

STREET DESIGN MANUAL: WALKABLE NEIGHBOURHOODS

A contemporary guide for the design and development
of Queensland's residential neighbourhoods



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Foreword

Streets and pathways are the building blocks of every residential neighbourhood. Along with our built environment, well-planned streets and neighbourhoods influence how people move and interact, access parks and open space, walk and cycle for leisure, recreation, exercise and transport.

IPWEAQ's *Street Design Manual: Walkable Neighbourhoods* (the Manual) is a contemporary guide for the design and development of Queensland's residential neighbourhoods.

Developed for industry by industry, the Manual recognises streets as an important connector to multi-purpose social spaces in our neighbourhoods. It offers access options for active transport delivering safer neighbourhoods and a sense of community.

By complementing the Queensland Government's model code for neighbourhood design and *Planning Regulation 2017* and other policy initiatives that offer leading practice guidance and technical design criteria for walkable residential streets, the Manual provides a more coordinated approach to neighbourhood planning and design for councils, developers and the community. It builds on previous IPWEAQ publications, *Queensland Streets and Complete Streets*, and draws material from *Economic Development Queensland* guidelines and relevant codes.

Through the provision of detailed practical guidance, the Manual will be a valuable resource for local authorities, engineers, planners, designers, practitioners and decision makers involved with the planning and design of walkable neighbourhoods.

I would like to acknowledge and thank the members of the Steering Committee and various working groups which facilitated the development of the Manual. The guidance provided within is a result of their tireless efforts and shared commitment to developing better communities by improving the standard and design of residential neighbourhoods.

It is my pleasure to introduce, and commend the use of, IPWEAQ's *Street Design Manual: Walkable Neighbourhoods*.

Regards,

Leigh Cunningham
Chief Executive Officer, IPWEAQ



It is with great appreciation that IPWEAQ thanks the members of the Steering Committee and Working Groups for their valuable contribution to this seminal publication.

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The Street Design Manual is in three parts:

Part 1 – Planning and Design Guidelines

Guidelines relating primarily to the urban design of neighbourhoods, incorporating elements covering community design, the movement networks, the open space network, lot design, and centres.

Part 2 – Detailed Design Guidelines

Guidelines relating to the detailed design of neighbourhood infrastructure including traffic, streets, active transport, and services.

Companion volume

Practice Notes will be “Live”, updated and augmented regularly.

All parts draw from and include material from such documents as Economic Development Queensland guidelines and the Queensland Housing Code and the Model code for residential development (A code for reconfiguring a lot).



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Introduction

This volume of the Street Design Manual (the Manual) builds on previous publications of the Institute of Public Works Engineers Australasia, Queensland (IPWEAQ), namely Queensland Streets (1993) and Complete Streets (2010), and provides a contemporary guide for the design and development of residential neighbourhoods in Queensland.

Several major changes to urban development have occurred since Queensland Streets and Complete Streets were released, including:

- the adoption of several important state government policy documents (e.g. the State Planning Policy, Regional Plans and a Model Code for Neighbourhood Design);
- the creation of the Urban Land Development Authority (ULDA) which evolved into Economic Development Queensland (EDQ) and its approval role in major greenfield areas in SEQ; and
- greenfield development densities rising from around 10dws/ha in the early nineties to 15-20+dws/ha today.

While development densities have been steadily rising, many regulations, guidelines, standards, and practices have not been revised since they were established to support much lower density forms of development.

Unfortunately, during this period the overall health of our communities has declined when measured against a range of benchmarks. Our communities are experiencing high levels of chronic disease which are partially contributed to by our increasingly sedentary lifestyles.

Queensland is part of a growing international movement that is implementing measures aimed at making our neighbourhoods more walkable and healthier.

The objectives of this document therefore are threefold:

1

to complement and support the implementation of key state government policy initiatives such as the Model code for neighbourhood design;

2

to provide leading practice guidelines to facilitate healthier communities by maximising active transport and recreation in our new neighbourhoods; and

3

to provide a resource document of leading practice solutions to assist developers, designers, and local authorities to plan and deliver high quality attractive neighbourhoods with a great sense of place and community.

This document is focused on greenfield development with a predominately residential land use focus. Designing for other land uses and brownfield development introduces a breadth and scope of issues and challenges beyond the intent and scope of this publication. However many of the principles, objectives, and strategies provided are still applicable to brownfield development.

The Manual has been produced to reflect the key principles and objectives espoused by the state government policies and other sources of leading development practice. Our new communities:

- are founded on a site-responsive design approach;
- incorporate a diverse range of housing options with residential densities achieving expressed policy targets;
- provide safe, comfortable, and convenient walking environments for all members, in particular unescorted primary school children, carers with babies in prams, people with walking impairments, and the elderly;
- ensure all active transport modes and public transport are prioritised and catered for;
- have streets that are fit for purpose and reflect their role within the wider urban context;
- have open spaces that are sized, located, and embellished to support the needs of their residents; and
- ensure land is treated as a finite and precious resource that is used as efficiently as possible.



PLANNING AND DESIGN GUIDELINES



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ELEMENT 1 – COMMUNITY DESIGN

Overview

The Community Design element goes to the heart of achieving the Street Design Manual’s objective of providing guidelines to assist the planning and delivery of neighbourhoods with a great sense of place and community.

This element’s approach is strategic, covering more than a single neighbourhood and considers the characteristics of a collection of neighbourhoods, their facilities, and the range of attributes that help make new communities great places to live.

In contrast, a single neighbourhood approach is adopted in the latter elements, Movement Network, Neighbourhood Open Space Network, Lot Design, and Activity Centres.

Community Design also recognises the interaction and inter-relatedness these other elements and the value of site-responsive design approach at a strategic level. This relationship balances the sometimes-competing aspects of the different elements to achieve the best sense of place and community.



1.1 SITE RESPONSIVE DESIGN

Objective:

To achieve a neighbourhood design that addresses site constraints and incorporates natural and cultural features to underpin a unique identity, sense of place and community.

Strategy 1.1.1

Undertake a comprehensive site analysis and sieve mapping to create a Constraints and Opportunities Plan.

Tip

Best practice site analysis will involve:

- site visits, not just desktop analysis; and
- a multi-disciplinary approach.



Figure 1.1: Example - Constraints and Opportunities Plan

Strategy 1.1.2

A synthesis and balancing of opportunities and constraints to produce Structure Plan options.

Tip

Best practice will involve:

- looking for ways to create special unique features for the neighbourhoods;
- co-location of uses to conserve space and introduce interest and vitality;
- exploring opportunities to integrate with adjacent areas;
- sanity checking with further onsite work; and
- a multi-disciplinary approach.



Figure 1.2: Example - Preliminary Structure Plan

Strategy 1.1.3

The Final Structure Plan clearly identifies the matters to be addressed in subsequent design processes and identifies for protection those features that will underpin a sense of identity and place for the neighbourhood..

Tip

A best practice structure plan will:

- provide a clear framework for further design for individual neighbourhoods;
- sufficient detail for certainty while allowing flexibility;
- clear identification of non-negotiable elements; and
- be checked and confirmed with relevant external stakeholders (especially service providers)

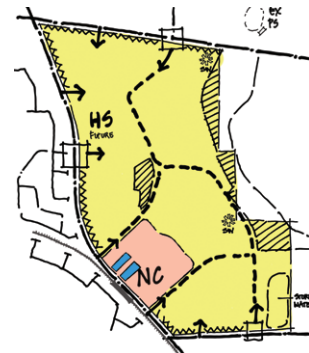


Figure 1.3: Example - Final Structure Plan



ELEMENT 2 – MOVEMENT NETWORK

Overview

The movement network of a neighbourhood includes the network of surrounding roads, streets, pathways, corridors, and infrastructure necessary to accommodate the physical activity and transport needs of the users within that neighbourhood.

This network needs to accommodate all relevant transport modes including walking, cycling (and other active transport modes, including low powered micro-mobility devices (MMDs)), public transport, service vehicles (e.g. refuse collection and emergency), and other motor vehicles. The movement network is the key determinant in delivering walkable neighbourhoods

A successful movement network ensures the communities have a high level of permeability, safety for all users, facilitates high levels of accessibility for all ages and abilities by walking, cycling and public transport and are integrated with the urban and natural environment. It is a key factor in the creation of a sense of place.

The movement network provides the opportunity for shared functions within the same space such as services, landscaping, view lines, vehicles, ride-share infrastructure, public transport, and active transport.

Key Principles

The principal movement functions that a street must accommodate are:

- pedestrian movement;
- cyclist and non-motorised (or low powered MMD) vehicles movement;
- public transport; and
- motor vehicles, including service vehicles and space for parking.

The principal place-making functions that a street must accommodate are:

- paths to support pedestrian activity;
- street tree planting;
- street furniture;
- landscaping and shading;
- a variety of social activities;
- aesthetic treatments that enhance the streetscape and complement the adjoining built form;
- micro-climate mitigation to reduce heat island effects; and
- ecological connectivity.

The principal infrastructure functions that a street must accommodate are:

- stormwater conveyance (major and minor);
- stormwater quality;
- utility services (including emerging technologies); and
- lighting.



Element 2 is in two sections:

Section A – Structure planning of the neighbourhood movement network

This section provides strategies that address the structure planning of the movement network for the overall neighbourhood area, its external connections, boundary roads and internal collector streets.

The outcome of this work will confirm the key features of the neighbourhood that need to be considered at the more detailed concept design phase for the neighbourhood streets. These key features include:

- land uses (residential, non-residential, schools, parks, shops);
- physical constraints and opportunities (topographical, drainage, infrastructure, parks and open space corridors);
- means of encouraging walkability and accessibility (for all abilities and user types);
- movement desire lines (pedestrians, cyclists and motor vehicles);
- climatic considerations – prevailing breezes, solar orientation;
- place-making opportunities; and
- infrastructure needs, including street hierarchy.

Section B – Concept design of the neighbourhood streets

This section provides strategies that address the concept design of the neighbourhood street network to respond to the structure planning outcomes.

The outcome of this work will identify the general alignment of the street, open space, bus routes, and active transport paths and street hierarchy.

This section does not provide specific dimensions for street sections, rather it suggests typical dimensions and aspects of the street network to be considered in the preparation of a neighbourhood's concept design.

Part 2 – Detailed Design Guidelines establishes the size and dimension of each of the movement network components and assists in the creation of the appropriate cross-section for each of these components using the “Build-a-Street” concept, whereby the street or movement corridor is assembled from various component elements based upon the outcomes of the structure planning and concept design phases.



SECTION A – STRUCTURE PLANNING OF THE NEIGHBOURHOOD MOVEMENT NETWORK

Overview

The aim of the structure planning process is to develop movement network plans for active transport and motor vehicle transport for neighbourhoods.

The primary objectives of these network plans are:

- **A movement network based on a site-responsive design.** Site responsive design identifies constraints and natural and cultural assets, underpinning the development of options for the movement networks with the aim of balancing competing interests to create a unique identity and sense of place integrated with neighbouring areas.
- **Safe, comfortable, and convenient active transport environments.** The layout of roads, streets, and open space in neighbourhoods:
 - a) accommodates active transport infrastructure to connect dwellings with environmental corridors, parks and open space, community facilities and places of employment in a direct manner;
 - b) provides a network of active transport infrastructure that delivers a coordinated and integrated response to the needs of, and ensures perceived and actual safety for, pedestrians, cyclists and users of other forms of active transport of all ages and ability levels;
 - c) provides active transport connections that are more direct, and provide safer route options, than motor vehicle routes; and
 - d) maximises comfort and enjoyment by users.
- **Public transport options are facilitated.** The layout of roads and streets in neighbourhoods facilitates existing and potential future public transport networks and links to destinations.
- **Safe and effective environment for motor vehicles.** The layout of the road and street network provides for the movement of motor vehicles between and within neighbourhoods, whilst maintaining safety for all users (in particular pedestrians and cyclists).
- **Successful movement network planning** should also consider connections with the surrounding network (all transport modes), adjacent future development, prioritisation of active transport modes (where relevant) and ease of navigation within the neighbourhood.

Note

The key determinant in achieving walkability of a Neighbourhood is the inclusion of pedestrian infrastructure in every street, including safe crossings (refer Part 1-2.7 and Part 2). This section relates more to understanding the required widths of the pedestrian infrastructure, its best location within the street and interrelationship with other movement networks.



