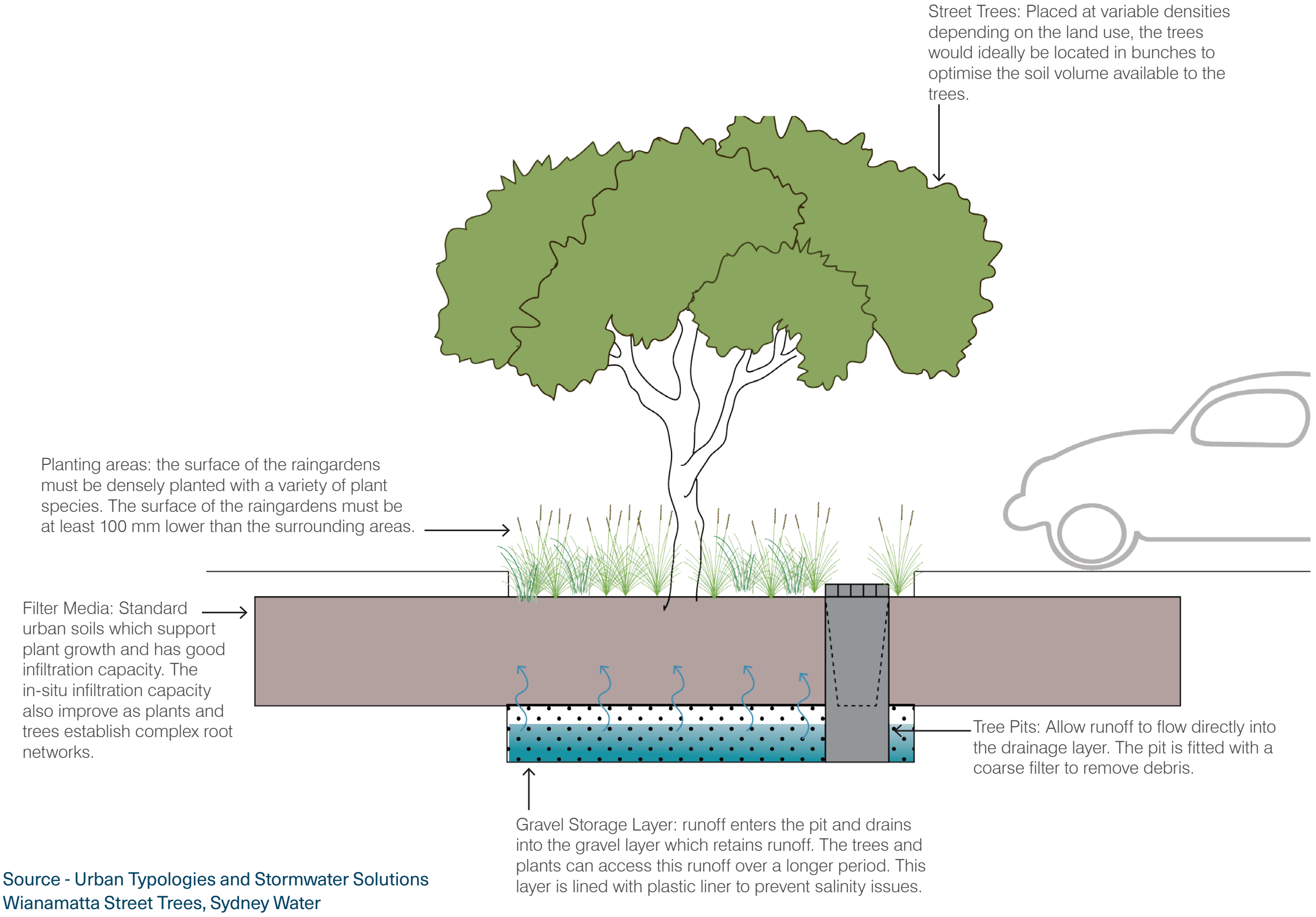
Refer to **Part C2.5** for general WSUD Feature Requirements

Directly connect the inlet stormwater pit to the gravel drainage zone and allow for bypass or overflow of high flows

Match tree species selection to the water availability by checking catchment runoff characteristics

Incorporate passive irrigation kerbs **(C2.8)** around the trees to maximise water infiltration

Consider planting more than one tree in each stormwater connected pit where soil volume permits




Source - Urban Typologies and Stormwater Solutions
Wianamatta Street Trees, Sydney Water

# THE GREEN AND BLUE GRID

## C2.7 SWALES AND RAINGARDENS

**Swales and Raingardens are used to replace or supplement traditional stormwater pits and pipes, where landscape planting areas allow infiltration of rainwater to be filtered by growing media and subsurface drainage systems to carry clean water downstream.**

Swales carry water like pipes and are designed as shallow, open, vegetated channels to convey runoff and remove pollutants. Swales slow water flow and trap sediments to improve the water quality. Swales and raingardens have capacity to collect water from storms and slowly release them to the downstream environment, thus reducing the impacts of highly erosive flows on waterways.

Raingardens have a special soil filter media that can remove pollutants from road runoff. Raingardens are also called bioretention systems, or vegetated water quality systems. Some are designed to allow filtered water to infiltrate underlying soils while others are lined, and discharge filtered water to a connected stormwater system. Configure plant and soil filtration systems as garden beds or street tree pits such that they are designed to treat stormwater runoff.

Different areas have different issues and each of these needs a specific management approach. In Western Sydney, the underlying Wianamatta Shale naturally has a high salt content, compounded by changes to the natural water cycle from farming and development across the region.

Retaining vegetation and using salt tolerant local species is critical to maintaining a suitable water balance to manage salinity. Trees provide deep roots to draw saline water away from the surface. Lined raingardens have been found to be feasible in saline environments.

Salinity management should not be seen as being fundamentally in conflict with WSUD. WSUD emphasises the need to understand the site and develop site specific solutions, which is a very sound basis for good salinity management outcomes.

A densely planted raingarden along a street in Sydney.
Image - (ASPECT Studios)

### DESIGN GUIDANCE

Maximise environmental performance by incorporating swales and raingardens into verges

Provide swales and raingardens as an alternative to piped drainage systems where space is available, and the gradient allows

Use systems with an impermeable liner where the underlying soil is not suitable for infiltration, or when adjacent to a structure that is sensitive to water

Connect roof drainage pipes and other stormwater inputs into swales and raingardens where possible

Use endemic native species and introduce habitat and food production plants where possible

### DESIGN REQUIREMENTS

Refer to **Part C2.5** for general WSUD Feature Requirements

Size raingardens and swales to be sized to accommodate low flow rain events, which generally clean 95% of gross pollutants and sediment from the street. A good rule of thumb is to size the raingarden to be 3–5% of the impervious street catchment

Ensure inlet zones to raingardens are protected from erosion by armouring or using inlet pit structures

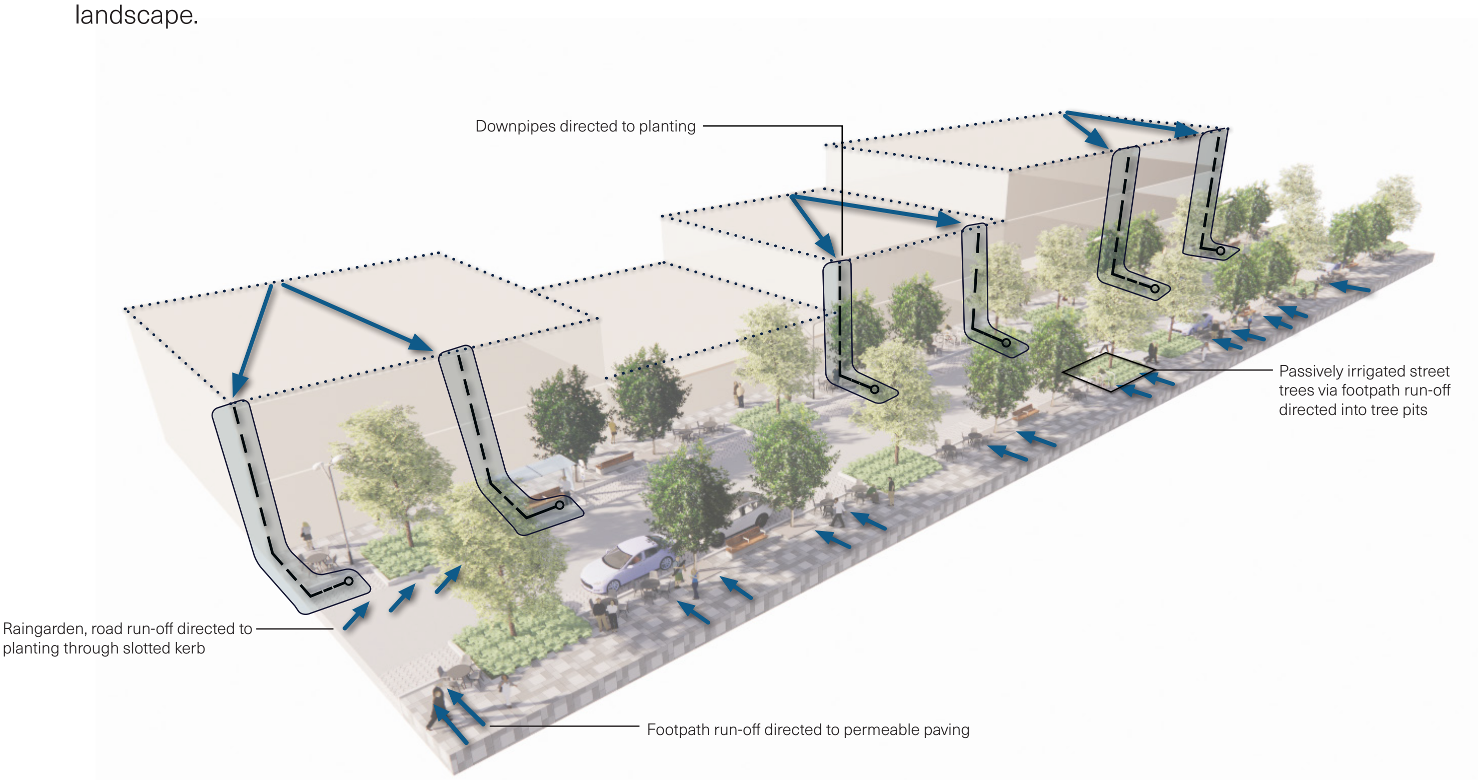
Select plants based on resilience to the site conditions and extended periods of dry and intermittent wet

# THE GREEN AND BLUE GRID

## C2.7 SWALES AND RAINGARDENS

The WSUD approach holistically considers site characteristics and identifies opportunities for solutions to a range of water issues. Incorporating WSUD into streets and the built environment enables multiple benefits and functions in one space.

The design guidance provides a suite of options to enhance street sustainability and aims to reduce clashes between traffic, pedestrian and environmental needs through integrated design, while reducing the impact of stormwater runoff on the downstream environment and minimising the water resources needed to sustain the landscape.




WSUD features integrated throughout the street.

Planted swale in Eckersley Way, Moorebank.
Image - (ASPECT Studios)

Raingarden with a slotted kerb in lieu of car parking, Rozelle.
Image - (ASPECT Studios)

# THE GREEN AND BLUE GRID

## C2.8 PASSIVE IRRIGATION KERBS

**Kerbs are typically located between the carriageway and the adjacent footpath.** Along with the gutter, their primary role is to divert errant vehicles, and to direct the flows of stormwater off the road surface into stormwater pits. For this reason, kerbs and gutters can be important opportunities to further integrate passive irrigation or WSUD into streetscapes.

Passive Irrigation Kerbs are modified to enable better flow of water into landscaped areas adjacent to the carriageway. The adjacent page contains section drawings of typical passive irrigation kerb types and the site characteristics they are best suited to. "Design components are a useful compilation of Passive Irrigation". Designs are not limited to what is provided. Indeed, any kerb or edge which is designed to divert water into tree pits and planted areas can be considered a Passive Irrigation Kerb.

Inlet pit structures can also be modified to direct low flows to water treatment, while high flows are diverted to larger systems. This balance of where high and low flows should be directed is a critical component of the broader design of catchment water management and will influence the scale of downstream works and the ongoing maintenance burden of all systems.

**DESIGN GUIDANCE**

Incorporate passive irrigation kerb types as often as possible into new and refurbished streets

Modify kerbs, gutters and inlet pits as required to direct low flows to WSUD systems and divert high flows to larger systems, while ensuring vehicle safety

Kerb cuts for passive irrigation on Bourke Street, Surry Hills.
Image - Bourke Street Cycleway, City of Sydney (Simon Wood)

Kerb cuts for passive irrigation in Harold Park.
Image - Harold Park Precinct, ASPECT Studios (Simon Wood)

Kerbless areas for passive irrigation with inlet pits at Moorebank.
Image - (ASPECT Studios)

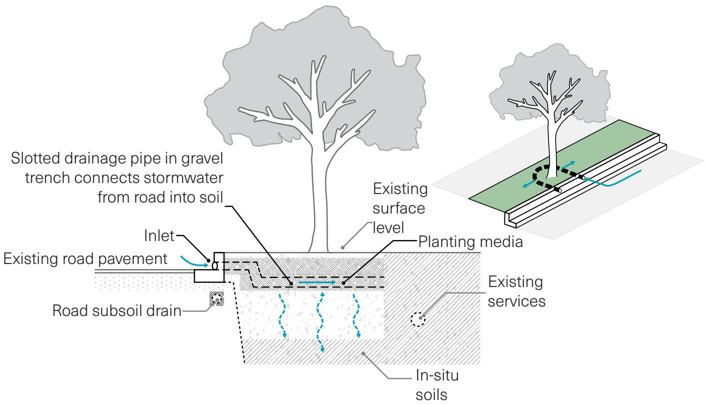
# THE GREEN AND BLUE GRID

## C2.8 PASSIVE IRRIGATION KERBS

**Example 1 - No underdrainage**

Typical site characteristics:
- No stormwater network
- Limited budget for retrofit

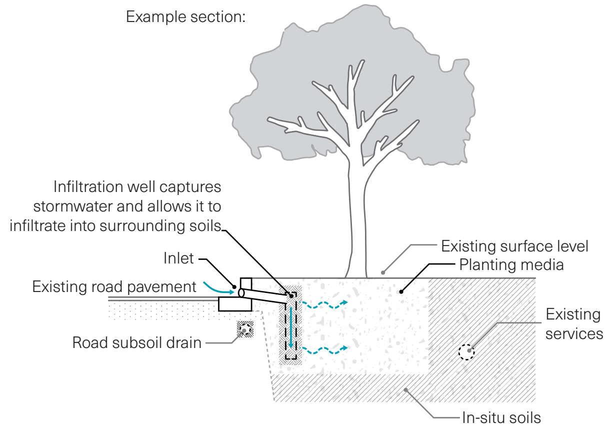
Example section:




**Example 2 - Infiltration trench/pit**

Typical site characteristics:
- No stormwater network
- Limited budget for retrofit

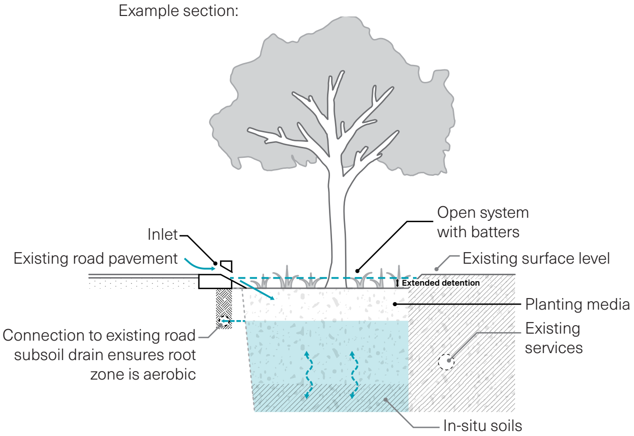
Example section:




**Example 3 - Elevated underdrainage**

Typical site characteristics:
- Existing road subdrain
- Limited budget for retrofit