2.1 PEDESTRIANS

Objective

To develop a pedestrian movement network plan that provides safe and effective infrastructure to encourage walking for transport, leisure, recreation and exercise (or similar low-speed active transport modes e.g. MMDs) that achieve appropriate standards and convenience for equitable access and accessibility within and between neighbourhoods.

Strategy 2.1.1

Identify desire lines for pedestrians, recognising external neighbourhood connections, land uses, parks and open space corridors, and the limitations of distance and topography.

Estimate approximate (high, medium, low) demand volumes for each desire line.

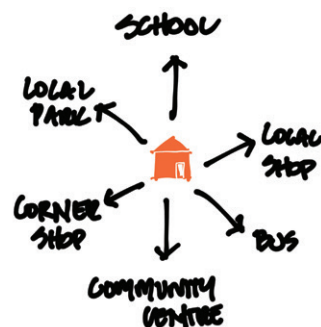


Figure 2.1: Example - Neighbourhood Connections

Strategy 2.1.2

Identify an appropriate hierarchy of pedestrian pathways, cognisant of the desire lines and demands.

- **Principal Pedestrian Route:** Connects and provides access to and between major destinations (such as principal activity centres, major schools, major sports/recreation areas, rail or bus stations and residential areas).
- **Local (or Neighbourhood) Pedestrian Route:** Connects and provides access between residential areas and neighbourhood destinations.
- **Activity Place (e.g. main street):** Provides access to commercial, retail, employment and community land uses (such as sub-regional or district activity centres).

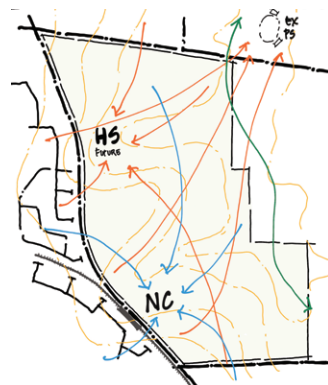


Figure 2.2: Example – Developing Desire Lines.

Strategy 2.1.3

Develop a network of pathways to achieve the pedestrian movement objectives, with footpaths provided on at least one side of local streets and both sides of all other streets.

Tip

To make walking trips more desirable than motor vehicle trips, pedestrian connections should be more direct, and have more route options, than motor vehicle routes.



Strategy 2.1.4

Estimate the likely demands for pedestrian use of each desired line.

Use Table 2.1 (Page 32) – Typical Road and Street Concept Design Parameters to identify the type of pathway facility necessary to accommodate the appropriate:

- volume of users (one-way and passing);
 - type of users (e.g. children, people with disabilities);
 - function/purpose (e.g. commuter, recreation); and
 - hierarchy (level of importance).
-



2.2 CYCLISTS

Objective

To recognise that pedestrians and cyclists are not compatible with motor vehicles on the Major Road system, (where the higher volume and speed of vehicular traffic results in much greater risk for the pedestrian and cyclist) and to provide for their safe interaction on these higher trafficked roads.

Strategy 2.2.1

Identify desire lines for cycle-related trips for transport, leisure, recreation and exercise while recognising external neighbourhood connections, land uses, parks and open space corridors, and limitations of distance and topography.

Where pedestrian and cycle routes follow Major Roads, depending on expected cycle and pedestrian volumes and vehicle speeds, provide for either:

- shared paths for pedestrians and cyclists;
- specific on-road cycle lanes; or
- separate off-carriageway cycle tracks.

Objective

To develop a Cycle Movement Network Plan that provides safe and effective infrastructure to encourage cycling (and/or other active transport modes, e.g. low powered MMDs) with appropriate levels of accessibility within and between neighbourhoods.

Strategy 2.2.2

Identify desire lines for cyclist-related trips, recognising external neighbourhood connections, land uses, open space corridors, and limitations of distance and topography.

Estimate the Level of Traffic Stress (LTS) for each desire line to determine the cycle infrastructure required.

Tips

- Local / State Government Cycle Network Plans are a useful resource or reference for this information.
- Cyclists should be provided with separated facilities if there are high levels of conflict, such as near schools, activity centres, transport hubs, etc. and other locations with high pedestrian usage.



Figure 2.3: Example – Establishing the Cycle Network Plan.

Strategy 2.2.3

Identify an appropriate hierarchy of cyclist routes, cognisant of the desire lines and demands using the Level of Traffic Stress approach.

- **Principal Cycle Route:** Connects major regional destinations (e.g. activity centres, major schools, major sports/recreation areas).
- **Secondary Cycle Route:** Connects to principal routes and attractors (e.g. rail or bus stations, neighbourhood centres, other schools).
- **Local (or Neighbourhood) Cycle Route:** Connects to secondary routes and provides connections to minor attractions (e.g. parks, residential areas).



Strategy 2.2.4

Develop a network of cycleways to achieve the cycling movement objectives. This may include cycle streets, cycle lanes (on-street), separated cycle tracks and shared paths (within the street or open space corridor). This will typically be a function of the traffic speeds, volumes and proportion of heavy vehicles.

Tips

- To encourage cycling trips over motor vehicle trips it is desirable for cycling connections to be more direct and have more route options, than motor vehicle routes.
- The network of cycle routes may be integrated with the other movement network infrastructure (e.g. shared paths, shared corridors, on-street, cycle streets) to reduce the width of the overall verge or street reserve.

Strategy 2.2.5

Estimate likely (high, medium, low) demand volumes for cyclist use of each desired line.

Use Table 2.1 (Page 32)– Typical Road and Street Concept Design Parameters as a guide to identify the type of cycle facility necessary to accommodate the appropriate:

- volume of users (one-way and passing);
- type of users (cycling confidence – cautious, confident);
- function/purpose (commuter, recreation);
- hierarchy (level of importance); and
- Level of Traffic Stress (LTS).

Refer to Practice Note 6: Design for cyclists.



2.3 PUBLIC TRANSPORT

Objective

To develop a public transport network which is designed to allow for the extension of existing, or provision of future public transport routes, that are convenient and accessible to the community. The network should allow public transport services to operate as effective and reliable and comparable transport services to private motor vehicle modes. The infrastructure should achieve appropriate standards, convenience, reliability, frequency and levels of accessibility within and between neighbourhoods. Public transport routes/stops should be well connected with active transport routes.

Strategy 2.3.1

Identify catchment areas, including origins and destinations, for users of the public transport network/service, recognising external connections, land uses, and the limitations of distance and topography.

Estimate the likely (high, medium, low) demand volumes for public transport users to determine routes and service frequency.

Strategy 2.3.2

Identify an appropriate hierarchy of public transport routes, cognisant of the origins, destinations and demands.

- **Principal Public Transport Route:** Provides regular services to/from major regional destinations (e.g. principal activity centres, major schools, major employment centres, major rail or bus stations).
- **Secondary Public Transport Route:** Provides services to/from district level destinations (e.g. district centres, other schools) and/or connection with principal routes (e.g. via interchange locations).
- **Local (or Neighbourhood) Public Transport Route:** Provides services to/from local attractions (e.g. neighbourhood centres, schools).



Figure 2.4: Principal, Secondary and Local Transport Routes.

Strategy 2.3.3

Develop a network of public transport routes (roads and streets of sufficient width), public transport stops and pedestrian connections (pathways to/from public transport stops), and associated infrastructure to achieve the public transport objectives.

Within neighbourhoods the network of public transport routes will typically be integrated with other movement network infrastructure (e.g. road and street corridors) rather than in a separate corridor.

To encourage public transport trips (over other motor vehicle trips) it is desirable for public transport routes and stops to deliver a service that can compete with other motor vehicle trips.



Figure 2.5: Design for Public Transport objectives.



Strategy 2.3.4

Identify the likely principal, secondary and local public transport elements that ensure 90% of proposed lots are within a 400 m of an existing or planned bus (or other public transport) stop.



Figure 2.6: Example - Design for linkages to public transport



2.4 MOTOR VEHICLES

Objective

To develop a major road and street network plan that provides safe and effective infrastructure to accommodate trips by motor vehicles (typically private motor vehicles) within and between neighbourhoods. Traffic safety considerations should include interaction with other movement networks.

Ensure that the road and street network for motor vehicles (including parking) does not compromise the pedestrian and cycle objectives and strategies.

Strategy 2.4.1

Identify the network of existing, proposed and required roads (arterial and sub-arterial) carrying through traffic which connect to and traverse the study area. This network should be external to the neighbourhoods.

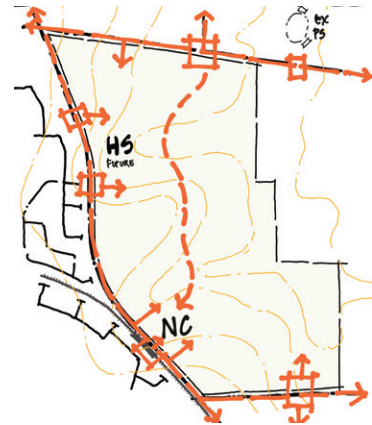


Figure 2.7: Example – Preliminary designs for through traffic

Strategy 2.4.2

Identify a pattern for the key neighbourhood street network (major collector and collector) recognising the necessary connections to the external road network (arterial and sub-arterial).

Estimate the likely motor vehicle traffic volumes for each of the key neighbourhood streets using the trip generation rates from Table 2.1 (page 33).

Strategy 2.4.3

Allow for an arterial road spacing of 1-2 km and spacing of intersections along an arterial road from the neighbourhood street network of between 300-500 m.

Strategy 2.4.4

Provide a number of routes to/from the neighbourhood, appropriate to the catchment size, such that accessibility is not restricted.



Strategy 2.4.5

Allow for a sub-arterial road spacing of 0.8 km to 1.6 km and spacing of intersections along a sub-arterial road from the neighbourhood street network of between 200-300 m.

Tip

These spacings are suggested and may need further refinement near activity centres. Refer to Part 1, Element 5 - Activity Centres.

Recommended Road Hierarchy

Arterial

The primary objective of an arterial road is to serve as a major through traffic carrying route. Arterial roads will carry motor vehicle traffic efficiently whilst facilitating pedestrian and cycle movements along the corridor and across the corridor at strategic locations. They also play a key role in the public transport network.

Arterial roads are typically higher volume four-lane roads and will often form the principal connection between major regional/activity centres and/or suburbs.

Sub-arterial

Sub-arterial roads will typically provide a traffic carrying connection between residential, commercial, or industrial areas and arterial roads. They should serve a more efficient/convenient route than using the street network.

Sub-arterial roads are typically two - to four-lane roads that carry motor vehicle traffic efficiently whilst facilitating pedestrian and cycle movements along the corridor and across the corridor at strategic locations. They also play a key role in public transport.



Recommended Neighbourhood Street Hierarchy

Major Collector

A Major Collector generally has restricted or limited direct motor vehicle access to individual properties.

Major Collector streets provide linkage between and within neighbourhoods to facilitate short trips for pedestrians, cyclists and motor vehicles in a calm and low-speed environment. Major Collectors also provide connection between the Collector streets and the external road network (arterial and sub-arterial) and are the preferred location for any public transport route through a neighbourhood.

Development frontage to collector streets is appropriate for residential (and non-residential) development and parking is typically accepted.

Major collector streets are typically provided where the function and/or traffic volume on that street is such that there is a need to achieve higher traffic efficiency and/or to provide improved safety of users. On major collector streets, the following may be necessary:

- restricted or limited vehicular access to property (e.g. consolidated driveways, centre median, turning lanes);
- indented bus stops;
- indented parking lanes;
- separated cycle facilities (i.e. separate from motor vehicle traffic and/or pedestrians); and
- wide verges suitable for landscape/streetscape improvements and pedestrian pathways on both sides of the street.

Collector

A Collector Street provides direct motor vehicle access to individual properties.

Collector streets provide linkage between and within neighbourhoods to facilitate short trips for pedestrians, cyclists, and motor vehicles in a calm and low-speed environment. Collectors also provide connection between the local neighbourhood access streets and the external road network. They may be used as a public transport route through a neighbourhood.

Development frontage to collector streets is appropriate for residential development. Vehicular access and parking are typically encouraged due to relatively low traffic volumes.

Collector streets should make specific provision for cycle movement and should include pedestrian pathways on both sides of the street.

Access

An access street provides direct access to individual properties. An access street also provides a connection to other access streets but is not so significant that it would function as a collector street.

It should facilitate movement by pedestrians and cyclists, without significant constraint by motor vehicle traffic needs. In general, public transport does not utilise an access street.

Local Access

A local access street provides direct access to individual properties. A local access street generally, is one that services only motor vehicle traffic for that street but allows the necessary connections for pedestrians and cyclists from other streets. It is typically a cul-de-sac or a short connecting street between two access streets.

Public transport should not utilise a local access street.

Laneway

A laneway provides a very low volume, very low-speed environment that provides vehicular access to the rear (or side) of individual properties, typically where vehicular access from the front of the lot is undesirable (for improved front street aesthetics or direct access to open space) or not achievable (due to road hierarchy, high traffic volumes or high demand for on-street parking on the frontage street). A laneway services only motor vehicle traffic for that street (i.e. it does not serve other streets) but sometimes allows the necessary connections for pedestrians and cyclists from other streets. It typically excludes on-street parking unless in specifically designed parking areas.



SECTION B – CONCEPT DESIGN OF THE NEIGHBOURHOOD STREETS

Overview

The primary objective of the concept design is to deliver the movement network functions identified in a structure planning process.

The concept design will give effect to the structure planning objectives of a site-responsive outcome, integrated active transport and public transport networks and facilities, and provision of a safe efficient motor vehicle environment.

The concept design of the neighbourhood streets will:

- achieve a high degree of connectivity and allow for the infrastructure to facilitate walkability and active transport;
- assist in the provision of green infrastructure to create pleasant walking and cycling networks and ecological connectivity, where this is desirable;
- contribute to the creation of the neighbourhood's sense of community and place;
- facilitate public transport provision (both existing and potential routes);
- include the main linkages to the road network within and between neighbourhoods, centres, and other areas of community activity;
- identify the appropriate motor vehicle speed environment for neighbourhood streets where appropriate; and
- provide for all necessary infrastructure service functions in an efficient and effective manner.

In areas identified as flood prone, the street network and layout of lots should implement the principles and actions of any relevant authority Floodplain Management Plan.



2.5 SITE RESPONSIVE DESIGN

Objective

The layout of streets in a neighbourhood:

- a) preserves and celebrates, where possible, the cultural elements, history, and vistas of the neighbourhood;
- b) addresses the context of surrounding existing and proposed future development;
- c) respects the natural slope, drainage lines and areas identified as flood prone;
- d) contributes towards community infrastructure resilience and addresses the impacts of flooding, flood liability and the water quality of stormwater runoff; and
- e) provides opportunities for and is responsive to ecological corridors.

Strategy 2.5.1

Undertake a site analysis to identify matters to be accommodated in the design process;

Tip

The best urban design outcomes are likely with a multi-disciplinary approach (urban design, planning, engineering, landscape architecture, and marketing) to address these matters and balance competing objectives in the design process.

Refer to Practice Note 1: Walkable and legible neighbourhoods.



Figure 2.8: Example – Design following a multi-disciplinary approach

Strategy 2.5.2

To address site drainage issues the street layout:

- recognises and mirrors drainage lines;
- can accommodate the major drainage flows within the street reserves and open space drainage paths with appropriate freeboards and with due allowance for extreme events; and
- is designed to avoid trapped sags or culs-de-sac that result in overland flow paths through properties.

Tips

- The street layout should be developed in parallel and integrated with the site-based stormwater management and/or integrated stormwater management plans.
- Designers should demonstrate at the street network planning stage that major drainage flows (ARI 190) can be accommodated in the street carriageway with the required freeboard.
- If stormwater quality management is to occur within the street reserve, designers should demonstrate that this is achievable within the street reserve and is a low maintenance cost solution.
- Infrastructure such as bio-basins, water harvesting, active transport routes could be co-located in a neighbourhood park.



Strategy 2.5.3

In areas identified as flood prone, the street network and layout of lots should implement the principles and actions of any relevant authority's Floodplain Management Plan and in its absence endeavour to develop a street layout that:

- meets design standards for flood immunity to roadways and evacuation routes;
- implements flood-resistant infrastructure through design; and
- contemplates climate change impacts and events rarer than the defined flood event.

Strategy 2.5.4

A neighbourhood's street layout connects with surrounding roads and streets in accordance with the overall future development structure and planning scheme provisions and by providing the appropriate connectivity for all transport modes.

Strategy 2.5.5

Existing site vegetation is retained where practicable.

Tip

The street reserve may provide opportunities for increasing a neighbourhood's green infrastructure where existing site vegetation (not impacted by infrastructure and not adversely impacting on other objectives) can be accommodated within the street reserves.

Refer to Practice Note 2: Increasing trees in our neighbourhoods.



2.6 SENSE OF PLACE, COMMUNITY AND SAFETY

Objective

The layout of streets in a neighbourhood contributes positively to the sense of place and community identity and reinforces their intended role and function.

Strategy 2.6.1

Enhance Place Making by designing roads and streets that:

- provide attractive and safe places for people walking and riding, such as a tree line to provide shade;
- identify and promote key gateways and nodes;
- are aligned with distant views and site features;
- provide both visual and physical connections to open space areas; and
- provide opportunities to highlight special characteristics of the neighbourhood (e.g. vegetation, cultural and heritage elements, architectural features).



Figure 2.9: Example - Highlighting special characteristics of the neighbourhood

Strategy 2.6.2

Minimise the length of major collector streets with no direct residential lot access within a neighbourhood.

Tip

Driveways for individual property access may need to be constrained in some situations:

- if < 6,000 vpd then access is permitted; and
- if > 6,000 vpd then access restrictions/limitations need to be considered.

Strategy 2.6.3

To improve resident amenity and safety for active transport users, neighbourhood streets do not operate as through traffic routes for externally-generated motor vehicle traffic.

Tip

The likelihood of such shortcutting or rat running may be minimised in two ways:

- the situation can be minimised by identifying the most likely rat-running movements in the morning and evening peaks and keeping connections through the neighbourhood generally at right-angles rather than parallel to the main traffic movements; and/or
- off-setting intersections of residential streets to arterials, rather than using four-way signalised intersections or roundabouts.



Strategy 2.6.4

To assist in encouraging appropriate user behaviour, the design features of each type of street convey its primary function.

Tips

Techniques to assist in reading the function of a street:

- streets link with other streets that are no more than two levels higher or lower in the hierarchy;
- consistent street naming convention (e.g. drive, circuit, place, etc); and
- hierarchy in street infrastructure (e.g. planting, thresholds etc).

Strategy 2.6.5

Street layout facilitates wayfinding within the neighbourhood.

Tip

For legibility, the layout should not generally exceed 3rd order i.e. a driver should not have to make more than three turns or utilise more than three different streets between the neighbourhood Collector Street system and the destination.

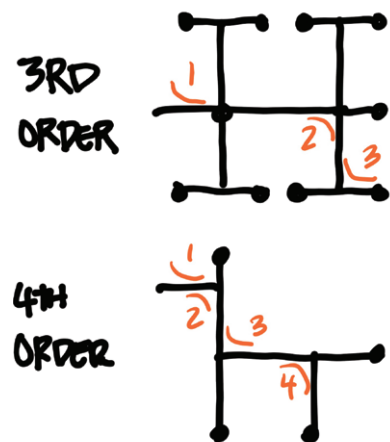


Figure 10: Example – Street layout design order

Strategy 2.6.6

To achieve good pedestrian connections the typical maximum block length should be 250 m.

Refer to Practice Note 1: Walkable and legible neighbourhoods.

Note

Where block lengths are greater than 250 m subject to unique site features, special pedestrian routes should be considered.

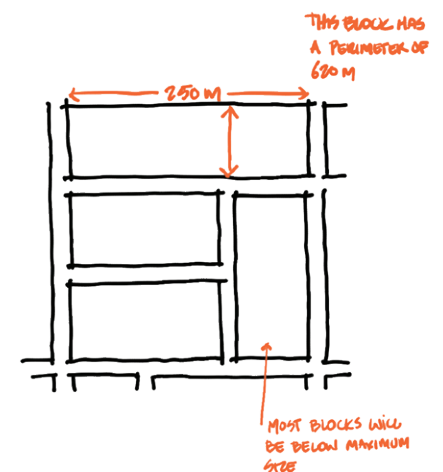


Figure 2.11: Example - Typical maximum block length



Strategy 2.6.7

The design and layout of streets and lots facilitate:

- casual surveillance of footpaths and parkland; and
- activity and interaction within public spaces and movement networks.

Note

For design guidance refer to Queensland Government Crime Prevention Through Environmental Design (CPTED) Guidelines.

Strategy 2.6.8

The street layout and other features, taken together, promote a suitable speed environment with the Target Maximum Speeds in the table below.

Table 1 – Target Speeds for Streets

Street Classification	Target Maximum Speed (km/h)
Major Collector	60
Collector	40 – 50
Access Street	30 – 40
Local Access Street	30
Laneways	20

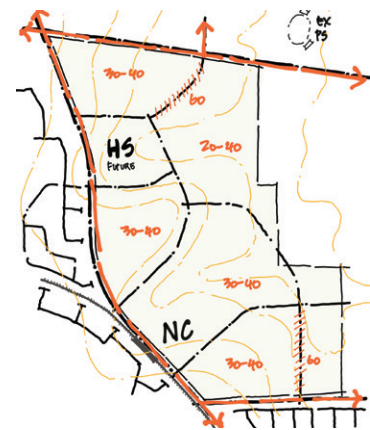


Figure 2.12: Example - Target speed street layout



2.7 FIT FOR PURPOSE

Objective

The streets in a neighbourhood have an alignment, width, and geometric design to accommodate:

- a) active, public, and motor vehicle transport infrastructure;
- b) motor vehicle access to dwellings;
- c) stormwater drainage (underground and overland) conveyance (minor and major);
- d) stormwater quality infrastructure;
- e) street trees and urban vegetation for urban cooling and stormwater quality management;
- f) utility services infrastructure;
- g) refuse, delivery, and emergency service vehicles; and
- h) visitor parking.

Tip

In the absence of detailed design or specific network requirements, the neighbourhood street network will typically include the parameters in Table 2 of Part 2– Typical Road and Street Concept Design Parameters.

Refer to Part 2 Street Design Manual for the Build-a-Street approach to determining street reserve widths.

Strategy 2.7.1

The street layout:

- provides for pedestrian infrastructure in all streets;
 - delivers the desired active transport network in the most direct and safe manner by street reserves, pathway, and open space connections accommodating the size and types of pedestrian and cycle paths identified for that network;
 - provides pedestrian and cycling infrastructure to connect:
 - to open space and active movement networks in the surrounding area;
 - to public transport routes and stops;
 - open space, educational, employment, and community facilities within the neighbourhood; and
 - provides for the pedestrian and cycling infrastructure needed for all streets.
-

Strategy 2.7.2

The layout of the street network should be such that an appropriate level of connectivity and driver convenience is achieved.

Tips

- *The objective is to achieve a travel time of typically no more than 90 seconds within the low-speed environment of 36 km/h (on average).*
 - *The above seeks to avoid a situation where drivers are frustrated by excessive travel time at slow speed and might then seek to inappropriately increase their speed in the street network.*
 - *To achieve this, the street network should typically provide no more than 900 m travel distance on the low-speed (<50 km/h) street network between any lot and the Major Collector street or road network.*
-

Strategy 2.7.3

Design the spacing of intersections along a Major Collector street to be typically not less than 100 m and along a collector street typically not less than 60 – 100 m.



Strategy 2.7.4

Design the layout of the street network to be a connected and legible grid-like pattern that is responsive to topography with a maximum block length of 250 m.

Tip

To ensure that pedestrian and cycle paths are direct and avoid convoluted vehicle travel paths, the grid or modified grid pattern may benefit from four-way intersections, that facilitate safe crossings by pedestrians.

Refer to Part 2 of the Streets Design Manual for guidelines for their use and design.

Strategy 2.7.5

Culs-de-sac are designed in the connected grid-like layout where they are utilised to minimise adverse impacts to constrained land, minimise fragmentation of environmental corridors, or minimise adverse impacts to natural features.