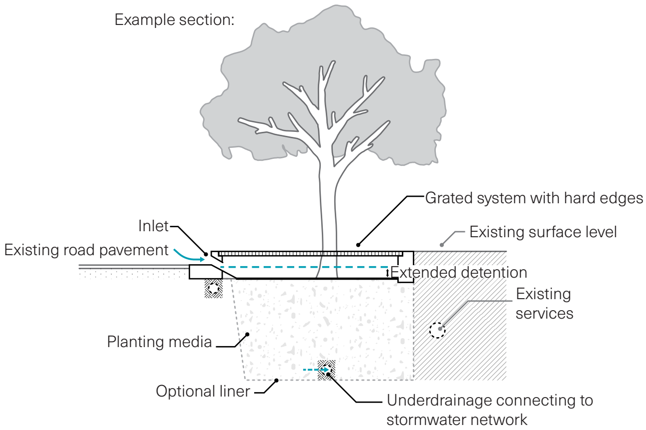
Example section:




**Example 4 - With underdrainage**

Typical site characteristics:
- Existing road stormwater network
- High rainfall climatic zone
- Large catchment area

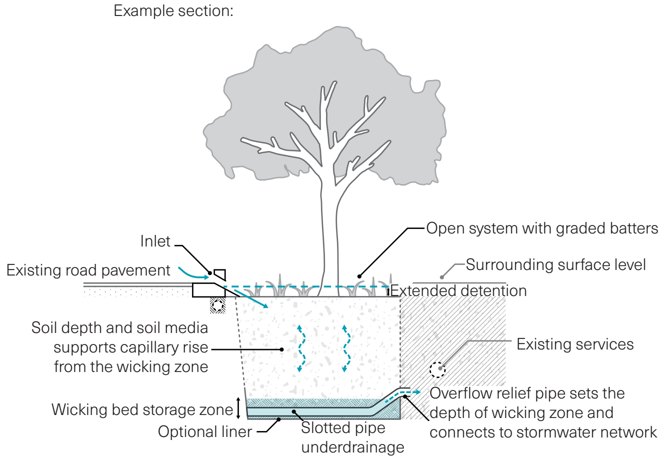
Example section:




**Example 3 - Elevated underdrainage**

Typical site characteristics:
- Existing road subdrain
- Limited budget for retrofit

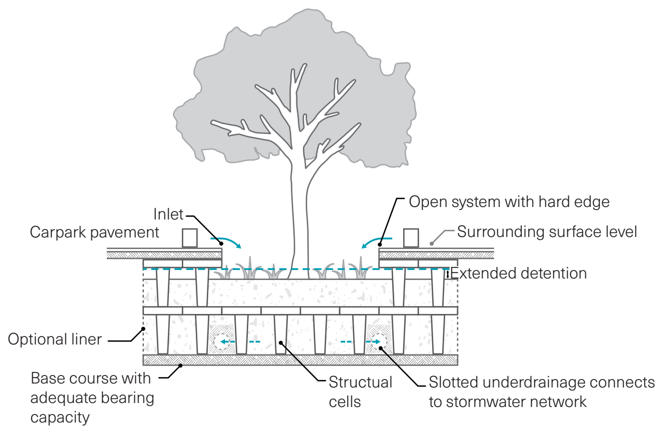
Example section:




**Example 4 - With underdrainage**

Typical site characteristics:
- Pavement required over system

Example section:




Source - Water Sensitive Cities "Examples of typical passive irrigation design components", Monash University

# THE GREEN AND BLUE GRID

## C2.9 PERMEABLE PAVING

**Permeable Paving refers to paved areas that allow water to infiltrate between pavers or through porous materials to the substrate below.**

Permeable paving enables hard surfaces to perform water quality improvement, quantity reduction and cooling functions.

The sub-layer for permeable paving can be engineered to have an effective water treatment function, or simply to slow water before draining to the stormwater system, depending on site conditions and the frequency of vehicle use.

It can be effective when placed next to a WSUD feature or street tree pit to expand the permeable zone draining to the root zone.

Permeable paving is an excellent option in streets where there is limited space, and therefore limited ability to incorporate other permeable surfaces like planted verges. This is because permeable paving can used for a carriageway or street parking while also meeting WSUD and permeability targets.

Permeable paving does have a higher installation cost than other road surface options such as asphalt, and other permeable surfaces such as planted verges. The cost can be reduced by consolidating areas of permeable paving. Permeable paving also requires maintenance, which asphalt does not. However, it does not require any specialist equipment and is as easily maintained as other types of paving, such as that on footpaths or in other public spaces. Additionally, permeable paving can require less maintenance than other permeable surfaces such as planted verges. Lastly, maintenance can be minimised through design process by considering things like adjacent tree selections.

Permeable paving for street trees on Rider Boulevard, Rhodes.
Image - (ASPECT Studios)

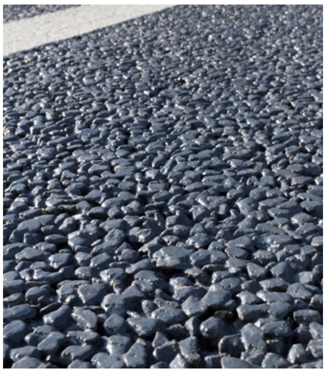
### DESIGN GUIDANCE

Use permeable paving instead of traditional impervious surfaces where appropriate, such as in parking bays, laneways, or driveways

Ensure a thorough understanding of the underlying geology, how water will infiltrate, and how the permeable paving system will be maintained

Maximise use of permeable paving adjacent to street tree planting to ensure the health and longevity of street trees

Permeable paving examples



Permeable Asphalt
Image - (construction climate challenge)

Ecotrihex Pavers
Image - (Australian Paving)

Stoneset
Image - (Stoneset)

HydroSTON concrete pavers
Image - (HydroSTON)

Permeable car park paving.
Image - (ASPECT Studios)

# C3 VEHICLES

Well designed streets allow for safe vehicular access and thoroughfare without allowing traffic volumes and speeds to have a detrimental impact on the experience of the street for other users.

Vehicle design parameters—such as traffic calming, clear zones, lane widths, parking, and transit lanes and stops—all play a role in the balancing of user needs. This section describes and illustrates these design parameters, providing design standards that ensure the Street Design Objectives of The Guidelines are achieved.

Vehicle design controls—Design Speed and Design Vehicle, —are discussed in further detail in Part B, Design Controls.

## C3.1 LANE WIDTHS

**Lane widths influence the movement of motor vehicles and, in some circumstances, cyclists along the street.**

Wide travel lanes should be avoided in constrained urban environments, where space is at a premium and best put to alternate uses. Lane widths need to be considered within the overall structure of the street to ensure design requirements are met. Existing literature and research demonstrate that narrower lane widths provide effective speed management and increase safety for all users of the street.

Narrow carriageway at Moorebank.
Image - (ASPECT Studios)

### DESIGN GUIDANCE

When choosing a lane width within the ranges provided in Part B, these must be appropriate for the context and uses of the street. Key factors to take into consideration include:

— The volume of vehicular traffic and pedestrian activity

— The demarcation, if any, between carriageway and footpath (for example kerb, street trees or planting and public domain furniture)

— Whether parking is to take place in the carriageway and if so, distribution, arrangement, the frequency of occupation, and the likely level of parking enforcement.

— Design controls, such as design speed, Design Vehicle / Check Vehicle, and design hour

— The curvature of the street (bends require greater width to accommodate the swept path)

Lane widths may be narrowed as a traffic calming function. In streets with less traffic, consider narrowed intersections, traffic lanes and parking lanes, as they act to naturally calm traffic

### DESIGN REQUIREMENTS

Refer to Part B for required lane widths

When choosing a lane width within the ranges provided in Part B, priority should be given to reducing lane widths while still allowing for large Check Vehicles, such as garbage trucks

Exceptions may be required on some state owned streets but decisions regarding carriageway widths should support the design targets and objectives of the street types in Part B

VEHICLES

## C3.2 CLEAR ZONES

**A Clear Zone is an area adjacent the travel lane on higher speed roads kept clear of features potentially hazardous to errant vehicles.**

Clear Zones are provided on higher speed roads to provide a recovery area clear of non-frangible hazards for errant vehicles to re-enter the travel lane.

Although a vital safety feature on higher speed roads, the application of clear zones in well-established urban environments is usually problematic because of the lack of space and objects (e.g. utilities and road furniture) that must be accommodated at the side of the road.

### DESIGN GUIDANCE

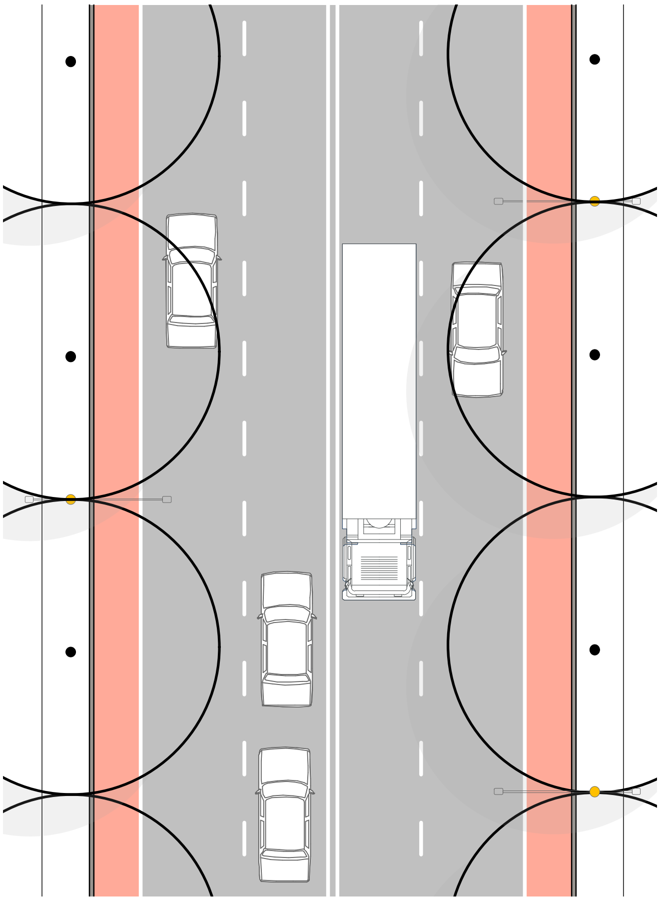
Balance the application of clear zones against creating self-explaining road environments which discourage drivers from exceeding speed limits

Avoid implementing clear zones in urban environments where recoverable zones may increase the likelihood of errant vehicles impacting other street users, or where valuable street space is best used to support other uses

### DESIGN REQUIREMENTS

Do not implement clear zones on local and lower order streets with design speeds equal to or less than 50km/h

Conduct a risk assessment process to determine the approach to street tree planting when implementing clear zones on Sub-Arterial roads with design speeds equal to or greater than 60km/hr. The risk assessment should consider all road users including pedestrians and cyclists as well as urban heat and community health impacts.



Clear Zones kept clear of potentially hazardous features such as street trees and light poles

Verge and median tree planting in Sydney Business Park, Marsden Park. Image - (ASPECT Studios)

VEHICLES

## C3.3 TRAFFIC CALMING

**Traffic Calming refers to the use of physical design measures, such as kerb extensions and lane narrowing, to create a balance between the movement and place functions of a street. It usually requires a change in a typical condition, alerting drivers to the potential presence of other road users and maintaining slow behavioural speeds.**

The principle of self-explaining roads is one aspect of the safer roads approach. Self-explaining roads naturally encourage drivers to adapt their behaviour in a way that is compatible with the design, function, and speed of a road. Additionally, a self-explaining road can potentially reduce the need for a large number of traffic devices to control behaviour. (Roads and Maritime, 2014)

### DESIGN GUIDANCE

Ensure traffic calming contributes to the creation of self-explaining street environments where their appearance reinforces their intended function and speed posting

Through the road conditions, drivers should feel uncomfortable exceeding the speed limit, and should be aware of the type of conditions ahead without excessive prompting from road signage.

### DESIGN REQUIREMENTS

Adopt traffic calming design measures on all Local Residential and Mixed-Use Streets

Traffic calming measures can take a number of forms. Acceptable examples are included in the adjacent diagram

Maximise the use of traffic calming measures to achieve the other Street Feature Design Requirements. For example, provide soft landscape elements within kerb extensions to maximise permeable surfaces

Tree planting & chicanes provide traffic calming on Eckersley Way, Moorebank.
Image - (ASPECT Studios)


Traffic calming in Nagurra Place, Rozelle.
Image - (ASPECT Studios)

# VEHICLES

## C3.3 TRAFFIC CALMING

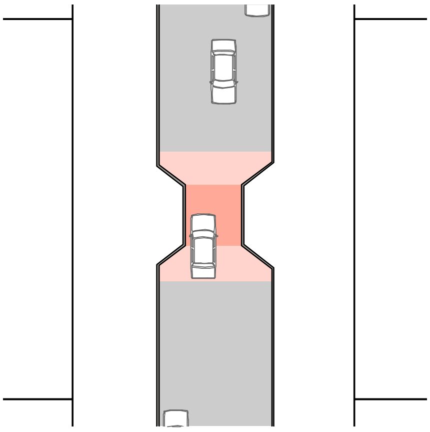


**Diagram 1: Pinch Points**
Pinch points are a narrowed section of the carriageway. In Local Street Type 2, opposite motorists yield to one another at pinch points.

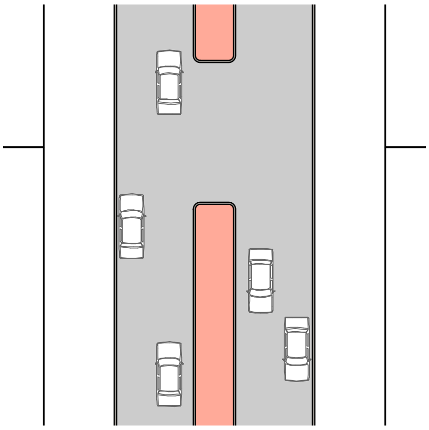


**Diagram 2: Medians**
Implementing raised medians in the middle of the carriageway narrows the overall carriageway width and allows for additional street tree planting.

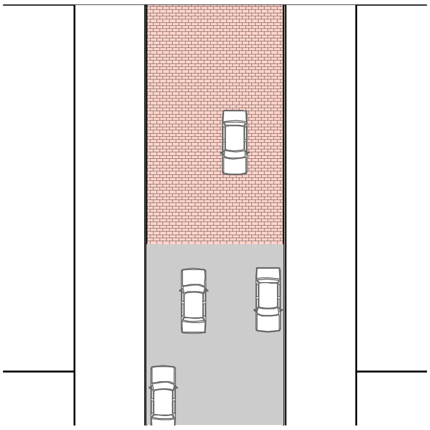


**Diagram 3: Pavement Alteration**
Changes in pavement signify a change in context, typically in which pedestrians are prioritised.

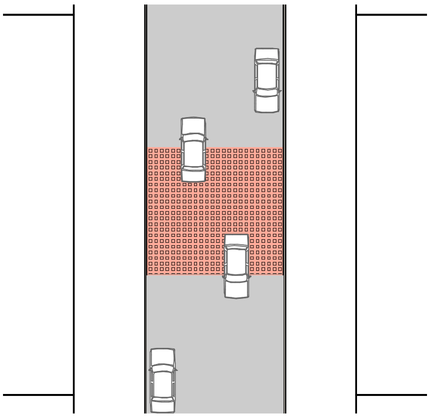


**Diagram 4: Rumble Strips**
Rumble strips can be of several different forms typically produced by cutting grooves within the pavement surface, or by adding plastic ribs to the carriageway.

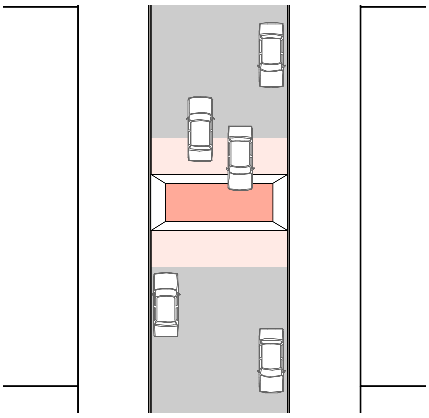


**Diagram 5: Speedhumps**
Speedhumps are raised sections which slow and control traffic. The sizing and dimensions of speedhumps are dependent on the behavioural speed of the street.

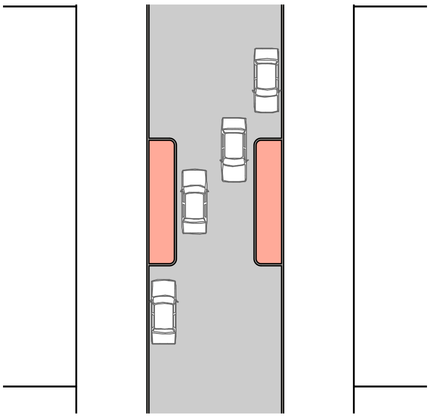


**Diagram 6: Kerb extensions (retrofit)**
Kerb extensions narrow the overall width of the carriageway resulting in vehicles having to reduce traffic speed. They can be detached from the kerb, avoiding modifications to stormwater assets and making them easy to retrofit on existing streets.

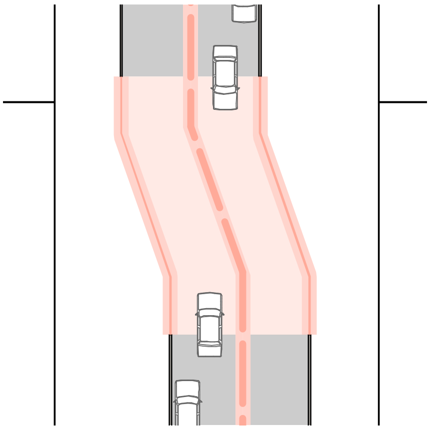


**Diagram 7: Chicane**
A Chicane is a sharp bend in the road from which drivers are expected to reduce speed to negotiate the alteration in the carriageway.

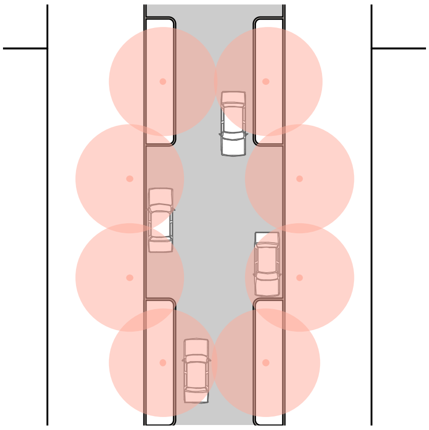


**Diagram 8: Street Trees**
A connected street tree canopy visually narrows the width of the carriageway and signifies to motorists they are entering a populated area.

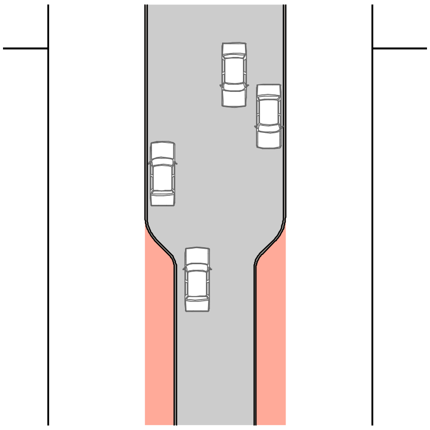
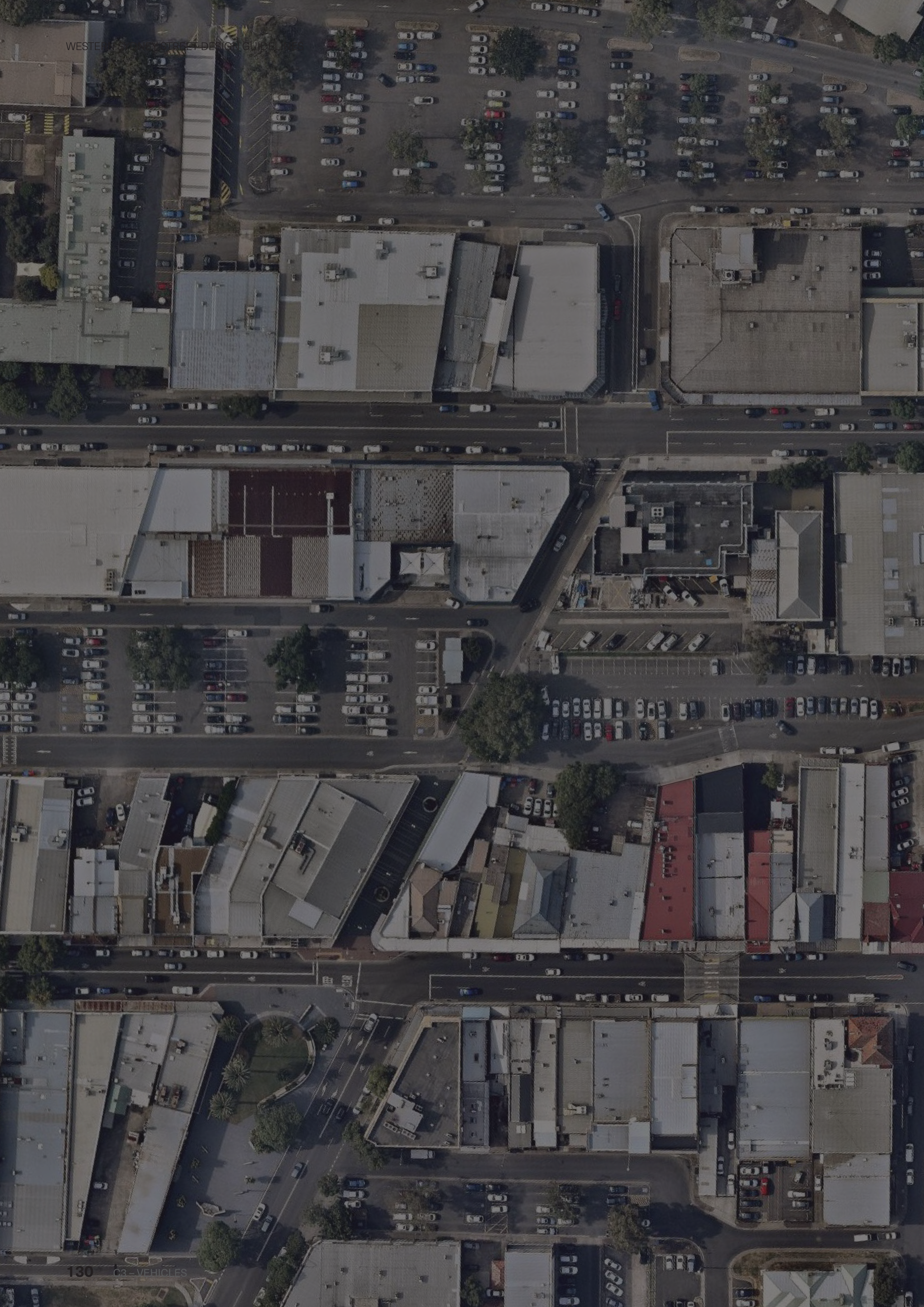


**Diagram 9: Kerb Extensions**
Kerb extensions are traffic calming elements which locally widen the verge and kerb line and narrow the carriageway.



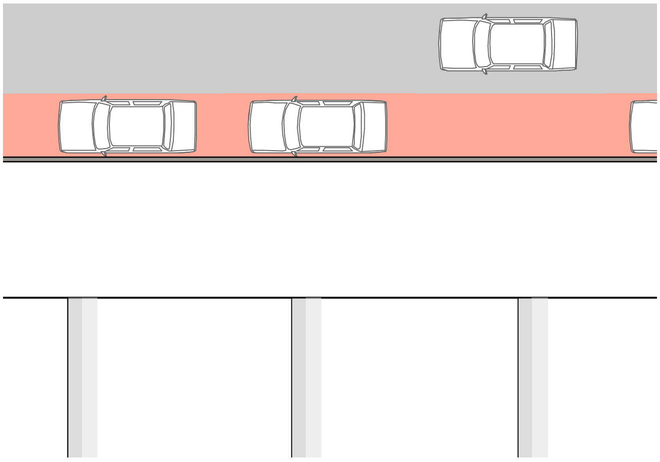
VEHICLES

## C3.4 COMMERCIAL ON–STREET PARKING

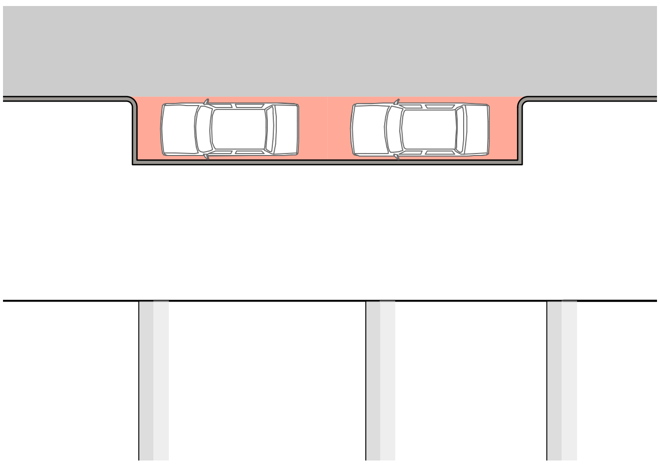
**On-street parking refers to the provision of kerbside and indented parking for motor vehicles.**

On-street parking in commercial streets allows visitors and workers to access local centres by car. Designated space for kerbside uses such as loading zones safely facilitate commercial activity on the street.

On-street parking can be a contentious issue due to the parking demand typically exceeding supply in mixed-use streets. Demand for kerbside parking can be managed through pricing and time restrictions in commercial centres.



Kerbside parking on a commercial street



Indented parking on a commercial street

### DESIGN GUIDANCE

Consider the kerbside space occupied by on-street parking against other street design objectives and stakeholder aspirations when designing on-street parking

Regulate parking to avoid pushing parking demand into inappropriate spaces, such as verges, cycle lanes, and through-traffic lanes. Local councils can create a regulated market for parking by providing designated space for specific kerbside uses, such as loading zones, and by placing a value on general vehicle parking. A combination of purpose-based zones, time limits, and pricing can improve safety for all street users and make parking and loading significantly less time-consuming

Reduce the number of vehicles cruising for parking, and the time spent by drivers doing so, by:

- charging for parking during high-demand periods of the day or week; or
- providing smart parking information to citizens and drivers so that they can select whether to drive at all, and where they should drive to and park

When choosing a parking lane width within the ranges provided in Part B, consider minimising the width of parking bays to reflect the vehicle type most likely to park in each location, to maximise street space for alternate uses

### DESIGN REQUIREMENTS

Refer to Part B for required parking lane widths

Allow taxis, freight, and other private vehicles to load or unload in designated spaces without blocking through motor vehicle, cycle, and transit traffic

Provide kerb space for taxis to queue while waiting to pick up passengers. These can be valuable near major destinations and transit stations to organise taxi hailing

VEHICLES

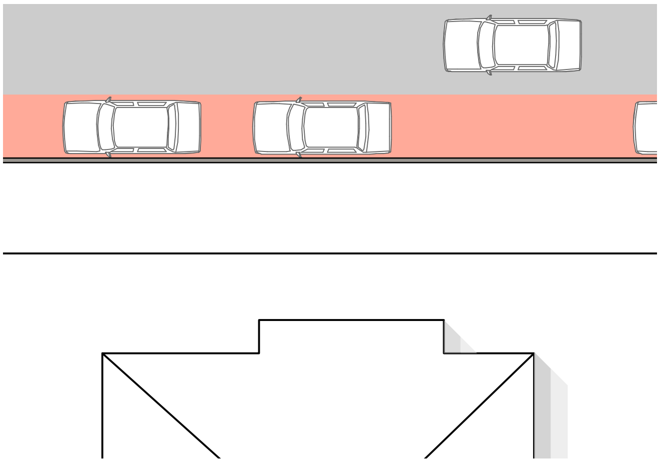
## C3.5 RESIDENTIAL ON–STREET PARKING

**On-street parking in residential areas is provided as kerbside parking and indented parking along streets.**

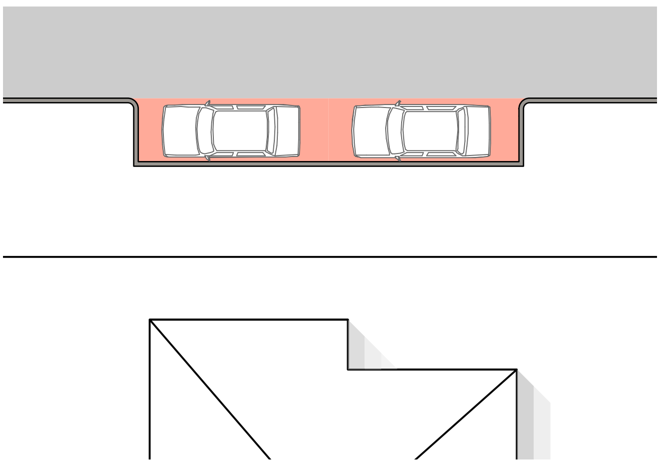
On-street parking provides for residents and visitor parking. It is also typically utilised by residents for storage of additional items such as trailers and boats. On-street parking is a valued amenity for residents in Western Sydney.

Its provision should be carefully considered against the cost of maintaining wider streets to local councils, and contributions to urban heating as well as polluted run-off by larger carriageways.

Site analysis is required to determine on-street parking requirements in areas such as public transport hubs and near schools, shops and sporting facilities.



Kerbside parking on a residential street



Indented parking on a residential street

### DESIGN GUIDANCE

Consider the kerbside space occupied by on-street parking against other street design objectives and stakeholder aspirations. Undertake an assessment to determine the best quantity and method of providing on-street parking

Utilise the flex zone to achieve a variety of street design objectives including parking provision, WSUD initiatives, and street tree and understorey planting

In higher density residential areas, provide residents of blocks or districts with parking permits, capping parking demand on neighbourhood streets, making it easier for residents to find parking spaces, and reducing the use of vehicles for neighbourhood to neighbourhood travel

### DESIGN REQUIREMENTS

Refer to Part B for required parking lane widths

When choosing a parking lane width within the ranges provided in Part B, minimise the width of parking bays to mitigate urban heat effects and maintenance costs

Allow taxis, freight, and other private vehicles to load or unload in designated spaces without blocking through motor vehicle, cycle, and transit traffic

Provide kerb space for taxis to queue while waiting to pick up passengers. These can be valuable near major destinations and transit stations to organise taxi hailing

CASE STUDY

**Desktop Parking Analysis**

The analysis on the opposite page presents a preliminary review of parking uptake in recently completed developments. While case studies from Oran Park, Willowdale, and Gledswood Hills are presented here, similar results were also found across the LGAs of all nine partner local councils.