Tip

Preferred culs-de-sac designs

Where culs-de-sac are proposed they should accommodate the following:

- cul-de-sac heads are capable of accommodating a three-point turn by a medium-rigid vehicle;
- on-street vehicle parking is accommodated with the medium-rigid vehicle movement;
- pedestrian or cycle movement is accommodated; and
- a wide pathway connection to the network is provided at their end which complies with CPTED principles.



Figure 2.13: Example Best practice Cul-de-sac design



Strategy 2.7.6

Introduce laneways to:

- minimise the number of vehicle crossovers of pedestrian and cycle paths;
- provide a suitable design solution for some no-access street locations; and
- deliver a positive contribution to onsite and on-street carparking.

Laneways should:

- a) provide only enough width for safe and efficient vehicle movement, including service and emergency vehicles continuous movement;
- b) be a slow speed environment and shared zone for walking and cycling as well as vehicle movement;
- c) not provide for visitor parking within the lane unless in specifically designated areas;
- d) not be longer than 140 m without a mid-block path for pedestrians to an adjoining street; and
- e) not be a dead-end or cul-de-sac.

Tips

- Keep laneways narrow to avoid undesirable parking;
- introduce vegetation if possible;
- have dwellings with habitable areas fronting the laneway to provide passive surveillance of the laneway; and
- allow reduced truncations at their entry and internal corners e.g. zero or 1 m x 1 m.

Refer to Practice Note 5: Laneway design.

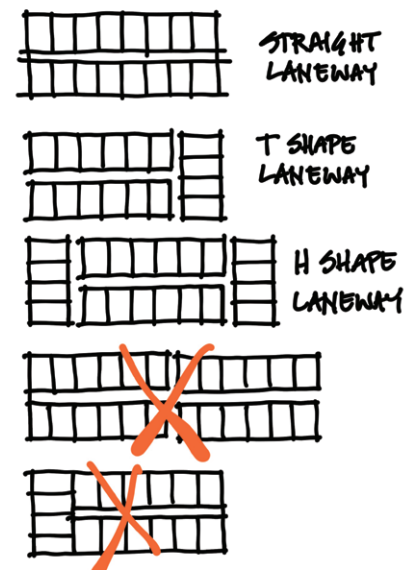


Figure 2.14: Example - Best Practice Laneway design



2.8 LAND USE EFFICIENCY

Objective

The layout of streets in a neighbourhood provides for all required infrastructure and user requirements as efficiently as possible.

Strategy 2.8.1

Design the street reserve widths:

- to the minimum total of the necessary verge (including pathways and cycleways), street trees, parking and vehicle (including cycles and other mobility devices) movement pavement widths as required by the street type and residential density; and
- increased where desirable for place creation and existing tree retention / additional tree planting.

Tip

As a general rule, street reserve percentages typically will be:

- Neighbourhoods less or equal to 15 dws/ha 25 %
- Neighbourhoods 15-20 dws/ha 25-30 %
- Neighbourhoods 20-30 dws/ha 30-35 %

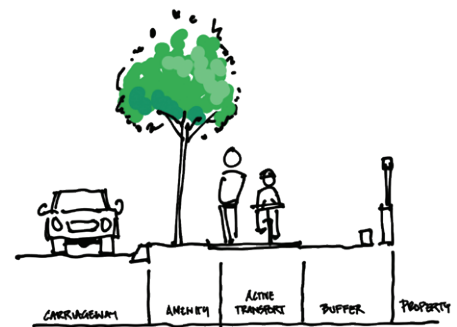


Figure 2.15: Verge Components

Notes

1. $\text{Street reserve \%} = \frac{\text{street area}}{\text{lot area} + \text{street area}}$.
2. Street reserve area increases for additional tree retention may be necessary depending on the extent of trees retained.

Refer to Practice Note 1: Walkable and legible neighbourhoods and Practice.

Note 2: Increasing trees in neighbourhoods for additional details.



Table 2.1 – Typical Road and Street Concept Design Parameters

Parameter	Laneway	Local Access	Access	Collector		Major Collector	Sub-Arterial	Arterial
Typical max. volume (vpd ¹)	< 400	< 1,000	< 3,000	< 6,000	< 7,500	< 10,000	< 30,000	> 20,000
Direct residential lot access for vehicles	Yes	Yes	Yes	Yes ²	No ²	No	No	No
Indicative range of reserve widths (m)	6.5 – 8.0	13.5 ³ – 15.5	15.5 – 16.5	18 – 20		20 – 25	20+	25+
Desired max. length (m)	140	2504	2504	n/a		n/a	n/a	n/a
Intersection spacing min. (m)	n/a	40	40	60 – 100		100	200 – 300	300 - 500
Pedestrian paths	Shared	One side	One side ⁵	Both sides		Both sides	Both sides	Both sides
Cycle paths, either								
• Cycle lanes on carriageway	Shared	No ⁶	No ⁶	Yes ⁷		Yes ⁷	Possibly ⁷	Possibly ⁷
• Off carriageway shared paths	No	No ⁶	Yes ⁷	Yes ⁷		Yes ⁷	Yes ⁷	Yes ⁷
• Separated cycle track	No	No ⁶	Possibly ⁷	Yes ⁷		Yes ⁷	Yes ⁷	Yes ⁷
Bus route	No	No	No	Possibly		Likely	Yes	Yes
Street trees	Possibly	Both sides	Both sides	Both sides		Both sides	Both sides	Both sides

Notes

- A. The street category should be determined by the function it performs and not just the motor vehicle traffic volume.
- B. The determination of the appropriate type of cycle path and its dimensions should be the outcome of an analysis of the types and volumes of cyclist activities and the motor vehicle speeds in the street.
- C. Street trees should be provided at an average spacing of 15 m to both sides of every street but not laneways.
1. For concept planning purposes, a guide for traffic generation is a rule is 8 vpd/dwelling. (The historical rate of 10 vpd/dwelling has proved overly conservative for neighbourhood planning).
2. Direct vehicle access from residential lots is typically acceptable up to 6,000vpd. Above this traffic volume, direct access might be acceptable depending on the number of driveways, parking, and moving lane configuration. Usually, no direct access is appropriate where traffic volumes exceed 7,500vpd.
3. Local access street reserves of 13.5 m with narrower carriageways of 5.5 m are suitable for local access streets for up to 50 contributing lots, providing traffic volumes are low and there is low potential for conflict between lot access/egress and on-street parking (e.g. few narrow-frontage lots). For greater than 50 contributing lots a carriageway width of 7.5 m is recommended.
4. For Local Access and Access streets, this refers to block length to achieve good pedestrian access.
5. Unless required as part of the pedestrian movement network or in the near vicinity of community facilities, parks, or schools where footpaths both sides are appropriate.
6. Unless required as part of the cycling movement network or in the near vicinity of community facilities, parks, or schools where the circumstances indicate this is a preferred solution.
7. Dependent upon the desired lines, cycle hierarchy plan road speed and estimated pedestrian and cyclist demand.



ELEMENT 3 – NEIGHBOURHOOD OPEN SPACE NETWORK

Overview

In the creation of healthy, vital neighbourhoods, the design should provide an accessible open space network that, where feasible, co-locate various infrastructure:

- encourages and promotes outdoor activities;
- contributes to interconnected paths and spaces creating healthy communities;
- provides a range of park opportunities;
- accommodates the planned location of trunk, open-space infrastructure;
- contributes to the legibility and character of the neighbourhood;
- links to existing parkland or open space networks wherever possible;
- provides for multiple purposes;
- meets the community's needs and is designed to maximise use by the community it serves; and
- offers a broad range of informal and formal experiences to the community including provision of parks which range from small pocket parks to large district parks.

As our new communities are developing at higher densities, the roles of quality parks and open space are increasingly important:

- in connecting our commutes either by foot, cycle, or small electric vehicle;
- improving micro-climate through larger shade trees, reducing air pollution, noise and excessive heat;
- allowing for informal recreation and socialisation opportunities; and
- improving mental health and wellbeing by creating a range and choice of open-space opportunities and experiences.

The following objectives are designed to allow place-based solutions that address the needs of the changing and evolving needs of our communities.



3.1 PROVISION OF NEIGHBOURHOOD OPEN SPACE

Objective

Sufficient land is provided for neighbourhood open space, (including parks) and community facilities appropriate to the characteristics of the neighbourhood and local community needs.

Strategy 3.1.1

Provide neighbourhood open space at a rate of 0.5 ha/1,000 people for 15 to 20 dws/ha neighbourhoods up to 1.0 ha/1,000 people for greater than 30 dws/ha.

Tip

Each neighbourhood will have differing needs and requirements for open space provision as well as unique opportunities provided by its topography and site characteristics, as well as opportunities to co-locate open space and community uses.



Figure 3.1: Example – Lot design providing sufficient open spaces embrace topography. Not all parks need to be flat, kick-around spaces. Steep topography provides opportunities to vary recreational outcome and experience.



Figure 3.2: Examples of Recreational Experiences



3.2 THE NEED FOR SOCIALISATION, INFORMAL RECREATION OPPORTUNITIES, AND DIVERSIFICATION

Objective

An open space recreational network that caters for changing needs within our communities is needed to ensure that we design for the whole of the community. Master planning new areas will need to address opportunities that support healthy lifestyles and social interaction across a range of open space opportunities.

Strategy 3.2.1

Incorporate smaller, embellished public spaces that are interconnected by a series of linear parks throughout the master planned area as part of a pedestrian or cycle network.

Tips

- Seek to locate open space with points of interest, connected by pathways that offer attractive and pleasant walking/ cycling circuits with a length of around 2 km offering an ability for a 20 - 40 minute walk.
- The pathways should address both community-based linkages as well as passive recreational opportunities.
- Maximise the recreational and potential for social interaction in areas of open space by co-location of uses that offer opportunities for different user groups at different times of the day and of the week.

Strategy 3.2.2

Identify possibilities for informal recreation opportunities within areas that have a primary use of drainage or other requirements.

Tip

Some drainage reserves, future road corridors, or energy easements may offer permanent or medium-term opportunities for incidental open-space for informal recreation uses.

Maintenance and credit-based, open-space systems at a local government level could be redefined to facilitate developments delivering the opportunities to support this strategy.



Figure 3.3: Example - Incidental open space for informal recreation

Strategy 3.2.3

Design community and open space that incorporate a health and wellbeing plan that illustrates the various tracks, paths, and interconnected destinations (e.g. schools, shops, parks) to deliver:

- safe, attractive, and convenient paths for students to walk and cycle to school, and for pedestrians, cyclists and users of other forms of active transport of all ages and ability levels to access community facilities, shops, and public transport nodes;
- substantial shade trees within the street and open space segments of these paths;
- lighting design which has been integrated with the tree planting design; and
- maximum use of stormwater for irrigation of trees and open space.



3.3 LOCAL RECREATIONAL PARK TYPES

Objective

Open space provision is reflective of creating liveable and healthy communities. Modern densities with its range of typologies requires designers to provide a range of open space outcomes that together meet the overall needs of a diverse community and their evolving expectations.

Strategy 3.3.1

Provide sufficient land for open space and community facilities appropriate to the characteristics of the neighbourhood and local community needs.

Park Type	Design Intent	Minimum usable activity area	Shape
Informal park	Provide visual amenity, additional street tree opportunities and key linkages.	250 m ²	Minimum dimension of 10 m
Local parks	Local park for a range of activities	2,000 m ²	Minimum dimension of 40 m and land with slope greater than 1:5 is not suitable
Linear park	Linking open space for connectivity may include or connect to areas of environmental significance or buffer/transition spaces	2,000 m ²	Minimum dimension of 20 m and land with slope greater than 1:5 is not suitable
Urban parks	Embellished urban spaces also provide visual amenity, additional street tree opportunities and key linkages	250 m ²	Minimum dimension of 10 m

Table 3.1 – Typical Park Types and Characteristics

3.3.1: Source: Public Transport Infrastructure Manual, Department of Transport and Main Roads, Chapter 5 – Bus stop infrastructure, June 2020



3.4 OPEN SPACE DISTRIBUTION

Objective

Neighbourhood design provides an accessible open space network that accommodates planned, trunk, open-space infrastructure and meets the community's needs.

Strategy 3.4.1

Provide local recreational public open space areas generally within the following distance of dwellings:

- 400 m radially of each dwelling for a residential density < 25dws/ha; and
- 200 m radially of each dwelling for a residential density > 25dws/ha.

Tip

Public open space requirements may be achieved by local recreational open space areas:

- *within local, district or regional parks; and*
- *infrastructure corridors, or district and regional, open-space areas and corridors.*



3.5 LOCAL RECREATIONAL PARK DESIGN

Objective

Local, recreational parks are provided with a reasonable level of flood immunity.

Strategy 3.5.1

At least 10% of the local recreational park area is located above the 2% Annual Exceedance Probability (AEP) flood level and embellishments, including play equipment and shelters are constructed above the 2% AEP flood level.



3.6 MULTIPLE USE

Objective

A holistic approach is undertaken to the delivery of open space and service infrastructure which specifically considers multiple use of open space to optimise land uses and achieve the efficient use of land.

Strategy 3.6.1

The neighbourhood's open space design recognises that efficient use of valuable greenfield land requires open space areas to have multi-use outcomes.

Tip

Co-location of community open-space with education facilities can deliver space and associated infrastructure (e.g. parking, servicing) efficiencies as can co-location of infrastructure such as bio-basins, water harvesting, active transport routes in neighbourhood parks.

Objective

Seek opportunities to introduce water ('blue space') into the neighbourhood's open space network.

Strategy 3.6.2

Consider opportunities to introduce lakes and other permanent water bodies in parks provided they:

- form part of an overall integrated stormwater management system;
- are located in district or major recreation parks;
- are highly visible;
- have safe and active edge treatments; and
- are designed to maintain the required levels of water quality and minimise ongoing maintenance costs.

Tip

To recognise their importance in adding positively to the open space and health of the community, a credit is provided towards the required open space provision of:

- where the water quality standard supports secondary contact recreation – 50% of the water surface at normal fill level; and
- where the water quality standard does not support secondary contact recreation – the area between the edge of the water body at normal fill level and a line 5 m in from the water edge.



ELEMENT 4 – LOT DESIGN

Overview

Lot design and its ability to facilitate diversity of housing typologies and densities is essential in achieving quality urban outcomes. Lot design must be cognisant of and address key issues such as:

- various typologies and densities;
- housing typologies and diversity and their overall impact on streetscape character;
- setbacks and separation;
- driveway design and locations;
- relationship to road types;
- on-street parking; and
- development on slope.

Note

Practice Note 3 Contemporary Lot Typologies provides additional background and information that may prove useful in conjunction with this section.



4.1 SITE RESPONSIVE DESIGN

Objective

The design of lots minimises the visual impact of cut, fill and retaining walls on the amenity of the streetscape and adjoining lots.

Strategy 4.1.1

Where lot retaining works are not carried out by the developer, unless an integrated solution is proposed, lots of 450 m² or less are located so that the slope on a lot does not exceed:

- 10% side slope (cross fall); and
- 5% lengthwise slope (longitudinal fall).

Tip

Integrated solutions include outlook style, split and stepped home construction typologies.

Strategy 4.1.2

Where lot retaining works are carried out by the developer subsequent to managed earthworks, retaining walls on side and rear boundaries are limited:

- for lots >450 m² to 1.2 m in height unless terraced;
- for lots ≤450 m² to 1.2 m in height; and
- a maximum of 3.0 m where combined with a boundary fence.

Tips

- Mid-lot terracing with the house design accommodating the terrace may be a consideration for minimising the extent of retaining walls.
 - Retaining walls should be entirely contained within the lot to be retained.
-

Strategy 4.1.3

Where a built-to-boundary wall is used as a retaining wall for an adjoining lot it is located on the low side of the lot to avoid drainage issues.

Refer to Practice Note 4: Designing for small lots.

Objective

Lot size and shape facilitates retention of existing appropriate vegetation and planting of major trees in the road verges and lots.



Strategy 4.1.4

Leading Practice

If the development approval requires a Plan of Development, consideration is given to:

- increasing the front setback where existing vegetation suitable for retention has been identified is not affected by site earthworks or infrastructure and is within the first 3m of the front boundary;
- increasing front and rear boundary setback to provide sufficient space for deep/large canopy planting providing shade to recreational areas or complementing street verge planting; and
- planting areas being identified on rear laneway lots to complement the laneway landscaping.

Note

In each case above, suitable consideration needs to be given to the vegetation species to minimize impact on foundations.

Strategy 4.1.5

Identify opportunities for localised lot boundary realignment to assist retention of existing vegetation or to facilitate large tree-planting adjoining street landscaping.

Tip

Corner truncations might be reconsidered from the standard 3 x 6 m cord truncations to provide increased verge planting for large shade trees having regard to tree location and species, while maintaining site lines and utility corridors, where possible.

Varying the straight, front boundary for tree-retention is not advisable due to impact on service location.

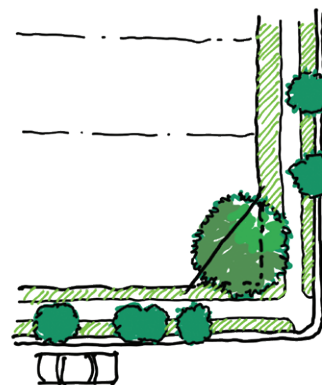


Figure 4.1: Example - Corner truncation



4.2 LOT SIZE, HOUSING DIVERSITY, AND STREETScape

Objective

The lot sizes and their distribution provide for:

- a range of housing options; and
- higher densities located in the most accessible and well-serviced locations.

Strategy 4.2.1

Design lot sizes and shapes to suit the standard house plans available from most builders in the local area.

Tips

- Builders typically will have standard house plans for lot depths of 25 m and 30 m.
- Proposed new lot-sizes be tested with building designers and the market before widespread introduction.

Objective

An attractive streetscape is achieved.

Strategy 4.2.2

Where lot frontages of 10 m or less are proposed, they are located so that:

- a diversity of housing choice is provided;
- variety of lot frontages is achieved in each street; and
- sufficient on-street parking can be provided.

Strategy 4.2.3

Unless an integrated design is proposed which incorporates a variety of lot widths and dwelling styles, articulation and an attractive appearance, lots with frontages 10 m or less are arranged within the block so that:

- there are no more than eight (8) lots with a frontage of 10 m in a row, unless serviced by a laneway;
- there are no more than six (6) lots with a frontage of 7.5 m or less in a row, unless serviced by a laneway; and
- there are no more than eight (8) lots of the same frontage in a row unless serviced by a laneway.

Strategy 4.2.4

Three or more lots with frontages ten (10) m or less are not located:

- opposite t-intersections; and
- at the end of a cul-de-sac where sufficient on street carparking cannot be otherwise provided.

Tip

Integrated lots and dwelling design can also achieve the overall objective without resort to individual lot/dwelling approaches.

4.3 LOT ACCESS, ON-STREET PARKING, AND INFRASTRUCTURE

Objective

On-street car parking is provided to suit the housing density in neighbourhood streets and does not obstruct sight lines, vehicles and pedestrian movement.

Strategy 4.3.1

Provide an on-street parking analysis plan that demonstrates parking to suit the housing density in neighbourhood streets considering:

- the provision of 0.75 on street spaces, per dwelling, with 75% within 25 m and 25% within 50 m of a dwelling when less than 20 dws/ha; and
- the provision of 0.50 on street spaces, per dwelling, within 25 m when greater than 20 dws/ha.

Note

Where public transport services are available at a frequency that might affect car ownership, this strategy might be conservative.

An on-street parking analysis plan demonstrates parking does not obstruct sight lines, vehicle (including refuse vehicles) and pedestrian movement.

Strategy 4.3.2

Where the minimum setback to the garage is 5 m or more and the nett residential density is less than 15dws/ha a carparking analysis plan is not required.

Tips

- where there is a localised concentration of narrow lots or narrow street pavements, restrict on-street parking opportunities. A carparking analysis might be required where the residential density is less than 15dws/ha.
- where residential densities exceed 17.5dws/ha it is likely that additional parking areas, other than just the available on-street parking spaces, will need to be designed into the subdivision layout.
- where residential densities exceed 20dws/ha it is likely that some rear lane lots will also be required to free up kerb space to achieve the on-street parking requirements.
- where residential densities exceed 30dws/ha, it is likely that almost all lots will require laneway access to ensure the required on-street parking provision.



Figure 4.2: Example - Laneway considerations for High Residential Densities

Objective

The design of lots avoids minor mismatches in back property boundaries.



ELEMENT 5 – ACTIVITY CENTRES

Overview

Activity centres are critical to the support of neighbourhoods, providing retail, recreation, employment, education and community facilities.

In addition, they will be the focus of local and wider public transport services.

However, for the most part the location and design of activity centres is beyond the scope of the Street Design Manual in that:

- higher order centres require detailed, specific investigation, planning, and design and will be located on arterial and sub-arterial roads with a catchment of many neighbourhoods; and
- smaller centres will be typically located on sub-arterial and major collector streets with a catchment of several neighbourhoods and have limited impact on a single neighbourhood.

This element instead focuses on the strategies to ensure the successful intersection of the neighbourhood with the centre and the successful integration of the neighbourhood into the centre design.

5.1 NEIGHBOURHOOD AND CENTRE INTERSECTION AND INTEGRATION

Objective

The design of a centre and the adjoining neighbourhoods complements the uniqueness of the respective neighbourhood and adds to a neighbourhood's sense of place, community and safety.

Strategies:

Design features for centres that complement adjoining neighbourhoods include:

- 5.1.1 Activity centres with an interconnected street network of primary streets supported by secondary streets and lanes. The focus of the centre is a "Main Street".
- 5.1.2 Street layout that responds to the geometry of the surrounding street network, topography, and orientation.
- 5.1.3 Street networks that create blocks of a size that accommodate the land-uses of the centre and enables active development frontage to each street (i.e. open car-parking areas, service spaces, and blank walls of large format retail).
- 5.1.4 Primary streets having a generally continuous active development frontage with no vehicle crossings. Primary streets are high amenity places incorporating local traffic, on-street parking, street trees, and generous paved verges.
- 5.1.5 Secondary street/lanes having a service function with no specific active frontage requirements and include open car-parking areas, service bays, and blank walls.
- 5.1.6 The focus of the activity centre being a "Main Street" scaled to suit the size of the activity centre. The Main Street connects into the broader through-street network and forms a direct and legible connection to surrounding land uses, higher and lower density housing on both sides of the arterial and sub-arterial street network.
- 5.1.7 The Main Street as a high-amenity place with good spatial containment. This may include bends and offset intersections to create deflected and terminated vistas. The main street has multiple pedestrian crossing points linking key destinations in the centre.
- 5.1.8 The street network providing multiple connections to surrounding areas and land uses. These routes are direct, safe, accessible, legible and memorable for pedestrians, cyclists and users of other active transport.
- 5.1.9 Intersections designed for safe pedestrian crossings. Roundabouts are incorporated sparingly to enable turning vehicles.
- 5.1.10 Multiple access and egress points provided onto the existing arterial and sub-arterial road network.
- 5.1.11 Parking provided on the existing arterial and sub-arterial network to enable active development frontage to these corridors. Streets within centres accommodate additional parking where possible and provide significant on-street parking within the streets.
- 5.1.12 Public Transport and Active Transport stops and facilities, and if appropriate, interchanges provided within Activity Centres and routes providing connection to Public Transport to/from Activity Centres. Developments within centres provide Active Transport facilities (e.g. end-of-trip, rest, water fountains, etc).