# VEHICLES

**Oran Park**
Saturday, 12 January 2019
Total parking spaces: 188

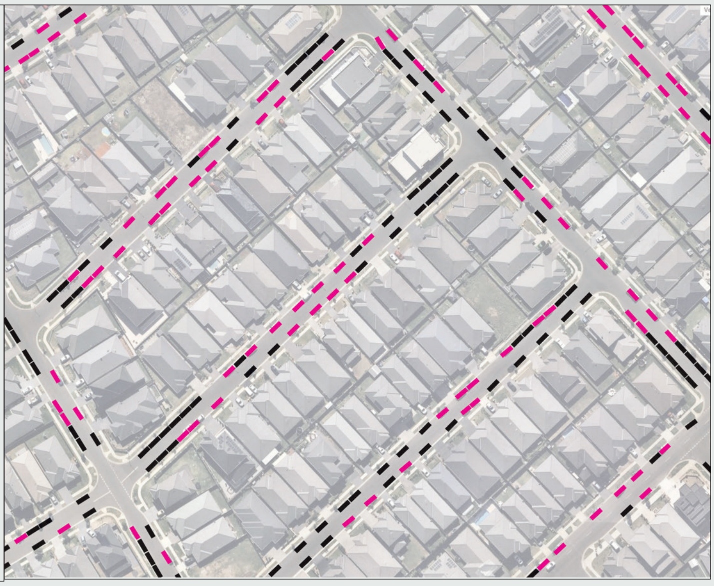
**Used: 64**
Empty: 124

**66%** of parking spaces are empty

**Willowdale**
Sunday, 31 March 2019
Total parking spaces: 198

**Used: 97**
Empty: 101

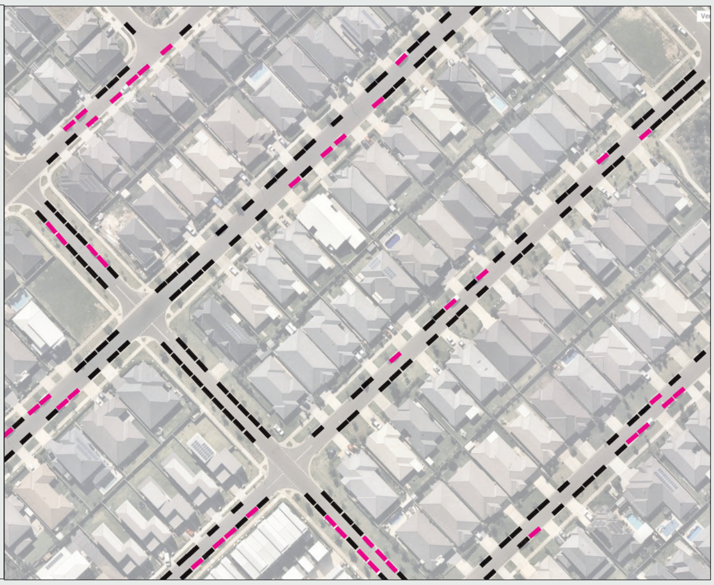
**51%** of parking spaces are empty



**Gledswood Hills**
Sunday, 31 March 2019
Total parking spaces: 188

**Used: 43**
Empty: 145

**77%** of parking spaces are empty



VEHICLES

## C3.6 CAR SHARE

**Car sharing schemes operate shared-use fleets of passenger and light commercial vehicles for short term hire for personal and business uses. Customers book vehicles via computer or mobile apps that provide cost and location information.**

Car share schemes provide convenient and affordable transport choices, encouraging reduced car ownership and enabling more sustainable travel habits. They offer an alternative option to private car ownership, while transferring the costs of purchasing and maintaining a private vehicle to the car sharing provider.

Car share schemes are typically supplied by the private sector but rely on on-street parking spaces, both fixed and non-fixed. Fixed parking spaces provide a marked parking space for the exclusive use of a car share vehicle. Non-fixed parking spaces operate on the basis of permit parking schemes. Both types are administered by local councils, as the relevant parking authority. Local councils are also solely responsible for enforcing car share parking spaces.

Anecdotal evidence reported by RMS suggests that enhanced markings increases compliance with car share only spaces. This includes the use of signage and painted treatments on the road surface.

In the long term, encouraging the use of car share schemes can be a viable way for local councils to reduce overall parking provision for private cars and costs associated with wider road corridors.

Dedicated car share parking, Sydney.
Image - (Cars Guide)

### DESIGN GUIDANCE

Reduce congestion and competition for parking spaces via implementing car share which allows a single vehicle to be used by several people

Report monthly data on the use of individual spaces to gauge whether additional spaces are needed

### DESIGN REQUIREMENTS

Provide car sharing parking spaces on both Local Residential and Mixed-Use streets to encourage the use of car sharing to help discourage car ownership

VEHICLES

## C3.7 ELECTRIC VEHICLE CHARGING

**Electric vehicle charging stations are the point at which electric vehicles connect to the electricity grid.** They provide power to electric vehicles while parked within the street, and are critical to establishing a full network of charging options for electric vehicle owners.

With the anticipated growth of electric vehicles as a widespread transportation choice, the incorporation of charging stations within streets will become a critical element of city.

### DESIGN GUIDANCE

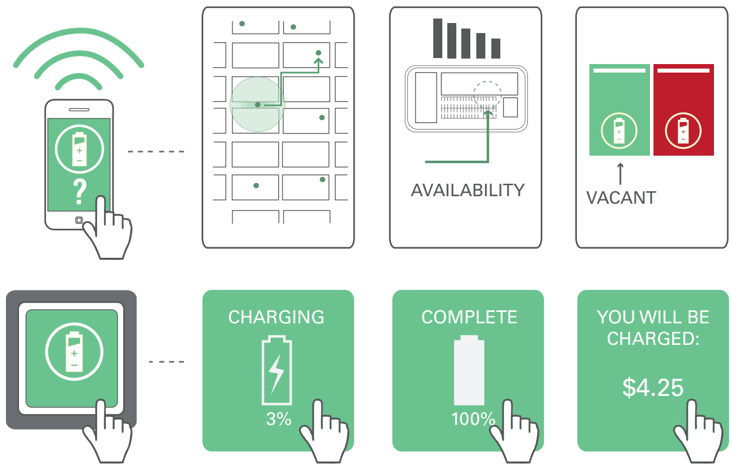
- Expand the charging infrastructure network to help make electric vehicles a viable option for all drivers.
- Thoughtfully place and coordinate charging stations with other street furniture

### DESIGN REQUIREMENTS

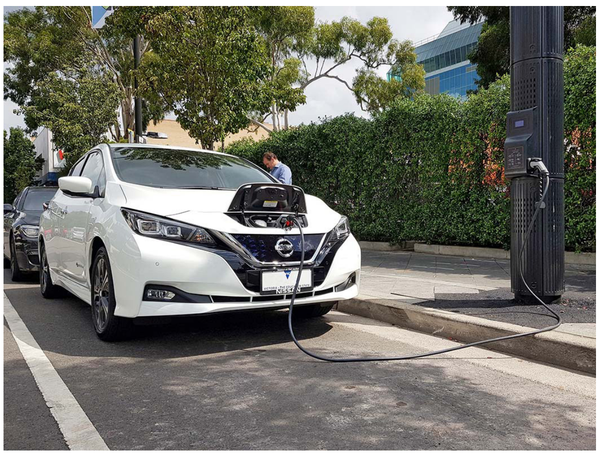
- Place charging stations adjacent to designated electric vehicle charging parking bays
- Site on-street charging stations within the Flex Zone or within kerb extensions in the Flex Zone, and locate charging stations a minimum of 600mm from the face of adjacent kerb
- Site charging stations clear of pedestrian paths of travel and do not inhibit desire lines

### FURTHER READING


**Siting and Design Guidelines for Electric Vehicle Supply Equipment**
WXY Architecture and Urban Design, 2012




Example of user interface with charging infrastructure.
Source - WXY Architecture and Urban Design



Electric vehicle charging, Western Sydney.
Image - (Renew)

VEHICLES

## C3.8 CONNECTED AND AUTONOMOUS VEHICLES

Not since the proliferation of mass-produced motor vehicles in the early twentieth century have we experienced a change in the mobility of our urban populations as we will with the adoption of connected and autonomous vehicles (CAVs).

In the not-too-distant-future, CAVs will transform our cities, their streets, and how we move around them, but technological advances and the rollout of CAVs must be guided by values and priorities that put people first. This means bold, thoughtful public policy. CAV technology must be harnessed to decrease Vehicle-Kilometres Travelled (VKT), not to merely make long drives more palatable.

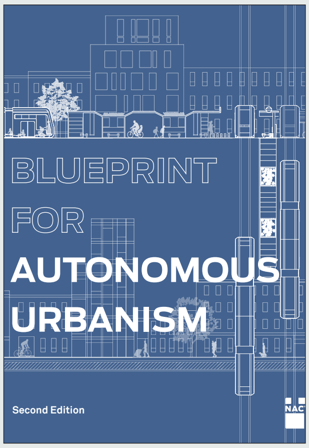
To reach a people-focused autonomous future, government at all levels need to make decisions today that are based on key principles of the public good; safety, equity, and sustainability.

*"We need to ensure an approach to driverless cars that is not focused on the individual customer of transport services but on the best outcomes for the city. The policy for driverless cars must not be tech–determined but city driven, and it must fit in with the overall integration of land use and transport strategy for Sydney...*

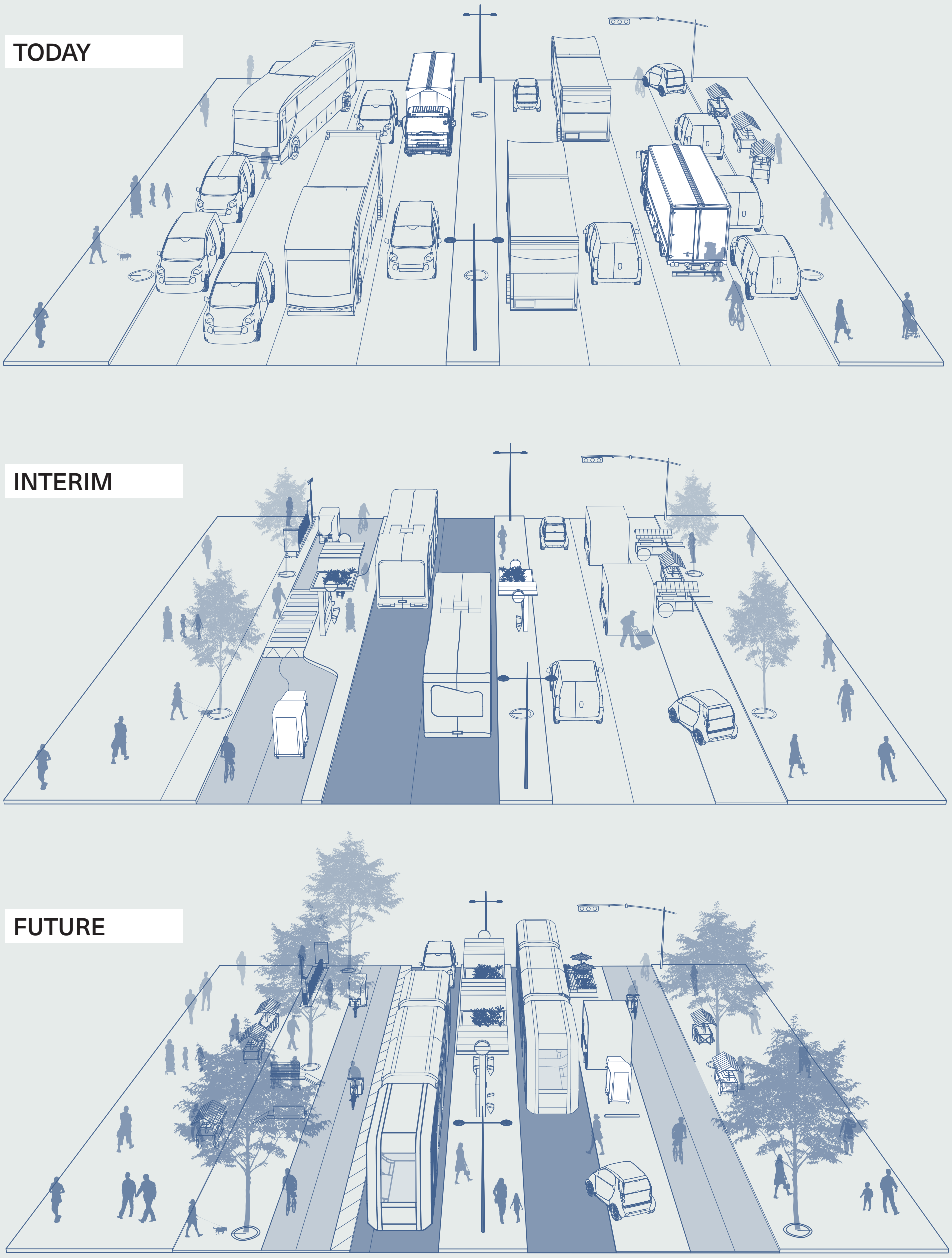
*If we want a less sprawled city we need to craft our regulatory approach to driverless cars to fit that objective. Transport modes don't just carry people; they shape cities. Our approach to driverless cars must first be based on what kind of city we wish to create."*

TIM WILLIAMS — ARUP
THE FIFTH ESTATE

## FURTHER READING




**Blueprint for Autonomous Urbanism**
NACTO, 2019




Transforming the street for a connected and autonomous future.
credit: NACTO, 2019

VEHICLES

## C3.9 AUTONOMOUS STREETS

**Autonomous streets will slowly come into being as an increasing percentage of our cities' vehicle fleets become connected and autonomous**. As this occurs, streets must continue to prioritise pedestrians, cyclists, and transit riders.

Forward thinking will allow the streets of Western Sydney to be prepared for this future, and the potential impact it will have on how the community uses streets. Autonomous streets will provide an opportunity to reorganise street space to prioritise the most efficient modes, increasing mobility options and safety for everyone.

In future, freight, delivery and other trucks will continue to be vehicles on streets and must also be considered.

Irrespective of the form that future travel modes take – building flexibility into the design of streets now will be critical in ensuring long-term suitability of streets in the future.

As this occurs, streets must continue to prioritise pedestrians, cyclists, and transit riders.

— Vehicle speeds will remain a key determinant of injury or fatality, so safety remains a priority for autonomous street design
— Fixed-route transit provides a unique opportunity for short-term rollout of CAV technology

Autonomous streets will provide an opportunity to reorganise street space to prioritise the most efficient modes, increasing mobility options and safety for everyone. The space efficiency offered by CAVs also provide opportunities for unlocking additional space within urban streets.

Forward thinking will allow the streets of the Western Sydney to be prepared for this future, and the potential impact it will have on how the community uses streets. Irrespective of the form that future travel modes take – building flexibility into the design of streets now will be critical in ensuring long-term suitability of streets in the future.

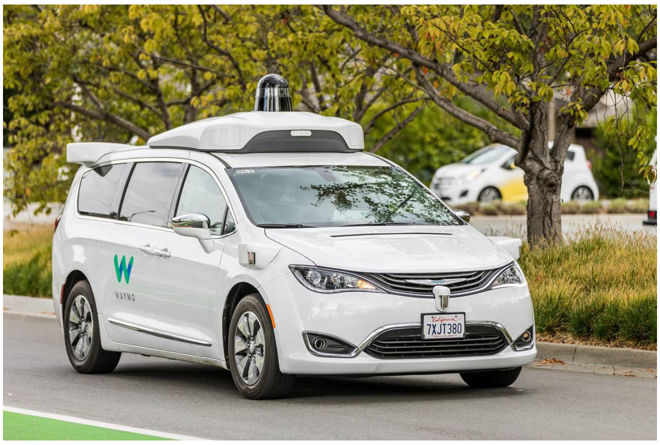
### DESIGN GUIDANCE

To take advantage of short-term transit-based CAV technology, design streets to prioritise transit operations

### DESIGN REQUIREMENTS

Ensure CAV travel speeds align with the agreed Behavioural Speeds included in Part B of The Guidelines

Ensure any street space unlocked by the efficiencies offered by CAVs is repurposed to meet the Street Design Objectives of The Guidelines



A Waymo self-driving car.
Image - (Jason Doiy)

VEHICLES

## C3.10 BUS LANES

**Effective transit systems that encourage modal shift to public transport need to be supported by a range of critical infrastructure, including dedicated transit (bus) lanes.** Providing dedicated bus lanes within the street helps transit networks provide reliable, convenient, and frequent service to passengers without delays from mixed traffic.


A dedicated bus lane, Moore Street, Liverpool.
Image - (ASPECT Studios)

### DESIGN GUIDANCE

Improve network legibility, travel time and performance by providing on–street transit lanes. Relieve transit congestion by dedicating street space for transit vehicles

Implement time-controlled transit lanes, and can be peak-only or all-day, depending on the needs of transit services and operations

### DESIGN REQUIREMENTS

Demarcate transit lanes by signs and pavement markings

Ensure the pavement is coloured to reinforce lane designation and to improve motorist compliance with the lane restriction

VEHICLES

## C3.11 BUS STOP CONFIGURATION

**In–Lane Stops** are the preferred stop arrangement in all local streets and town centre environments. They involve the use of kerb extensions to bring the footpath into the parking lane to meet the traffic lane.

This allows buses to stop in the traffic lane, which reduces bus delays compared with other stop arrangements, allowing buses to stop and re–enter traffic flow easily.

In–lane stops also make it much easier for the bus to park parallel to the stop for DDA–compliant boarding, while providing a wider bus passenger waiting area clear of the footpath, and allow additional space for stop amenity such as street trees or understorey planting.

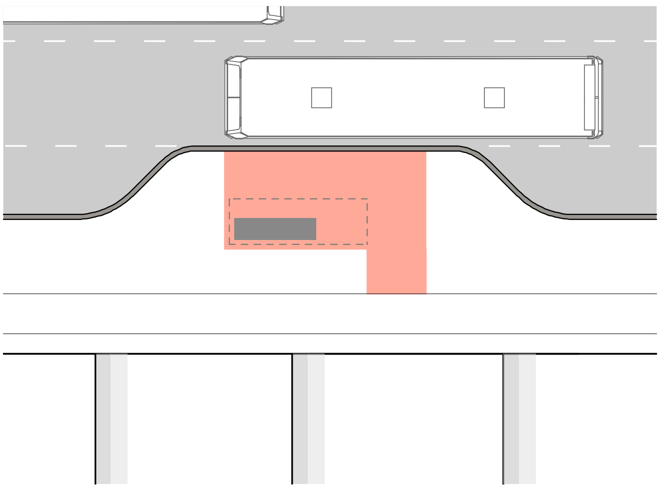
In–lane stops should be considered in town centres where both bus passengers and shoppers will benefit from the added space. They are also suitable in local streets where traffic numbers are low and traffic calming is desirable.

This stop arrangement occupies the shortest possible length of kerb in areas with significant demand for alternate use of the kerb, such as loading bays and parking.

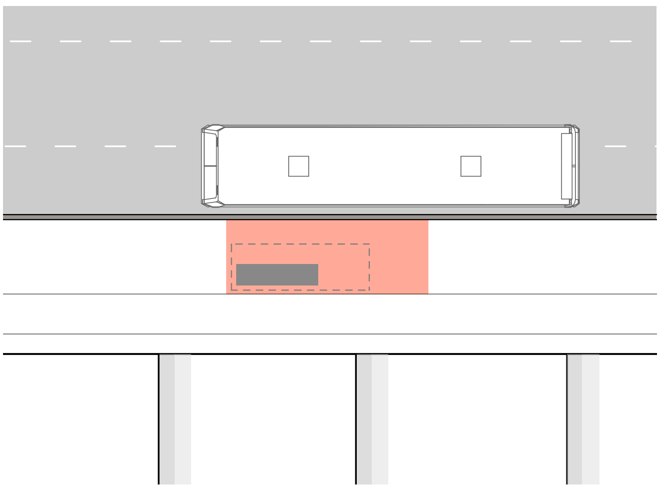
**Kerbside Stops** are currently the most common form of bus stop layout across Western Sydney, as they allow other vehicles to pass a stopped bus. However, a reduction in verge street trees is required in the vicinity of the stop, which will have a detrimental impact on streetscape amenity and customer experience.

For this reason, kerbside stops are only preferred on higher–order streets with high traffic volumes or with two lanes of traffic in each direction. Kerbside stops also work well where bus lanes are provided, so long as the stopped bus does not significantly delay following buses on high–frequency routes.

Kerbside stops need to be marked clearly to ensure cars do not park in them, or park too close, making entry to or exit from the stop difficult.



Typical In-Lane bus stop configuration



Typical Kerbside bus stop configuration

VEHICLES

## C3.11 BUS STOP CONFIGURATION

**Bus stops provide customers a designated, accessible waiting points with seating and shelter.** Bus stops can integrate signage such as route numbers and names, wayfinding information, schedules, and maps.

Bus stops are clearly marked to indicate to passengers where a particular bus service stops.

### DESIGN GUIDANCE

Arrange bus stops to minimise impact on the space available for other street users and elements. Consider opportunities for reducing the footprint of bus stop infrastructure and lane arrangement to minimise overall footprint

Provide seating for waiting passengers, and maintain clear paths for walking and universal access

Prioritise transit services over private motor vehicles on all local streets, with stops that allow vehicles to load a footpath from the transit or travel lane without pulling out of traffic

### DESIGN REQUIREMENTS

Provide in-lane stops wherever possible to prioritise public transport, increase amenity for both pedestrians and passengers, and minimise the impacts of stops on other street elements within the verge, such as street trees and WSUD systems.

Limit kerbside stops to circumstances where high traffic volumes dictate their necessity

Where deemed appropriate by operators, provide shelters to offer seating for waiting passengers, allowing space for people with strollers and in wheelchairs

Provide an accessible boarding area to every bus stop that allows people using wheelchairs access to accessible boarding doors

Provide dedicated bicycle parking racks or areas next to all bus stops that intersect with bicycle routes or where demand deems it necessary


In–lane bus stop on Crown Street, Surry Hills.
Image - (Google)

# C4 INTERSECTIONS

## C4.1 ROUNDABOUTS

**Roundabouts are circular islands at unsignalised intersections that route vehicles around the island rather than straight through an intersection.**

Roundabouts organise and calm traffic by slowing travel speeds.

Motorists are required to give way to pedestrians using crossings, cyclists and vehicles already in the intersection.

Raised pedestrian roundabout crossings on Abercrombie Street, Darlington. Image - (ASPECT Studios)

### DESIGN GUIDANCE

Provide pedestrian crossings across all arms of the intersection and design them to clearly communicate where pedestrians should cross and that they have priority

Use kerb extensions to shorten pedestrian crossing distances, protecting pedestrians while they wait to cross and to assist in preventing dangerous illegal parking close to intersection corners

### DESIGN REQUIREMENTS

Utilise elements such as mountable kerbs to minimise the size of roundabouts whilst adhering to Design & Check Vehicle requirements

Consider the use of other elements to calm traffic and maximise safety when designing roundabouts e.g. pedestrian crossings, kerb extensions, understorey planting, and street trees

INTERSECTIONS

## C4.2 CORNERS

**Corners occur where two roads intersect and are a fundamental element of the street environment, contributing to safety, accessibility, and comfort.** They assist with traffic calming and establish priority for pedestrians and other vulnerable street users at intersections.

### DESIGN GUIDANCE

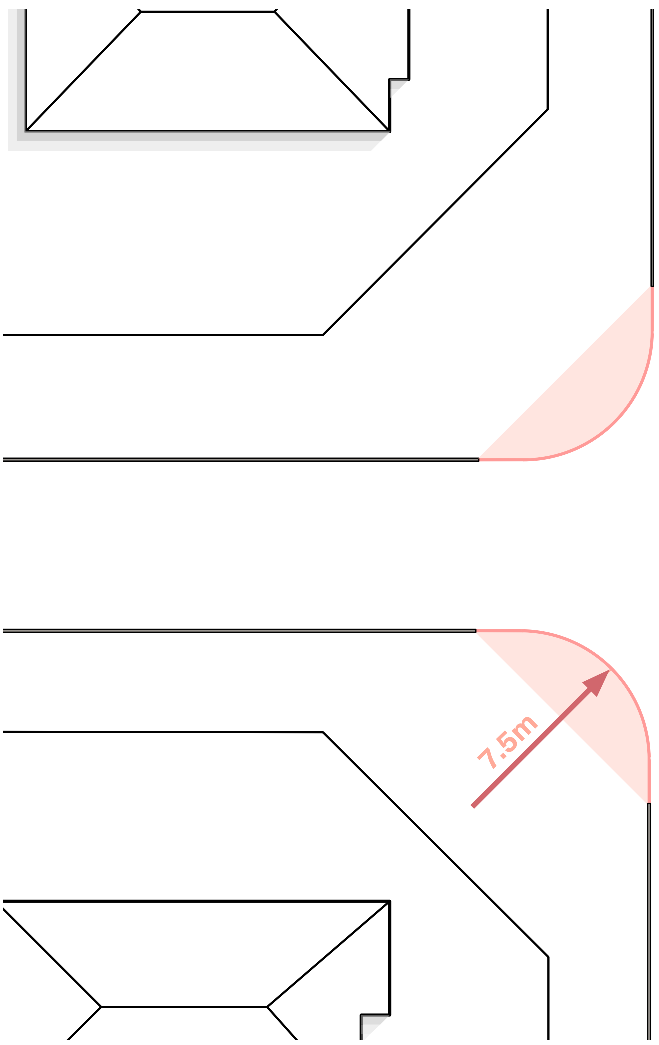
Minimise road carriageway widths to reduce intersection size and provide more space within the road corridor for alternate uses

Adopt a consistent corner radius throughout a precinct to achieve a coherent public domain

### DESIGN REQUIREMENTS

Adopt a corner radius in line with **Part B** to reduce turning speed, expand the pedestrian area, maximise sight lines and create a safer environment for all users

Adopt kerb extensions to maximise sight lines and reduce pedestrian crossing distances




Safer corners with a kerb return radius of 7.5m

INTERSECTIONS

## C4.3 SWEPT PATHS AND TURNING

**Swept paths and turning movements have a significant impact on corner design and therefore directly influence the experience and safety of the street for vulnerable users such as pedestrians and cyclists.**

Swept paths are used to calculate kerb and corner radii to ensure that vehicles can undertake turn movements at intersections. Designing for comfortable use by the occasional large truck often results in overly wide roads or high speed turns by cars, and opportunities are lost to create space for other, more frequent users such as pedestrians and therefore should be avoided.

Part B of The Guidelines includes kerb return radii as design requirements for most street types. Using swept path analysis, these radii were shown to allow the recommended Design Vehicle and Check Vehicle for each street type to move through the intersection within the allowable parameters of the NSW Road Rules 2014 (Rule 133) and Austroads Design Vehicles and Turning Path Templates Guide.

Site specific swept path analysis will need to be used to determine suitable radii for intersections with sub-arterial roads, for intersections with local industrial streets and atypical intersections.

### DESIGN GUIDANCE

Select a Design Vehicle and a Check Vehicle appropriate to the street type as recommended in Part B of The Guidelines

Accommodate the swept paths and turning movements of vehicles that frequently make turns (the Design Vehicle) and use geometric techniques such as shifting stop line locations to accommodate less frequent vehicle types (the Check Vehicle)

Use advance stop bars or other elements to accommodate movements by Design Vehicles.

Do not widen existing intersections to permit larger vehicles to turn

Tailor elements for the most vulnerable street user to ensure safe street design

When designing an atypical intersection, use both a Design Vehicle and a Check Vehicle to determine intersection turn radii and consider that the Check Vehicle is an infrequent presence on the street and may use multiple lanes to make turns

# INTERSECTIONS

## C4.4 CYCLING THROUGH INTERSECTIONS

**Providing adequate and protected facilities for cyclists at intersections is critical to ensure safety and comfortable and encouraging cycling for transport through urban environments.**

Intersections should be designed to provide bicycle riders with a safe, comfortable and legible route in the street environment.

One-way paired paths use a protected intersection design. A key feature of this design are the four islands at each corner of the intersection which separate cyclists and pedestrians from motor traffic. The size of the islands can be modified to suit turning requirements of larger vehicles.

On approach to intersections, bicycle paths ramp down to road grade and bend out to the cycle crossing points. This intersection design places cyclists ahead of turning traffic and in highly visible locations clear of turning vehicles.

Two-way paths at signalised intersections pose challenges for signalling as the two-way cycle flow on one side of a two-way carriageway creates multiple conflict points.

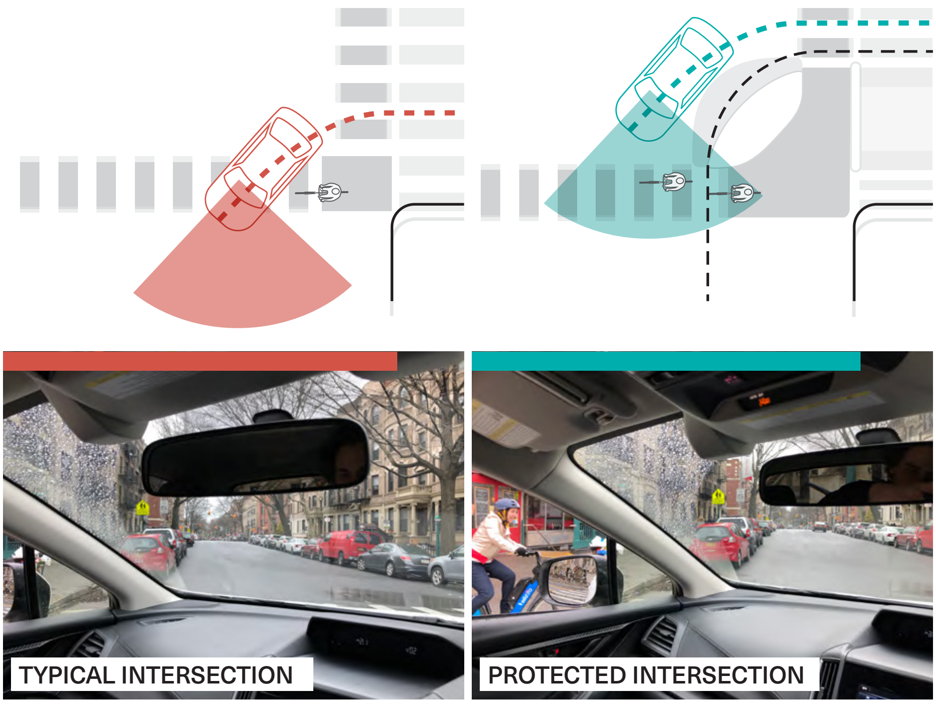
### DESIGN REQUIREMENTS

Implement the preferred, one-way paired paths as they have fewer potential conflict points with turning/crossing traffic at intersections and can be more easily integrated into standard intersection layouts

Where two-way paths are provided, overcome the lack of cycle-only turn indication lanterns by providing a cycle-only green phase or turn restriction signage to prevent cross-traffic cycle turns from the bicycle path

Reduce turn conflicts between motorists and cyclists by:

- **Reducing turn speed.** Drivers giveway more frequently to people walking and cycling when speeds are low. Lower speeds also give drivers more time to stop.
- **Making cyclists visible.** Providing good sight lines without encouraging faster speeds is a key challenge. Set back the cycle crossings, early stop lines for vehicles, and raised cycle crossings all contribute to improved visibility.
- **Consider giving cyclists the right of way.** Cyclists need clear priority, particularly at busy intersections




Protected intersections improve cyclist visibility.
Source - NACTO

### FURTHER READING


**Don't Give Up at the Intersection**
NACTO, 2019


Dedicated cycle infrastructure allows for increased cyclist safety.
Image - Bourke Street Cycleway, City of Sydney (Simon Wood)

# C5 UTILITIES

## C5.0 OVERVIEW

Streets need to be designed in coordination with utilities such as stormwater, sewer, electricity, gas, telecommunications, and digital infrastructure. The installation, maintenance and repair of utilities involves effort from many public and private agencies to ensure planning is coordinated and integrated.

In accordance with council and utility requirements, streets must provide enough room for utility spacing and depth of cover. Utilities should be installed prior to completion of new footpath, verge, and road works. All building connections should be installed up to the property line.

Advance notice and coordination between agencies regarding planned maintenance work is one of the most effective tools for reducing impacts on street users, residents, and businesses.

Energy saving utilities and green infrastructure such as swales, planting areas and permeable paving, reclaimed water systems, district cooling and heating, and automated waste collection systems should all be considered as part of planning new precincts.

Utilities will need to be underground as often as possible to achieve urban tree canopy targets. However, some above-ground infrastructure will be required. This needs to be considered amongst other street uses and urban amenity.

FURTHER READING


**Guide to Codes and Practices for Streets Opening**
NSW SOCC, 2018

# UTILITIES

## C5.1 SHARED UTILITY TRENCHES

**Shared utility trenches combine multiple utilities within a compact area of the street verge to reduce the overall space dedicated to in-ground utilities, and to maximise opportunities for other street elements.**

Shared trenching helps to deliver The Guidelines' design objectives, such as:

- Allocating more space for deep soil planting to encourage improved tree canopy
- Allocating more space in the verge for WSUD
- Providing adequate and well-designed footpaths

Other benefits include lower overall costs, particularly in new subdivisions. This is subject to arrangements that ensure suitable protection, support, and access throughout the life of the utilities.