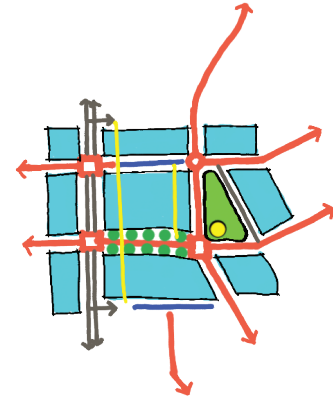


Figure 5.1: District centre

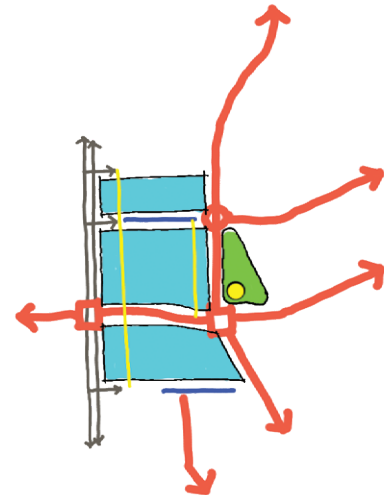


Figure 5.2: Neighbourhood centre

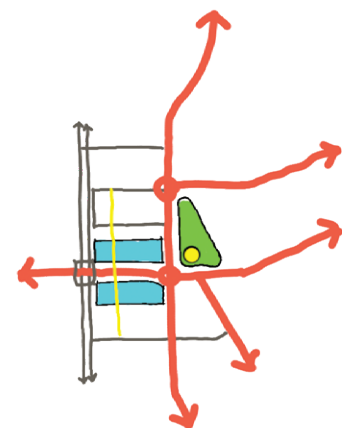
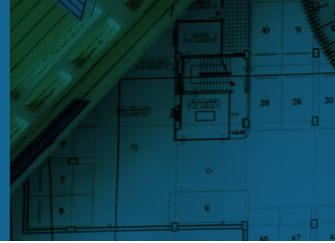


Figure 5.3: Local centre



1 Introduction

The Street Design Manual (Walkable Neighbourhoods), Part 2 – Detailed Design Guidelines, provides detailed engineering and landscape design information to support Elements outlined in *Street Design Manual (Walkable Neighbourhoods), Part 1*.

Part 2 – provides guidance on the design of neighbourhood infrastructure including streets, laneways and paths for active transport and motor vehicle traffic and associated landscaping and services.

Part 3 – Practice Notes, provides additional information about matters covered in *Parts 1 and 2* with case studies and supporting information and references.

All parts draw from and include material from Economic Development Queensland Guidelines and the Queensland Housing Code and Model code for neighbourhood design (A code for reconfiguring a lot).

This document revises and replaces previous publications of the Institute, namely *Queensland Streets (1993)* and *Complete Streets (2010)*. *Part 2* utilises the content of these previous publications where applicable and provides updated content based on contemporary leading practice in the design, construction and operation of infrastructure that supports our residential communities.

For the full introduction to and purpose of the *Street Design Manual (Walkable Neighbourhoods)*, please refer to the Introduction in *Part 1* of this document.

This Manual is structured around meeting the needs of everyone who uses neighbourhood streets. The detailed design of streets requires the integration of infrastructure that supports the roles and functions performed within the street. In doing so, the Manual encourages walking in the first instance over using other modes of transport, as well as walking for recreation. The outcome will be improvement of the health and well-being of our communities. The primary aim of this Manual is the provision of quality, safe, convenient and barrier-free infrastructure for all pedestrians, to promote walking.



1.1 THE FUNCTION OF THE STREET

The street reserve is generally comprised of two functional spaces, namely the verge and the carriageway. Table 1.1.1 describes the key functions of these two spaces.

Space	Verge	Carriageway
Extent	From the property boundary to the face of kerb.	Pavement area between face of kerb on each side of the street.
Functions	<ul style="list-style-type: none"> Provides for people to walk, including those with a disability or limited mobility; 	<ul style="list-style-type: none"> Provides for vehicle movements;
	<ul style="list-style-type: none"> Provides for people to ride bicycles or mobility devices; 	<ul style="list-style-type: none"> Provides for people who ride in low speed, low volume mixed streets or where bicycle lanes are considered appropriate;
	<ul style="list-style-type: none"> Provides shade and sufficient space for street trees and landscaping; 	<ul style="list-style-type: none"> Provide space to park vehicles;
	<ul style="list-style-type: none"> Accommodates Water Sensitive Urban Design (WSUD); 	<ul style="list-style-type: none"> Accommodates stormwater infrastructure for the capture and conveyance of minor storm flows;
	<ul style="list-style-type: none"> Accommodates necessary services; 	<ul style="list-style-type: none"> Accommodates trunk services; and
	<ul style="list-style-type: none"> Accommodates overland flows and provide freeboard for stormwater; and 	<ul style="list-style-type: none"> Accommodates overland flows in conjunction with the verge.
	<ul style="list-style-type: none"> Accommodates safety and visibility. 	

Table 1.1.1 Verge and Carriageway functions

1.2 HIERARCHY OF STREET USERS

Objective

The street network is designed to ensure all users are safe by considering their specific needs. People walking and cycling or using MMDs are provided with a more permeable network than vehicles and are protected from vehicles travelling at dangerous speeds. It is most important to ensure safe and efficient access for emergency vehicles.

Strategies

1.2.1 Safety for Vulnerable Users

Define a connected network for each transport mode that incorporates a hierarchy of routes with appropriate design treatments reflecting Safe Systems principles for street safety.

Notes

The needs of users are addressed in the design and management of transport networks in priority according to their vulnerability – from the highly vulnerable to the least vulnerable.

- the physical tolerance limits of pedestrians, cyclists and riders of MMDs become controlling factors in infrastructure design, reinforcing the hierarchy to prioritise the needs of these more vulnerable users;
- active transport networks are more permeable than traffic networks;
- streets in conjunction with active transport infrastructure are designed so that it is more convenient to walk and cycle than to drive – to both internal and external destinations; and
- the network for each mode is planned separately, without considering constraints from other modes or land uses, then assessed to provide a balanced level of service to meet the requirements of users.

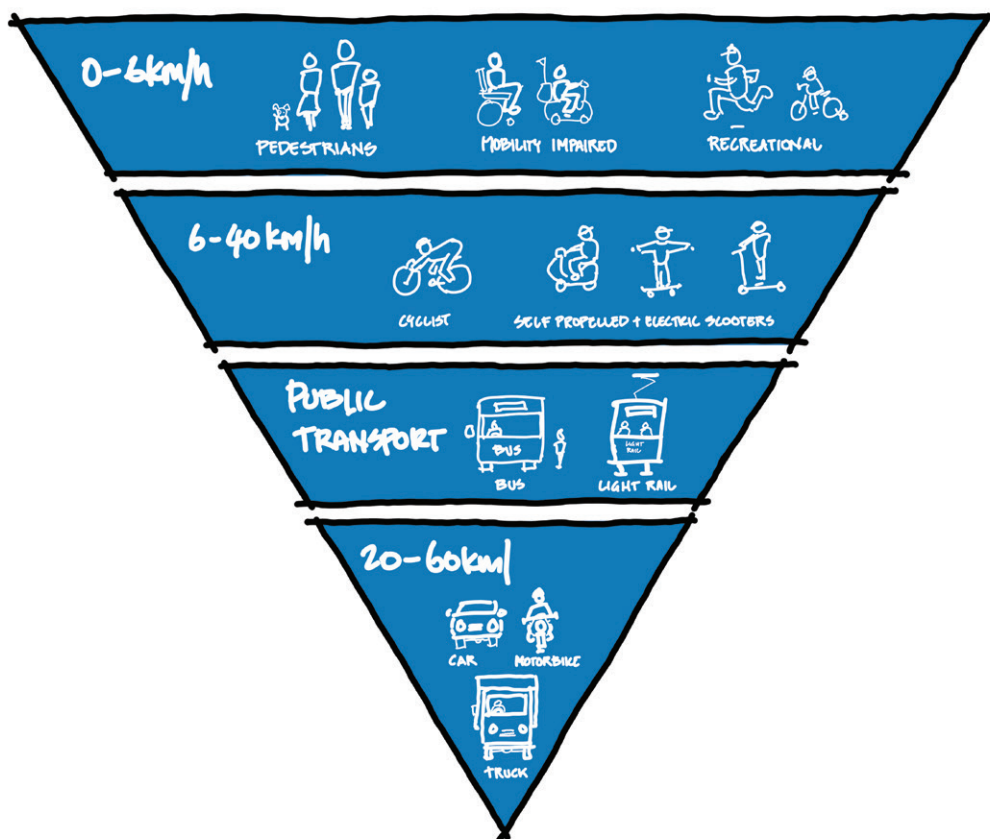


Figure 1.2.1 The Hierarchy of Street Users

1.3 BALANCING NEEDS AND DESIRES

Some functions that the street performs will have more importance than others in certain precincts. The challenge for professionals involved in street design is finding the appropriate balance of potentially competing objectives to achieve an outcome that satisfies the strategic intent without inappropriately compromising specific needs.

The design of infrastructure must satisfy the key functions of the street, whilst not being wasteful of limited public and private resources. It should have regard to:

- Efficient use of land (noting that as residential densities increase, the proportion of private land available for development reduces);
- Minimising future operation and maintenance costs to future asset owners (who invariably have limited financial resources); and
- Minimising construction costs (within the above parameters).

Achievement of these goals may lead to a need to address what might be seen as conflicting detailed design objectives of various infrastructure. For example, the summation of the desired land for each infrastructure type within a street (road) reserve on an individual basis, without consideration of the potential for their integration in three dimensions, could lead to excessive street reserve requirements, leading to inefficient use of land.

The appropriate balance in this respect requires a sound understanding of the neighbourhood design objectives, the site and the detailed design of all aspects of street infrastructure, including:

- applying the Build-a-Street concept to identify opportunities where more/less space is required for street trees, or where land values dictate more intensive construction/maintenance practices are justified when considered against land costs;
- optimising the use of low volume, low speed streets to build active transport networks that are well connected and don't require separated facilities;
- optimising use of open space corridors and flood plains to provide connected principal cycle routes in terrain that is more likely to support grade separated crossings;
- incorporating traffic calming and crossing treatments to achieve low vehicle speeds where they are most effective to encourage walkable neighbourhoods;
- providing minimum kerb radii to increase space available for at source bio-pods (when required), whilst encouraging low speed turn movements; and
- acknowledging that there can be disbenefits to active transport when streets are over designed, so that the need for additional traffic or turn lanes is carefully justified.

The infrastructure must therefore be fit-for-purpose, readily maintainable and durable, and the planning and design of all infrastructure must be coordinated so that developable land is used efficiently.

Tip

Cycling infrastructure can add considerable width to street reserves, especially where it is combined with on-street parking. Where possible, avoid installing bike lanes on streets with parking as it is less safe and very space intensive. Plan cycle networks where possible to make best use of connecting low speed networks, providing facilities on streets without property frontages and integrating with linear parks.

1.4 SAFE SYSTEM DESIGN

The Safe System underpins the national road safety strategy in Australia. It is developed around the central premise of preventing crashes that result in death or serious injuries, while recognising that humans make mistakes, and crashes will occur.

Children, the elderly, and people with disabilities who walk, cycle or ride scooters/MMDs are more likely to make mistakes. These vulnerable users are prioritised, so they are not relied upon to make the system safe.

Objective

The Safe System addresses key elements of neighbourhood design, connecting pedestrian and cycle networks across streets and creating environments that make all users feel safe. Street design using the Safe System framework, is to ensure the physical tolerance limits of pedestrians, cyclists and riders of MMDs become the controlling factor, where desire lines interact with vehicle paths or streets, reinforcing the hierarchy to prioritise the needs of these more vulnerable users.

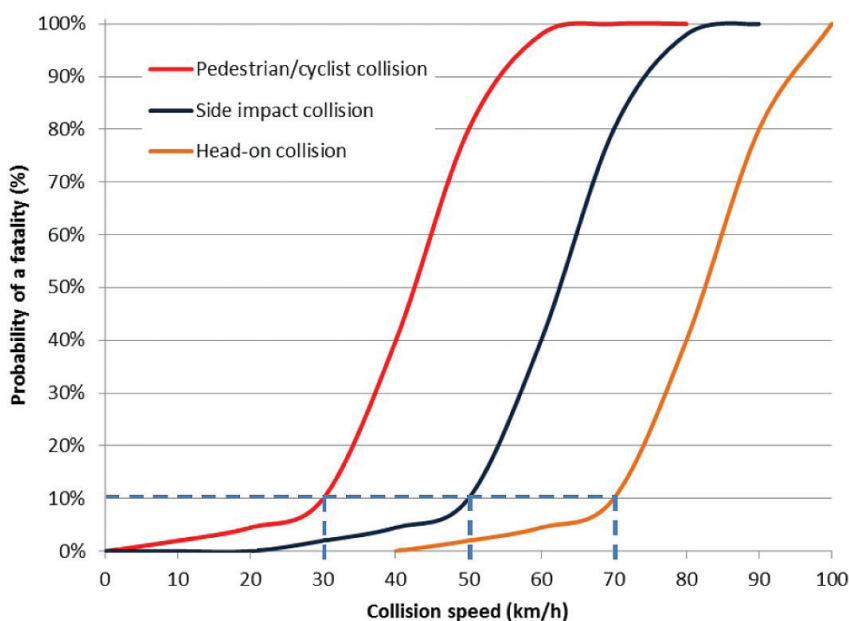
Ref: Austroads AP-R560-18 – Towards Safe System Infrastructure: A Compendium of Current Knowledge

Strategies

1.4.1 Safe System for Walkable Neighbourhoods

Design Safe Systems in the creation of Walkable Neighbourhoods with the following key considerations:

- streets reflect critical impact speeds for major crash types;
- transport infrastructure is designed to support appropriate speeds for a safe operating environment for all users;
- the intent and function of Infrastructure items are self-evident, forgiving, and protect all users from excessive crash forces. The carriageway is designed to reduce the risk and severity of crashes;
- the intent and function of streets and their components are self-evident and reinforce the priority of path users at driveways, crossings, intersections and side street crossings; and
- appropriate facilities for pedestrians, cyclists and riders of MMDs including physical separation (cycle tracks) where speeds are high and provision of appropriate crossing treatments.