Indicative shared utility trench sections are provided for information.  The sections show examples of how shared trenching could work and are not proposed as a standard detail. Designers and local councils will need to continue coordination with utility providers.

All Street Type case studies in Part B of The Guidelines are compatible with the shared utility trench sections provided.

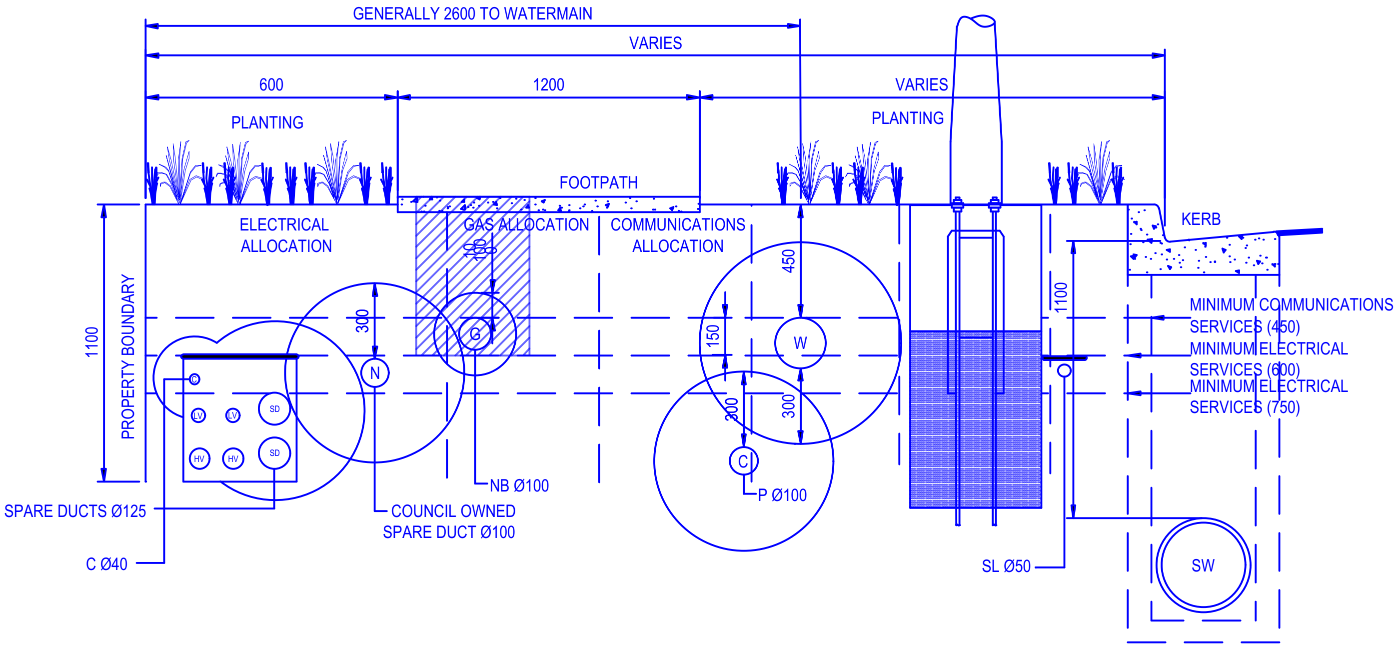
### DESIGN GUIDANCE

Tree root barriers should prioritise the protection of utility assets - not the constriction of tree roots - and should be located to maximise access for tree roots to adjacent areas of soil. Refer to **Part C2.1** for more general Street Tree Design Guidance

### DESIGN REQUIREMENTS

Where conditions allow, combine multiple utilities in local streets within shared utility trenches to support the delivery of the Street Design Objectives

Refer to the Engineering Design Manual for Western Sydney for further detail on shared utility trenching




Indicative Shared Utilities Trench as shown in the Engineering Design Manual for Western Sydney.
Source - (ACOR)

# UTILITIES

## C5.2 MULTI–FUNCTION POLES

**Multi-function poles are street poles that accommodate several functions and services on the same pole.**

Installation of multi-function poles reduces the total number of poles installed in the street. This reduces street clutter, improves streetscape amenity, and minimises potential conflicts with street users.

Multi-function poles will become increasingly important with the rollout of future technologies such as 5G. Sharing of infrastructure may be passive - where providers share mobile network infrastructure like transmission, power, cables, ducts, cooling systems, and towers, with each operator installing their own antennas and electronic equipment. Likewise, sharing of infrastructure may be active – where providers jointly invest in and share antennas, electronic equipment and even spectrum.

Potential services which would be incorporated into multi-function poles includes:

- TransportNSW signals and signage
- Street lighting
- Telecommunications and digital infrastructure (such as mobile cellular network providers)
- Council requirements (such as CCTV, signage and lighting)

### DESIGN GUIDANCE

Reduce street clutter and improve street amenity by implementing multi-function poles

Consideration to the placement of Multi-function poles should be given in regard to avoiding mature street tree canopy

Consider adding additional arms to Multi-function poles where adjacent amenity requires extra lighting

Co-locate multi-function poles with other street elements such as street furniture etc.

Placement of Multi-function poles to be a min 600mm from the face of kerb

Multi–function poles allow for multiple light fixtures at ANU, ACT.
Image - (Multipole)


Multi–function poles can combine services infrastructure with banners.
Image - (Hub Group)

# UTILITIES

## C5.3 WATER

Utilities in the street relating to water include potable water, stormwater and wastewater.

Clean and potable water should be distributed throughout the city by a comprehensive network of water supply pipes. Water used for firefighting can be carried through dedicated or shared pipes connected to fire hydrants.

Stormwater and wastewater infrastructure helps maintain public health and hygiene. It mitigates environmental risks like flooding, sewer overflows, and water pollution.

The stormwater system collects precipitation and water overflows. Wastewater pipes connect homes and buildings along streets to a main sewer leading to a wastewater treatment facility.

Green infrastructure strategies complement stormwater and wastewater infrastructure by reducing strain on stormwater systems through infiltration or evaporation, which also improves the quality of the street environment.

### DESIGN GUIDANCE

Explore opportunities to divert low-flow rain water to adjacent landscape and street trees

Focus on volume reduction over treatment of pollutants to achieve improved outcomes for downstream waterways

### DESIGN REQUIREMENTS

Locate potable water supply mains within verge

Avoid planting tree species with invasive roots in proximity to mains

## C5.4 ELECTRICITY

Electricity supply and infrastructure are vital to both streets and the city as a whole. Electricity cables typically serve street lighting and traffic signals and provide power for homes and businesses along the street.

Electricity will also be required to run new smart infrastructure like smart poles, bins, benches, and sensor networks to gather and share data. LV pillars are required for domestic connections intermittently along every street.

### DESIGN REQUIREMENTS

Locate electricity conduits in verge

Ensure a depth of cover of 900mm to bottom of conduit for low voltage and1100mm for high voltage

Ensure a min 300mm separation from adjacent utilities

UTILITIES

## C5.5 GAS

Gas services are provided as an alternative energy source and can assist in reducing reliance on electricity for things like heating and hot water.

**DESIGN REQUIREMENTS**

- Locate gas in verge, min. 1.2m from adjacent property boundary
- Ensure a 600mm depth of cover
- Ensure a 200mm horizontal separation from adjacent utilities
- Ensure services are parallel or perpendicular to adjoining property boundaries

## C5.6 TELECOMMUNICATIONS + DIGITAL CONNECTIVITY

Telecommunications supply and infrastructure is critical to support social and economic investment in Western Sydney. It can be above ground and below ground, providing fibre connections as well as mobile coverage.

The Western Parkland City is envisioned to be digitally enabled. The built infrastructure requirements for new technologies needs to be integrated with the other components of the street, in a way that puts the pedestrian experience first.

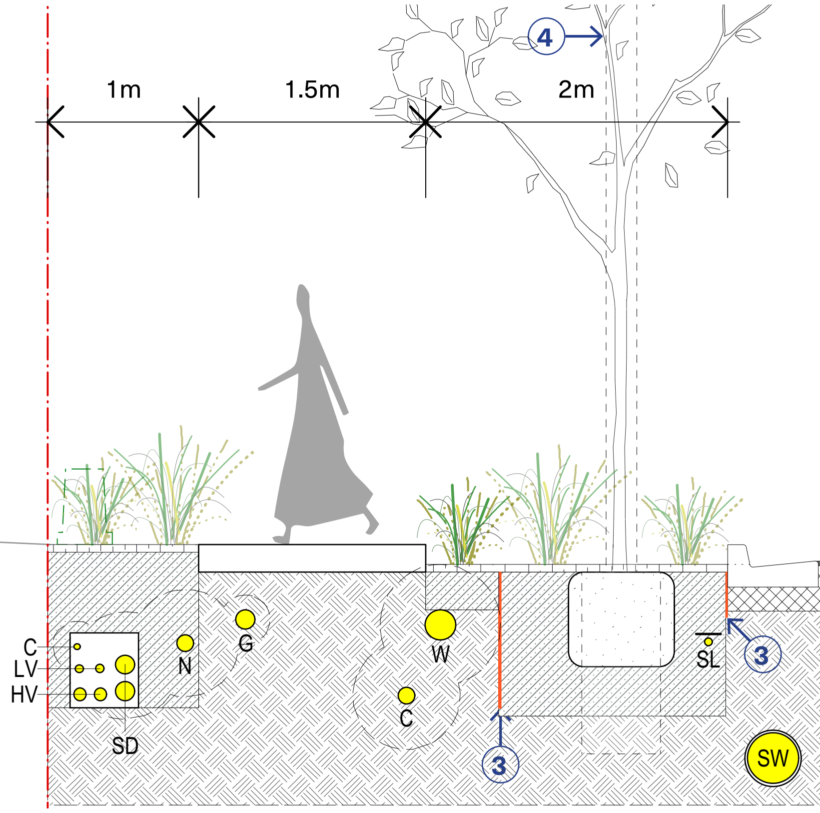
**DESIGN REQUIREMENTS**

- Ensure a depth of cover of 450mm in verge, 600mm in non-State roads, 1200mm in State roads
- Ensure separation from adjacent utilities: 300mm from water and mains gas, 100mm from comms
- Install a 100mm conduit for road crossings
- Place NBN within Telstra pits and co-locate with Telstra network
- Provide one distribution hub per 384 premises (new fibre-to the- kerb installations do not require large cabinets)
- Ensure a Max. 150m between distribution hub and premises
- Provide one pit per four premises: max. 250m between pits

# UTILITIES

## C5.7 INDICATIVE STREET CROSS SECTIONS - UTILITIES AND TREE PITS

The sections below are examples of how shared utility trenching can be incorporated into the Street Types.

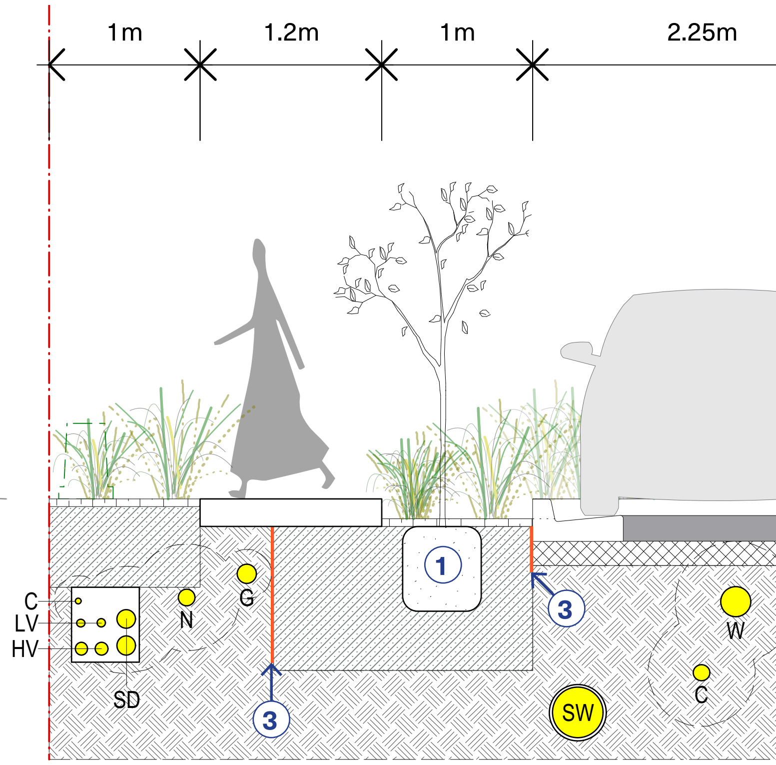



**LEGEND**

1. Tree in imported soil and mass planting
2. Structural soil
3. Optional Root barrier
4. Multi-function pole beyond
5. Secondary utilities trench as required

**Example 1**

Wide verge with in-ground shared utilities trench minimum 4.5m wide. Opposite verge a minimum 2.8m wide and optional additional services e.g. NBN



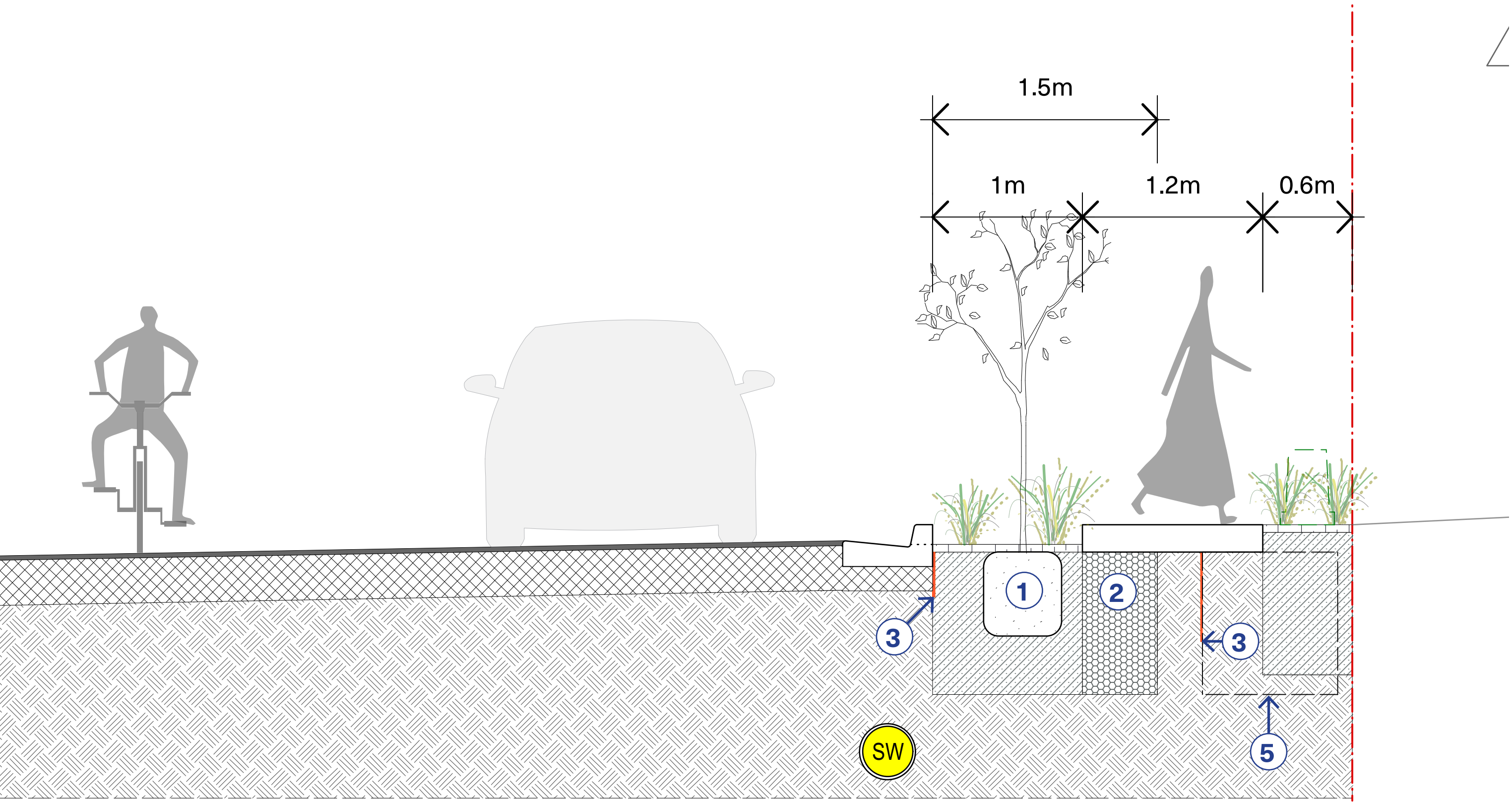

**UTILITIES LEGEND**

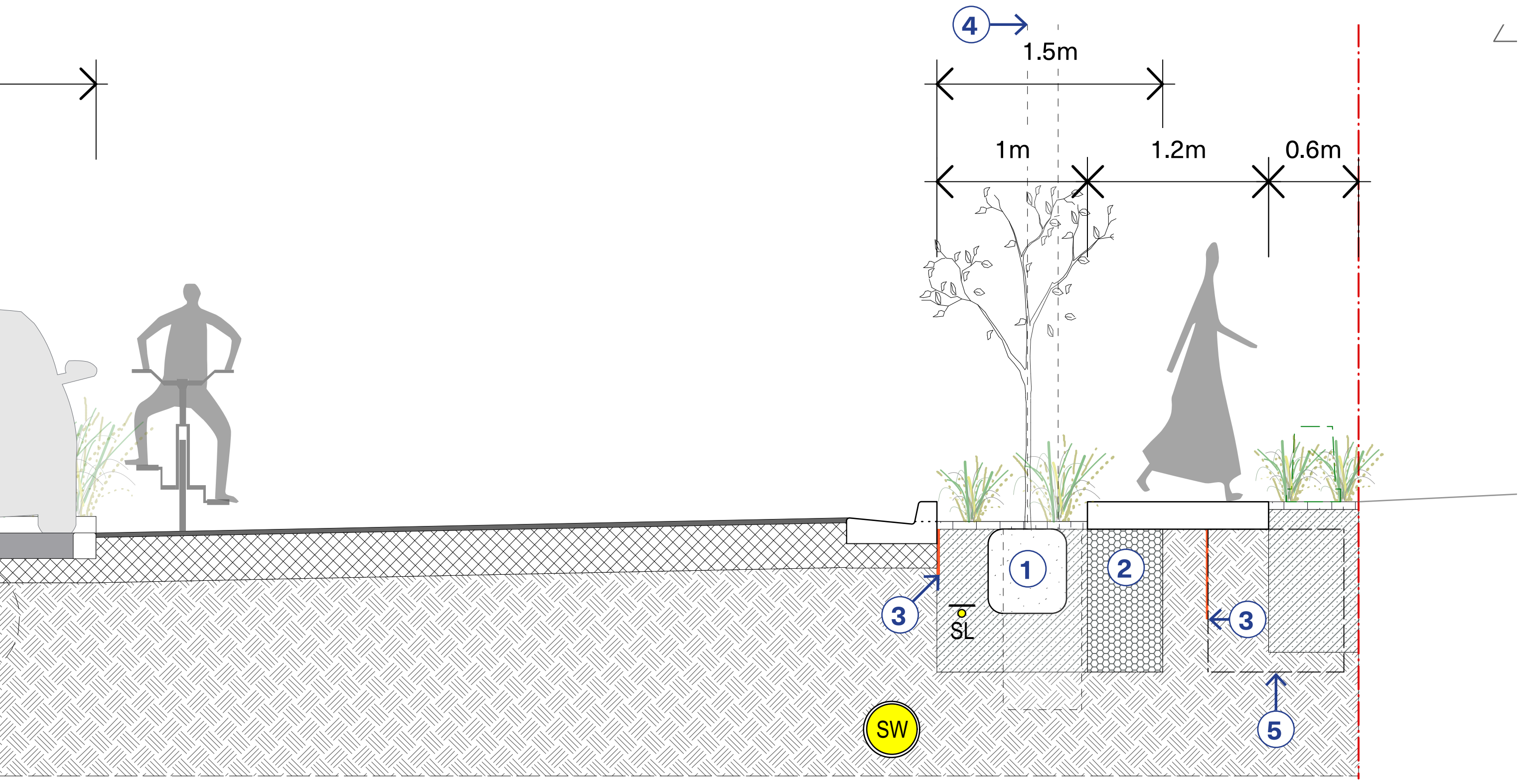
**HV -** High Voltage
**LV -** Low Voltage
**C -** Comms
**SD -** Spare Duct
**N -** Council Owned Service Duct
**W -** Watermain
**SW -** Stormwater
**G -** Gas
**SL -** Street Light

**Example 2**

Verge with in-ground shared utilities trench minimum 3m wide, water main extends into alignment with parking bays. Opposite verge a minimum 2.8m wide, includes street lighting and optional additional services e.g. NBN.

# UTILITIES



# C6 INNOVATION

## C6.0 OVERVIEW

The Guidelines' vision and objectives will rely on continued innovation in the planning, delivery and maintenance of streets in Western Sydney.

Innovation will involve a variety of new methods and approaches. This can range from new community and stakeholder consultation methods, and research partnerships with third parties, to new materials, post-completion monitoring, and new 'smart city' technologies.

# INNOVATION

## C6.1 SMART CITY

The introduction of smart city technology to Western Sydney will provide new connectivity and digital solutions.

Smart city technology will play an important role in ensuring the Western Parkland City will be:

— an inclusive and digitally capable region, where everyone has access to opportunities;
— a productive region with flexible, future-focused communication infrastructure for fast, reliable and affordable digital connectivity; and
— a resilient and sustainable region that uses technology to manage natural resources efficiently and is focused on environmental, air and water quality

Street design for smart cities accommodate power and digital connections for sensor networks and new technologies to collect data. They also provide opportunities for data insights to be conveyed in real time to inform citizens.

Smart city technology will allow data to be harnessed on:

— pedestrian and vehicular activity
— use of assets (like public bathrooms, bins etc)
— environmental factors, like soil moisture, air quality, water quality
— pressure in water pipes (to assist in leak and burst detection)
— water and energy use
— parking utilisation
— transport options and utilisation.

Changes in technology will lead to increased use of electric vehicles, shared vehicles, micromobility options, mobility as a service and automated vehicles.

Sensor networks and technology can also enhance public safety - with improved CCTV networks and sensor lighting to assist in activating areas at night for pedestrians.

Data provides insights to assist citizen decision making as well as assisting governments and the private sector to better serve citizen needs.

For example, technology and data insights can be used to identify the best locations for footpaths, reducing pedestrian impacts on grass and garden bed verges and parking needs can be better addressed using pricing levers and other policy interventions.

The Western Parkland City Deal includes commitments to achieve a digitally enabled world.

# INNOVATION

## C6.1 SMART CITY

### DESIGN GUIDANCE

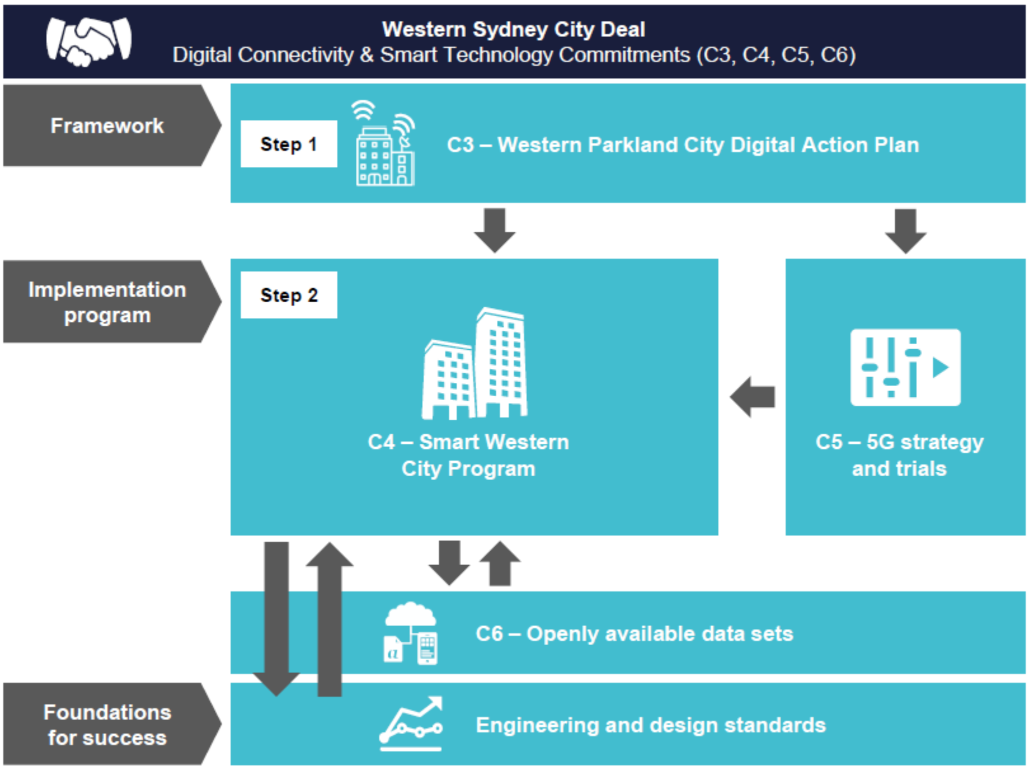
Gather helpful data that improves user quality and overall street management.

Enable digital connectivity to street furniture, such as park benches and bins. Smart poles should include relevant sensing networks, with flexibility to enhance these in the future. This could include Realtime data collection devices like air-quality monitors, noise sensors, and pedestrian, cyclists, and traffic counters.

Consider making data available through an open data platform for organisations to create third party resources such as transit maps and schedules, and to inform future design projects

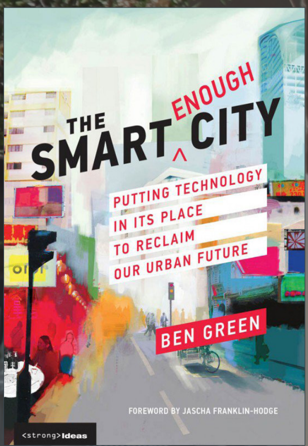
Aim to create intelligent ecosystems on streets by incorporating amenities such as WiFi access points, mobile phone applications, real-time transit information, and transit, bikes, and car-sharing facilities

Consider making data available to encourage innovation and participation from users of the street




Digital connectivity and smart technology commitments.
Source - Draft Digital Action Plan

FURTHER READING




// There is more to progress than adopting new technology. Progress ought to also mean adapting policies and practices to achieve a more inclusive and democratic city. Designed thoughtfully, technology can be an incredibly potent tool to advance such progress; designed carelessly or inappropriately, technology can inhibit or even derail it. //

— Ben Green, The Smart Enough City

# INNOVATION

## C6.2 INNOVATIVE AND SUSTAINABLE MATERIALS

**The manufacturing of many streetscape materials results in extensive environmental impacts. These are related to the energy used in the quarrying of raw materials and the energy consumed in material production.**

### Permeable Paving

Permeable paving allows rainwater to infiltrate through the material into the ground. Water is then stored for gradual absorption into the soil or filtered through soil to groundwater below.

Consideration of the drainage characteristics of underlying soils, the depth of the water table and the slope of the adjacent land must be given when implementing permeable pavements.

Permeable pavements can be used in footpaths, parks, plazas, shared zones and medians.

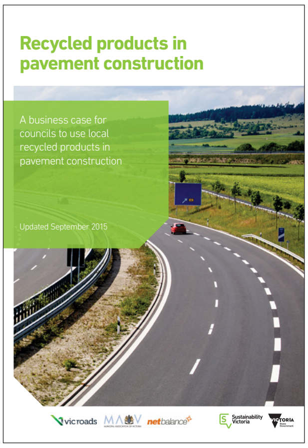
Permeable concrete and asphalt are pavements with uniformly graded coarse material, creating voids or 'pores' that allow water to flow through the pavement. These pavements will require further field testing to determine the appropriate construction specification and application with other WSUD devices.

### Recycled Materials

Recycled materials offer advantages in quality, price and availability, as well as many long-term environmental benefits. Using recycled products in pavement construction results in future costings of pavement construction and maintenance being more manageable.

A variety of materials now supplement traditional virgin aggregate and sand extracted from quarries, including recycled crushed concrete, crushed brick, glass fines, Reclaimed Asphalt Pavement (RAP) and crumbed rubber.

FURTHER READING


Recycled products in pavement construction

A business case for councils to use local recycled products in pavement construction

Updated September 2015

**Recycled Products in Pavement Construction**
Vicroads, 2015

### DESIGN GUIDANCE

Utilise permeable paving to meet the permeability targets in Part B

Pilot innovative and sustainable materials in local streets, with a view to improving materials used in retrofit or in building new streets

Provide street trees where cool pavements are to be used. Trees shade the material during the day, reducing radiant heat. Where trees cannot be planted in areas of high pedestrian traffic, alternative shading options should be considered rather than cool pavements alone

CASE STUDY

### City of Sydney Green Concrete Trial

In April 2019, the City of Sydney began a trial of 'green concrete'—a sustainable concrete blend that reduces the emissions associated with concrete manufacture—to test its durability under heavy traffic conditions.

Green concrete reuses materials and by products such as blast furnace slag as an aggregrate substitute and fly ash as a Portland cement substitute, generating only 180 kg of $CO_2$ per tonne, compared to 900 kg used in producing traditional cement (City of Sydney).

University of NSW researchers and the Cooperative Research Centre for Low Carbon Living will use results from the trial to create the first set of industry guidelines for geopolymer concrete.

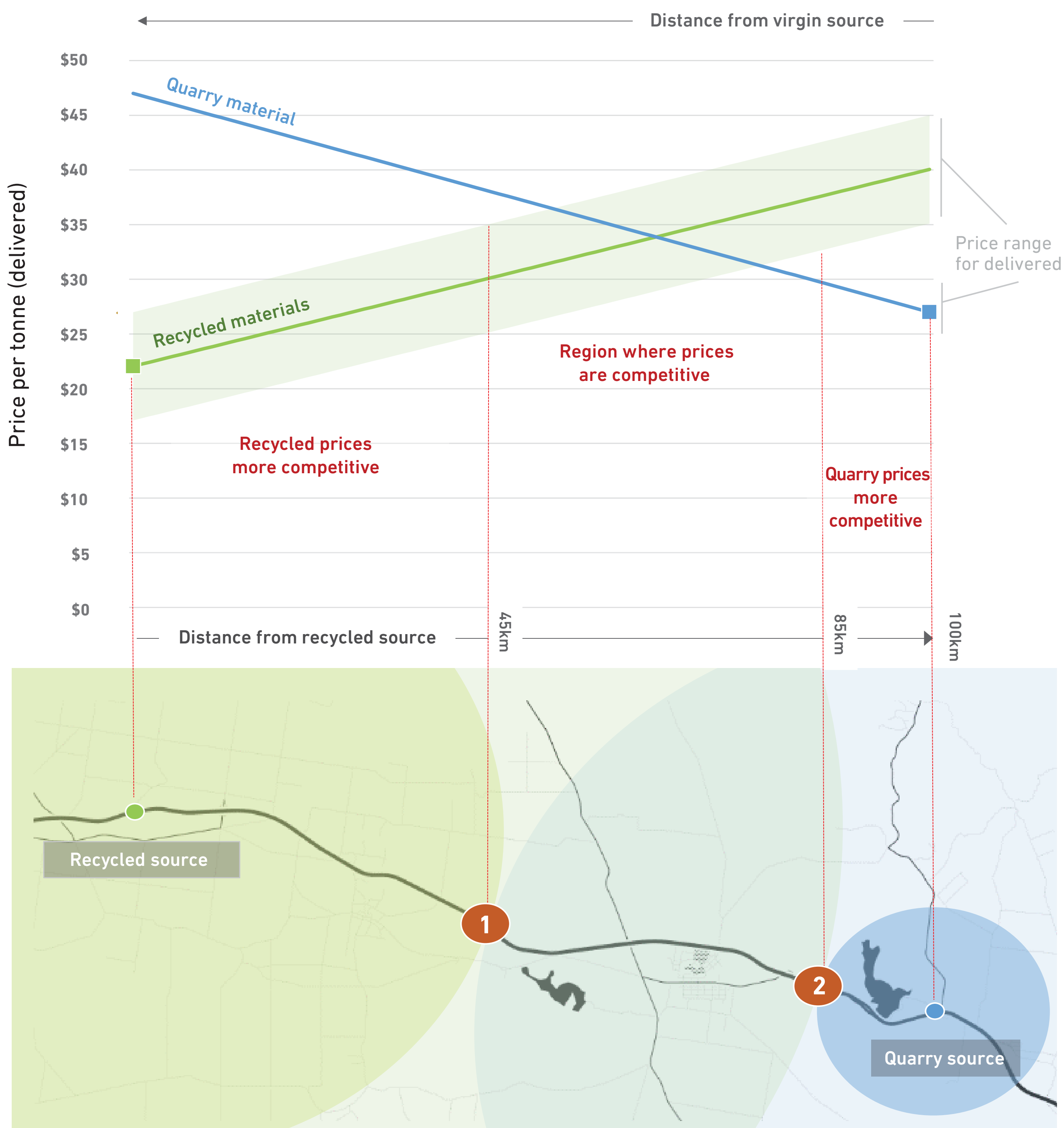

'Green concrete' on Wyndham Street, Alexandria
Image - (City of Sydney)

INNOVATION

CASE STUDY

**A business case for local councils to use local recycled products in pavement construction**

The haulage distance and associated cost of quarried and recycled materials is an important factor in price. The below graph illustrates the relationship between delivered cost and geographical location of material, highlighting where prices are expected to be competitive and it would be practical for recycled product to supplement virgin quarry material.