Source: Jurewicz, Sobhani et al. (2015) and based on Wramborg (2005)

Figure 1.4.1 Relationship between collision speed and probability of a fatality for different crash configurations

[Source: Austroads AP-R560-18 – Towards Safe System Infrastructure: A Compendium of Current Knowledge]

1.5 BUILD-A-STREET

Objective

Provide a street reserve no wider than necessary, that caters for the needs of all users and achieves the functions of the street.

Strategies

1.5.1 Develop a Fit-for-Purpose Cross-section

Use the build-a-street concept to develop a cross-section that is the combined width of the verge and carriageway components. The total width of the street reserve should be fit-for-purpose and avoid using more land than necessary.

1.5.2 Seek opportunities to Share Space

When building a street, each component is considered, and then opportunities sought to share space where conditions are compatible.

Efficient use of space through sharing, while meeting the needs of all users creates more compact, vibrant streets that are better for walking.

Note

The “Build-a-Street” concept complements the conventional practice of “standard cross sections”.

Tip

In the process of building a street, the reserve width, verge width and carriageway (pavement) width should be developed using the relevant street and street design guidelines in this document, as well as other industry standards (e.g. Austroads, local authority standard drawings/design standards, Department of Transport and Main Roads (DTMR) technical notes/guidelines, Public Transport Infrastructure Manual (PTIM)) as appropriate source documents.

Practice Note 7 - Build-a-Street.

1.6 APPROPRIATE PROFESSIONAL INPUT

The detailed design of street infrastructure must involve a multi-disciplinary team with the appropriate skills, but with a heavy emphasis on civil engineering.

It is stressed that this manual is a guideline and not a standard. Certain aspects of the manual will require the application of professional engineering decision-making. Practitioners will be reminded that, in the use of the manual in Queensland, the requirements of the *Professional Engineers Act 2002* must be complied with in terms of the provision of professional engineering services.

2. ACTIVE TRANSPORT

Introduction

Active Transport represents transport by modes typically described as Pedestrians and Cyclists. Facilities for pedestrians should also be designed for people using mobility devices including wheelchairs, motorised mobility devices (MMD), scooters and skateboards/skates. Facilities for cyclists should also provide for people using electric bicycles, motorised scooters, motorised skateboards, and Segway style devices. Transport by all such means is typically described as Active Transport.

To encourage more sustainable transport patterns and to promote more walkable neighbourhoods, the provision of safe and convenient facilities for pedestrians and cyclists is of equal or higher importance to providing for the requirements of motor vehicles. In residential streets it may often be the primary consideration. The risks and benefits of increasing active transport in neighbourhoods are described in Figure 2.1. It should be noted, the risks apply mostly to active transport users, whilst the benefits are spread over the entire community.

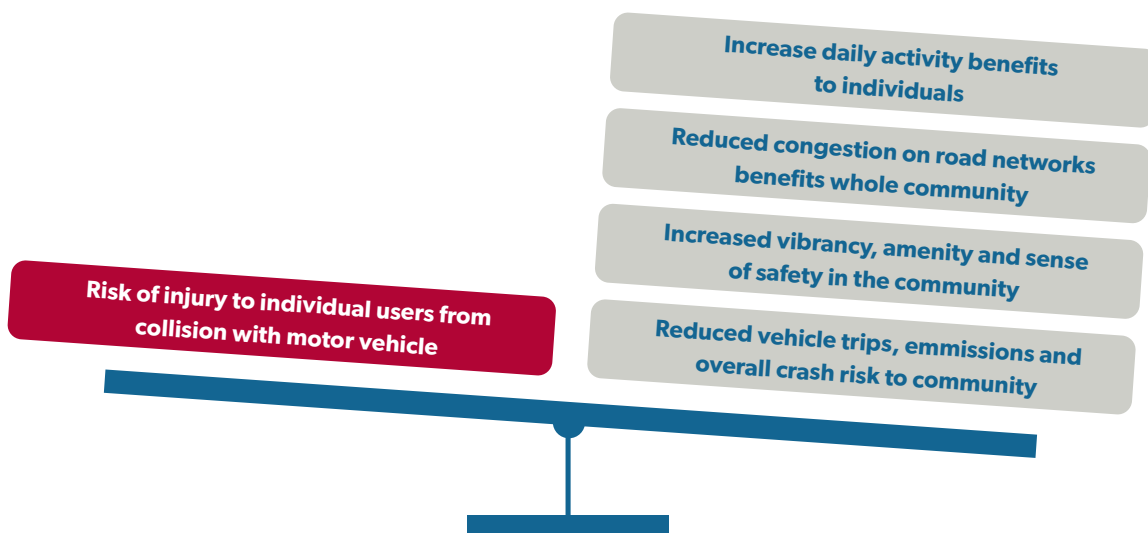


Figure 2.1. Benefits and risks of increasing walking and cycling

Pedestrian and cyclist facilities are important for those who do not have a motor vehicle, or choose not to use it, e.g. school children, the elderly, shoppers and commuters connecting to bus routes or railway stations.

Providing high quality walking and cycling infrastructure is a fundamental part of good neighbourhood design. This infrastructure should provide safe and comfortable access for people of all ages and abilities. See Figure 2.2 which shows different types of pedestrians.



Drive, catch public transport or are a passenger in motor vehicle



Push prams walk with children or are children



Run or walk, alone or with others, or with pets or recreation



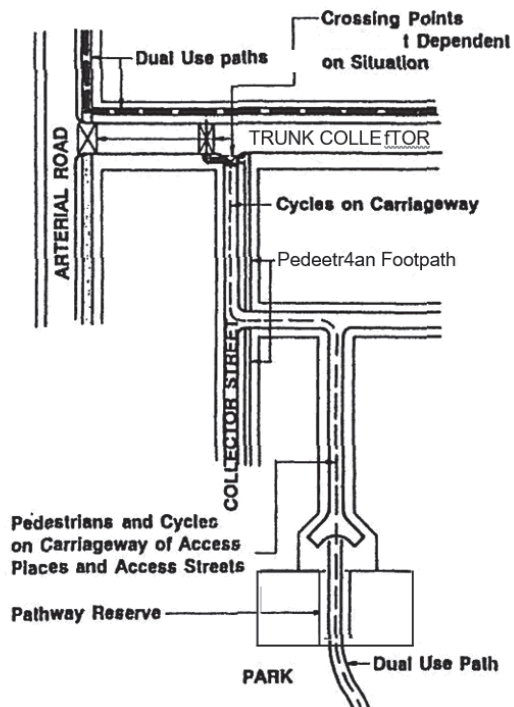
Go shopping, deliver goods, walk to work or walk to the shops at lunch time



People with disability who require wheelchairs, or mobility devices to get around

Figure 2.2: Types of Pedestrians

The development of safe and convenient active transport networks is a primary consideration in the design of contemporary residential neighbourhoods. To this end, the Safe System approach to street design aims to reduce speeds to a maximum of 30 km/h at points of potential conflict between vehicles and people, typically at street crossings.



PEDESTRIAN & CYCLIST SYSTEM TYPICAL COMPONENTS

Figure 2.3: Speed Reductions at Points of Conflict

2.1 PROVIDING FOR ACTIVE TRANSPORT MODES

Overview

Neighbourhoods should be welcoming places for everyone to walk, spend time and engage with other people. This assists health of the community through physical activity and social interaction.

People will choose to walk and cycle if these are at least as safe as vehicle trips and the most attractive options for them (direct and pleasant amenity). This means making walking and cycling and public transport use more convenient, pleasant and appealing than private car use, particularly for shorter trips within the neighbourhood (see Figure 2.1.1).

Streets need to be safe and easy to cross for all people. If any part of a journey is unsafe or too difficult, the trip is disrupted. This is called 'severance' and things such as physical barriers, lack of safe crossing points and fast-moving traffic all contribute.

Amenity impacts such as air quality and noise, as well as lack of vegetation and shade will discourage people from choosing active transport modes. Network planning serves to identify routes for different modes of transport, however it is the design of those routes that contributes to the success of that network planning.

Street environments and open spaces should be visually appealing to people walking and cycling, provide shade and shelter from rain and in hot weather.

Active transport facilities can be provided for pedestrians and cyclists either separately or shared.



Safe

- Active transport users are at least as safe as motor vehicle users, giving consideration to crash forces and their lack of protection compared to vehicle occupants
- Where vehicles and active transport users must share space at crossings, and in mixed environments, infrastructure is designed to enforce low vehicle speeds and inconsistent with other principles for creating a Safe System
- Active transport infrastructure is designed to keep children and people with disabilities safe



Connected

- Active transport network is more permeable than the vehicle network
- Pathways and mid-block treatments are connected with safe crossings
- Infrastructure is as close as possible to pedestrian desire lines
- Intersection or road treatments that form barriers in the network and create severance are avoided, or are carefully managed to provide more direct connections for active transport users



Convenient

- Streets can be easily crossed without delays
- Pedestrians can choose which side of the street they want to walk on
- Permeable networks
- Supported by casual surveillance from houses, recreation, other path users
- Maps and signage to make routes obvious



Conspicuous and attractive and comfortable

- Inviting environments on the street and in open space and parks
- Shade trees
- Appropriate width paths that allow people to pass and walk side by side
- Suitable path widths and horizontal and vertical geometry
- Street furniture where appropriate
- Activating open space areas with multiple active uses

Figure 2.1.1: Key elements of active transport infrastructure

Objective

Active transport networks should be more permeable than road networks by incorporating convenient connections to other streets and open spaces.

Tip

Provide additional pedestrian and cycle connections between streets and cul-de-sac open space to minimise pedestrian and cyclist travel distances, rather than having to follow the longer distances via the street system, where connectivity must be limited to prevent through traffic infiltration.

Objective

2.1.1 Pathway Reserves

Provide active transport connections between,

- the ends of culs-de-sac to other culs-de-sac, streets and open spaces/parks;
- all streets and open space/park areas; and
- from residential streets to major roads, attractors or destinations.

These connections should be provided via a continuation of road reserve (without continuing the carriageway). Pathway reserves should be sufficiently wide, well-lit, and have surveillance of the full length from each end, to comply with CPTED requirements.

Note

Pathway reserves should be designed as dual-purpose pedestrian and cycle routes for practical and economic considerations, however they may be shared paths or separated.

Tip

Pathway reserves may serve additional purposes, such as a location for stormwater drain lines, interconnecting water mains or other services, or as overland stormwater flow paths. However, in the latter case, care must be taken to ensure that the maximum depth and velocity of flow will not be a hazard to users.

2.1.1 Pathways in Open Space

Public open spaces/parks provide ideal locations for pedestrian and cycle paths, providing separation and safety from vehicular traffic, and providing high environmental amenity. Provide sufficient lighting and visibility for the security of users. Consider the likely users of each section of network to decide whether a shared pathway, or separate pedestrian and cycling facilities are required.

Tips

1. Paths around the perimeter of parks provide walking circuits but also consider convenient routes through parks to provide access to facilities (such as play equipment, etc) and to link to external routes either side of the park area.
2. Where principal cycle networks extend through parks and open spaces, these paths are likely to attract significant numbers of higher speed cyclists. These paths should be separated from pedestrian paths to provide a comfortable environment for both users, that promotes use of the space and avoids conflicts and future complaints.
3. Providing high quality, separate cycling facilities through open spaces helps to activate the space, by attracting more users. This can support better CPTED outcomes in areas which are not highly activated.
4. Increasing the width of a path from 2.5 m to 3.0 m effectively doubles the capacity of the path, reduces conflicts and reduces likelihood of future complaints.