The impact of haulage on total cost of pavement construction.
Source - (Vicroads)

# INNOVATION

## C6.2 INNOVATIVE AND SUSTAINABLE MATERIALS

### Cool Pavements

Cool pavements are alternative pavement surfaces designed to reflect solar radiation and minimise their contribution to the urban heat island.

Cool pavements have a high albedo (surface reflectivity), which ensures they reflect more incoming solar radiation. They also tend to have a low thermal conductivity and/or heat capacity, resulting in less energy transferred into the ground. Some cool pavements may also have a high porosity, providing additional benefits of permeable paving.

Consideration should be given to widespread implementation of cool pavements. From the Case Study in Marrickville, cool pavements absorbed less heat and stayed cool at night but radiated heat during the day when exposed to the sun.

CASE STUDY

### Marrickville Council Cool Pavement Trial

In December 2015, the then Marrickville Council began a 'cool pavement' trial, resurfacing the conventional asphalt carriageway of Cecilia Street, Marrickville. Asphalt was removed and replaced with new "open graded" asphalt that was 40mm thick, with a nominal stone size of 10mm. This created quite a porous road surface. A light grey rubberised cement—known as 'Ascrete'—was then screeded and vibrated into the porous asphalt.

Results of the trial showed that *"the cool pavement clearly modified the surface, increasing the albedo from 0.08 to 0.23, and in combination with the reduced thermal conductivity and heat capacity of the cool pavement, resulted in a substantial reduction in daytime heat storage. This reduced heat storage meant that there was less energy to be lost at night, slightly reducing night time surface temperature, but more importantly, minimising atmospheric heating. Therefore, the cool pavement will act as an effective urban heat island mitigation measure if rolled out across the municipality.*

*The benefits of the cool pavement were confined to the night time. During the day, the surface temperature of the cool pavement was similar to the asphalt road...*

*This meant that daytime atmospheric heating was also similar between sites. The combination of a high albedo and surface temperature for the cool pavement would result in an increase in radiative loading on pedestrians and have a negative effect on daytime human thermal comfort."* (CRC for Water Sensitive Cities)

Inner West Council 'Cool Pavement' trial before [shown left] and after [shown right]. Image - (CRC for Water Sensitive Cities)

# INNOVATION

## C6.3 5G MOBILE COMMUNICATIONS

5G mobile communications networks will require denser networks with larger numbers of mobile cells than conventional 4G networks. This is mainly due to the need to distribute several cells over a large number of users in a dense environment as opposed to handling all users from a single base station.

The volume of new locations in which 5G infrastructure will need to be installed will therefore be significant. For example, in the United Kingdom, the *"National Infrastructure Commission found that around 40,000 5G access points may be required to serve the City of London with an area of 2.9km$^2$, whereas a similar number of access points today serve the whole of the UK, with an area of 242,000km$^2$."* (Ordinance Survey, 2018)

The delivery of new streets alongside the retrofitting of existing streets will need to consider and effectively coordinate this dramatic increase in mobile cell density. The growth of 5G networks will result in an increase of equipment closer to streets. 5G networks will likely be delivered through a combination of Macro and Micro cells, initially building on and working alongside existing 4G networks.

5G networks are expected to be significantly denser than current networks. This is due to the placement of additional base stations, particularly in urban environments as 5G typically requires line-of-sight connections delivered within a range of 10 to several hundred metres to achieve low latency and high network throughput.

### DESIGN GUIDANCE

Maximise planning opportunities for co-location of above and below ground infrastructure such as conduits and shared poles.

Adopt a collaborative approach between operators, local authorities and governments to allow readily accessible information about street furniture, existing fixed telecommunications infrastructure and access to power.

Provide 3D as-built model of completed works to help assist the delivery of future precincts. This will allow governments to provide operators with access to existing street furniture data for smallcell deployment, which will enable substantial cost savings, and will also help to deploy 5G networks within urban areas much more quickly.

Provide data relating to public sector buildings readily available to enable mobile operators to install antennae on walls if required.

Dense understorey planting and mature tree canopy in Newington.
Image - (ASPECT Studios)

# D

# Resources

# ACRONYMS

**AADT** Average Annual Daily Traffic counts published by RMS.

**AS** Australian Standard

**CPTED** Crime Prevention Through Environmental Design

**DCP** Development Control Plan

**DDA Act** Disability Discrimination Act, 1992.

**EP&A Act** Environmental Planning and Assessment Act 1979 (NSW)

**GANSW** The Government Architect NSW

**GSC** Greater Sydney Commission

**LEP** Local Environmental Plan

**LGA** Local Government Area

**RMS** Roads and Maritime Services

**TFNSW** Transport for New South Wales

**WSA Co.** Western Sydney Airport Corporation

**WSPP** Western Sydney Planning Partnership

**WSUD** Water sensitive urban design

# GLOSSARY OF TERMS

**Active Transport:** Non motorised travel modes including walking and cycling.

**Arterial Road:** The main or trunk roads of the State road network that predominantly carry traffic between regions.

**Asphalt/Asphaltic Concrete:** A dense, continuously graded mixture of coarse and fine aggregates, mineral concrete filler and bitumen usually produced hot in a mixing plant.

**At–grade:** Road at ground level, not on embankment or in a cutting.

**Austroads:** The peak organisation of Australasian road transport and traffic agencies that provides guidelines for design of streets.

**Autonomous Vehicle:** A vehicle that is capable of sensing its environment and moving safely with little or no human input or direction.

**Bollard:** A short steel or concrete post used to prevent traffic from entering a footway or public space whilst allowing pedestrians or cyclists access.

**Boulevard:** A form of street defined by its greater width, buildings and substantial trees that line it and can be a major element of city structure.

**Buffer Planting:** A strip of planting between Footway and Road that provides a physical and visual buffer between the movement of vehicles and pedestrians.

**Boundary:** Property boundary between the street corridor and developed land.

**Car Share:** A model of car rental where people rent cars for short periods of time, with dedicated on street parking areas.

**Carriageway:** The portion of a roadway used for the movement of vehicles including shoulders and parking lanes.

**Centreline:** The basic line that defines the axis or alignment of the centre of a road.

**Cul–de–sac:** a turning circle area at the end of a no–through road. Also No–through Road, Close, Court or Place.

**Cyclist:** Person using a bicycle.

**Cycleway:** A dedicated paved area for bicycles, usually two way and located above street level or in a public space or parkland.

**Dish Drain:** A scooped concrete gutter without a kerb that directs stormwater to a drainage point.

**Divided Road:** A road with a separate carriageway for each direction of travel created by placing a median between opposing traffic directions.

**Drainage Grate:** A gridded metal panel within the gutter that allows water to flow into the underground stormwater system.

**Driveway:** a paved path for vehicles to cross the footpath to access property usually leading to a car park, garage or car port.

**Driveway Ramp:** A flat transition area on the kerb to allow vehicles to access a driveway.

**Footpath Crossing:** An area where vehicles are permitted to cross a footway. See Driveway and Driveway Ramp.

**Footpath:** A paved area for the use of pedestrians on a Footway.

**Footway:** An area open to the public designated for the movement of pedestrians, cyclists and other non– and motorised modes.

**Green Grid:** A network of high quality green spaces that connect town centres, public transport hubs, and major residential areas.

**Gutter:** An area usually built as part of the kerb arrangement that directs rainwater to flow to a drain or raingarden.

**Flex Zone:** A flexible portion of the road corridor design that can allow for a variety of other design measures.

**Frangible:** Planting or structures which break under the impact of a motor vehicle.

**High Pedestrian Activity Area** (HPAA)**:** Areas of high pedestrian activity, near shopping strips, train stations, bus interchanges and services such as medical centres and hospitals. Maximum speed limit is 40km/h.

**Intersection:** A place where two or more roads/streets meet.

**Kerb:** A concrete or stone barrier between the footway and road surface. See Roll Kerb, Upstand Kerb. Dish Kerb, Flush Kerb.

- **Roll Kerb:** a rounded concrete kerb that a vehicle can drive over.
- **Upstand Kerb:** a vertical concrete or stone kerb usually 150 mm in height.
- **Dish Kerb:** a scooped kerb that also drains stormwater.
- **Flush Kerb:** a narrow concrete strip that marks and divides a level road pavement and footway.
- **Redirective Kerb:** *Elsholz* style concrete kerbs are shaped to deflect vehicles from medians and footpath areas

**Kerb Extension:** A protrusion of the footway to reduce the kerb–to–kerb crossing distance between two footways for pedestrians. Also assists in passive reduction of travel speeds.

**Kerb Ramp:** A paved (usually concrete) ramp graded down from the top surface of a footpath to the surface of an adjoining street surface. It is designed primarily for pedestrian, pram, bicycle, wheelchair and mobility usage and commonly found in urban areas at corners and crossing points where pedestrian activity is expected.

**Laneway:** A narrow, usually single lane width roadway for service and garage access.

**Lay By:** A part of the road where vehicles may pull over, clear of the through traffic.

**Light Pole:** A steel pole located on the footway for the purposes of lighting the public domain.

**Light Rail:** On street form of tram or urban rail transit, usually operating within it's own right and right–of–way.

**Local Road** or Local Street: Roads that have a low speed limit, have a small footprint, serve local communities and that are generally conducive to walking and cycling. *RMS definition: A road or street used primarily for access to abutting properties.*

**Local Traffic Area (LTA):** an area of local streets that have a speed limit of 40 km/h. The lower speed limit ensures greater safety for all road users.

**Median:** A raised division between two vehicle lanes. A central area separating traffic travelling in the opposite directions.

**Median Strip:** A raised and planted division between two vehicle lanes

**Mews:** A group of houses with a shared zone access area for pedestrian access and parking.

**Mobility Scooter:** An electrically powered scooter designed for people with restricted mobility, typically those who are elderly or disabled. Permitted to use footways.

**Multi-Function Poles:** Street poles which can accommodate multiple services including lighting, 5G and traffic signalling.

**Nature Strip:** see Verge

**No Through Road:** A street or road that does not connect to another street.

**Parking Bay:** A dedicated area for vehicle parking.

**Parallel Parking:** Vehicle parking located parallel to the kerb.

**Pavement:** The hard finished surface area of the vehicle roadway or footpath, usually asphalt, concrete, stone or unit pavers.

**Pedestrian:** A person on foot or using a mobility aid.

**Pedestrian Crossing:** A marked area to cross a street. See Zebra Crossing.

**Pedestrian Refuge:** A raised area in a roadway that provides protection from moving vehicles.

**Permeable Pavement:** Pavement materials that allows water to flow through to subground areas.

**Power Pole:** A steel pole to support overhead powerlines or communications.

**Pit Lid:** A trafficable access point for underground services.

**Public Domain:** A community's shared public space.

**Raingarden:** A porous garden area usually in the roadway that allows rainwater to enter the soil to support trees and plants. A designed depression storage or a planted hole that allows rainwater runoff from impervious urban areas, like roofs, driveways, walkways, car parks, and lawn areas, the opportunity to be absorbed.

**Road Furniture:** A general term covering all signs, street lights and protective devices for the control, guidance and safety of traffic and convenience of road users.

**Road Reserve:** A legally defined area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel.

**Roundabout:** An intersection where all traffic travels in one direction around a central island.

**Riparian Zone:** Relating to the planting and topography of a waterway.

**Run Off:** That part of the rainfall on a catchment that flows as surface discharge past a specified point.

**School Zone:** An area with a maximum of 40 km/h vehicle speed limit around schools. In force on all days which are not a weekend, a public holiday or a publicly notified school holidays.

**Shared Mobility:** Refers to the shared used of a vehicle, bicycle, scooter or other transportation modes.

**Shared Path:** A pathway used for both cyclists and pedestrians, usually located on the side of the road.

**Shared Zone:** A street, road or network of roads where the road space is shared safely by vehicles, cyclists and pedestrians. The maximum speed limit is 10 km/h.

**Shoulder:** The portion of the carriageway beyond the traffic lanes adjacent to and flush with the surface of the pavement.

**Smartpole:** An integrated light pole with the ability to add other components such as banners, CCTV, signs, planters, telecom equipment etc.

**Speed Hump:** A raised area of concrete or asphalt designed to slow vehicles.

**Stormwater:** Excess rainwater not absorbed in the area where it falls.

**Street Furniture:** A general term covering all items installed in the footway that supports the amenity and use of the street such as seats, benches, bubblers, bins, bicycle racks and bus shelters.

**Street Tree:** A tree planted within the street corridor on the verge, roadway, usually close to the Kerb.

**Swale:** A shallow, grassy drainage channel for stormwater.

**Swept Path:** The envelope swept out by the sides of the vehicle body, or any other part of the structure of the vehicle that defines the road geometry parameters.

**Town Centre:** A built up area of mixed uses, including commercial, retail, civic, educational and recreational.

**Traffic Calming:** Physical design and control to improve safety for motorists, pedestrians and cyclists including road narrowing, vertical and horizontal deflection, speed limits and closure of streets.

**Traffic Controls:** Traffic lights and signs.

**Tree Canopy:** The mass effect of tree foliage that provides shade and fauna habitat.

**Tree Guard:** A structure surrounding a juvenile tree to protect it from vehicle and other impacts.

**Underground Services:** Utility services that are located under the road surface, verge, cycleway or footpath.

**Urban Heat Effect:** Through the reduction of green areas and tree canopy and an increase in paved and built surfaces that absorb and reradiate heat in urban areas, they become warmer than the unbuilt areas surrounding them.

**Utility:** Supplier of services such as electricity, water, gas and telecommunications.

**Travel Lane:** A dedicated area for movement of vehicles usually marked by painted lines or reflective markers.

**Verge:** A strip of grass or garden between the kerb and footpath. That portion of the street corridor that is neither carriageway nor footpath.

**Water Sensitive Urban Design** (WSUD): The planning and management of all components of the hydrological cycle in urban settings in ways that deliver multiple benefits such as enhancing water quality and liveability. Establishing a sustainable approach to the design of stormwater drainage systems which integrates natural systems such as open raingardens, swales, bio–infiltration and wetlands within the public domain and road corridor to improve water run–off quality and management.

**Zebra Crossing:** A marked and illuminated pedestrian crossing marked by painted bars on the road surface.

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