2.2 PROVIDING FOR PEDESTRIANS

Overview

To design an appropriate pedestrian network, one early step is to undertake a walkable catchment analysis during development of the neighbourhood layout. This aims to identify the uses within, and external to, the catchment that would attract pedestrian demands and the time/distance to walk between the relevant locations (the typical volume of pedestrians should also be considered). A subsequent step is to develop the network of pathways to ensure that the time/distance on important routes does not discourage walking.

The permeability of the pedestrian network is an important factor in determining the accessibility of a public transport stop. The less permeable the network, the fewer places can be served within a given walking distance from a stop.

Analysis of catchment permeability can be made by calculating a 'pedshed'. This is a geospatial technique measuring distance from the stop based on street and other pedestrian networks. A percentage figure is calculated comparing the actual accessible area compared with the theoretical maximum based on a circular catchment. An acceptable minimum is considered to be 60%.

Note

For details of 'pedshed' analysis, refer to Queensland Transport's Interest in Planning Scheme (QTIPS) No 4: Planning for Movement Networks.

Objective

To provide for the safe and convenient movement of pedestrians throughout the development by providing sufficient pathways of suitable width to accommodate likely demands and encourage walking as an alternative to other modes. Design paths and crossings that are safe and facilitate ease of use by the most vulnerable street users including children, the elderly and people with disabilities. Paths are durable, slip-resistant, shaded and with a crossfall and gradient complying with recommended guidelines.

Notes

1. Provide pathways that are enticing, comfortable and shaded to encourage walking.
 2. Provide safe crossing arrangements at regular and appropriate locations on the road and street network, typically near intersections.
-

Strategies

2.2.1 Pedestrian Network

Ensure the design of pathways within the adopted network accommodates safe pedestrian use of the street system. Clearly delineate pedestrian space on higher trafficked streets.

Tip

Distance travelled is:

- vitally important to pedestrians;
 - slightly less important to cyclists; and
 - less important again to motorists.
-

2.2.2 Separate pedestrians from vehicles

Provide appropriately sized paths to provide for pedestrians on all streets, as shared use of street pavements (carriageway) (by vehicles and pedestrians) is not appropriate.

Tip

Ensure paths are connected by providing safe crossing treatments at intersections and on desire lines.

2.2.3 Pathways for pedestrians

Provide the appropriate number of paths within each street/corridor.

Notes

Provide paths on both sides of streets, or within a separate off-road corridor in the following situations:

1. for principal pedestrian routes;
2. for local pedestrian routes within 800 m of a major pedestrian attractor (rail or bus stations, major school, activity centres); and
3. for local pedestrian routes within 400 m of a minor pedestrian attractor.

2.2.4 Path Widths

Provide pedestrian path widths in accordance with the following typical minimum path widths:

1. 1.5 m for a low-use, low priority pedestrian corridor;
2. 2.0 m for a low-use, low priority pedestrian corridor where significant activity by users with a disability is anticipated; and
3. 2.5 m for a high-use, high priority pedestrian corridor.

Note

1. Best practice is to separate pedestrians from cyclists by providing a separated pedestrian facility. These should be provided on all high-use pedestrian corridors.
2. For shared pedestrian / cycle paths, total widths are typically:
 - 2.5 m absolute minimum for very low use, low priority corridor or on a route that has associated bike lanes that provide for more experienced riders;
 - 3.0 m is considered standard width for a shared path and should be the absolute minimum width applied in open space corridors, as it allows two users travelling in one direction to pass one user from the opposite direction without moving off the path; and
 - 4.0 m for a high-use, high priority corridor, though it is typically recommended that these facilities are delineated to provide 1.5 m for pedestrians and 2.5 m for bicycles.
3. For further detail on path widths, refer to relevant guidelines produced by Austroads and Department of Transport and Main Roads.

Tip

Even if paths intended only for pedestrians are provided, cyclists will inevitably use them if a separate cycling facility is not provided (and it is legal for them to do so).

2.2.5 Pathway Gradients and Crossfalls

Gradients on pedestrian paths should desirably not exceed 8% (maximum 12%), other than in constrained situations where no other alternative is feasible. Crossfalls on pedestrian paths should typically be in the range 2.0 - 2.5% (1.5% minimum crossfall may be acceptable provided there is sufficient longitudinal grade on the pathway).

Tip

Gradient is:

- vitally important to cyclists;
- slightly less important to pedestrians, and
- less important to motorists.

2.2.6 Pathway Surfacing

Construct paths using hard durable surfaces, typically being concrete or asphalt.

Note

For further detail on path construction (surface, gradient, crossfall), refer to IPWEAQ Standard Drawings, relevant local authority standards and/or guidelines produced by Austroads and Department of Transport and Main Roads

2.2.7 Pedestrian Facilities

Provide sufficient facilities for the comfort and convenience of pedestrians, particularly on principal routes.

Note

Facilities for pedestrians should include (subject to demand, user types, location):

- seating/rest stops;
- shade (including trees); and
- water fountains.

At destinations such as major parks, public transport stations and commercial centres, end-of-trip facilities are appropriate, including:

- shower/toilet facilities;
- personal storage lockers; and
- separation from cyclists on principal routes.

2.2.8 Street Trees

Ensure street/shade trees are planted adjacent to the pathway at an appropriate spacing to provide adequate shade (at an average of every 15 m on both sides of all street). Alignment of paths may need to be varied within the verge cross-section to preserve existing trees and other significant features and to add to visual interest.

2.2.9 Safe Crossings for Pedestrians

Provide safe pedestrian crossing facilities on all pedestrian desire lines, appropriate to the context and with consideration to vehicles speeds, complexity of crossing task and The Safe System principles. Where crossings are provided design for safety in accordance with Austroads Guidelines.

Notes

1. Use appropriate crossing facility types such as Signalised Crossing, Raised or speed enforced Zebra Crossings, Raised Priority Crossing, Pedestrian Refuge Crossing or School Crossing. Ensure adequate sight distance to and from pedestrian crossings.
2. For further detail on sight distance, refer to relevant guidelines produced by Austroads.
3. For further detail on crossing types (and their appropriate application), refer to relevant guidelines produced by Austroads and Department of Transport and Main Roads.



Figure 2.2.1: Zebra crossing where low vehicle approach speeds are enforced by speed cushions

2.2.10 Safe System for Crossings

Employ the Safe System approach and ensure vehicle speeds are reduced to a maximum of 30 km/h when designing crossing facilities.

Notes

Crossings of pedestrians across major roads must be carefully designed and consistent with Safe Systems so that these roads do not create major barriers for people walking (and cycling).

Tips

1. Grade separation by underpass or overpass removes the hazard entirely and should be incorporated into the design of major roads where they can achieve direct and comfortable connections for active transport users, with good surveillance opportunities.
2. For at-grade crossing of Arterial or Sub-Arterial roads, crossings should provide a level of service of no lower than C applying the Austroads Pedestrian Facility Selection Tool.
3. Central refuge islands, or median cut throughs may be appropriate for lower volume roads where speeds are already close to 30 km/hr or less.
4. Raised priority crossings or raised zebra crossings are appropriate where speed limits are up to 50 km/hr or at approaches to roundabouts.
5. At higher speed roads grade separation or signalised crossings are required.
6. signal-controlled intersections, pedestrian crossings must be provided on all legs of the intersection.

Note

The form of crossing to be provided should be discussed in advance with the relevant Road Authority.

2.2.11 Safe Crossing Facilities

Provide safe crossing facilities for active transport users (i.e. combined facilities for pedestrians and cyclists) that are appropriate to the street type, traffic volume and active transport volumes.

Tips

1. Assess the crossing point using the Safe System principles to ensure vehicle speeds are reduced to a maximum of 30 km/h.
2. On Access Streets no special provision may be required for pedestrian or cyclist crossing, so long as the infrastructure ensures a low speed environment (30 km/hr or less desirable) and volumes are low.
3. On Collector Streets, traffic speed and traffic volume usually justify a formalised pedestrian crossing.
4. On Major Collector Streets, a median or refuge of 2.0 m minimum width within the carriageway will greatly assist safe crossing of the street but does not achieve a Safe System outcome.
5. Where major pedestrian or cycle routes cross a Major Collector Street, it is desirable to create a lower speed environment to support the crossing. This can be achieved with a raised priority crossing and may also include a refuge/build outs to further narrow the crossing. These types of treatments can be used on streets with a speed limit up to 50 km/hr.
6. Slow Points in the network should be designed to align with pedestrian and cyclist crossing points and include pedestrian crossings.
7. Where mid-block pathways (pedestrian, cycle or dual-use) intersect with higher trafficked streets, physical barriers to prevent pedestrians or cyclists from directly crossing the street will assist safe crossing.

Example Crossing Treatments:



Figure 2.2.2 - Example Crossing Treatment – Raised priority Crossing

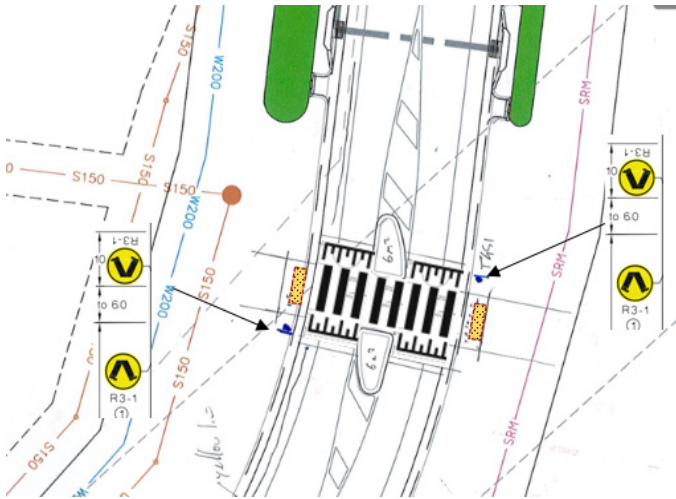


Figure 2.2.3 Cycle Infrastructure

2.3 PROVIDING FOR CYCLISTS

Overview

To design an appropriate cycle network, the first step is to identify key destinations within and external to the neighbourhood. As part of this, consideration should be given to the time/distance to cycle between relevant locations, as this may influence the cyclist/user type. A second step is to develop the network of cycle routes to ensure that the time/distance on important routes does not discourage cycling. A third step is to identify the appropriate type of facility based on such criteria as user types, volumes and adjacent road/street.

Objective

Provide constructed cycle routes appropriate to accommodate the cycle desire lines and demands, relative to hierarchy, Level of Stress, street speed and traffic/cycle volumes.

Notes

- Provide the type of cycle facility appropriate for each situation.
 - Recognise that cyclists (and pedestrians) are not compatible with motor vehicles on the Major Road system, where the higher volume and higher speed of vehicular traffic results in much greater risk for the cyclist (and pedestrian), and to provide for their safe interaction on these higher trafficked roads.
 - Provide constructed cycle lanes and/or paths at the appropriate width to accommodate the cycle hierarchy and demands.
 - Design cycling routes to facilitate ease of use by the full spectrum of users. As a minimum they should provide for users between the ages of 8 and 80. This requires that each route has a facility capable of providing for a cyclist travelling at 30 km/hr, as well as young children. Cycle tracks generally provide for all cyclists, whilst shared paths generally need to be accompanied by an on-road facility (bicycle lanes, or low speed/low traffic environment).
 - Path construction is to be durable, slip-resistant, with a crossfall and gradient complying with recommended guidelines.
 - Provide cycle paths/lanes and facilities that are enticing, comfortable, safe and convenient in order to encourage cycling as an alternative to other vehicle modes.
 - Provide safe crossing arrangements at regular and appropriate locations on the road and street network, typically near intersections.
-

Strategies

2.3.1 Level of Traffic Stress

Identify desirable and absolute Level of Traffic Stress (LTS) for bicycle riders corresponding to the chosen hierarchy of cyclist routes (in mid-block sections and at intersections).

Notes:

The LTS is analogous to levels of 'comfort' and 'satisfaction' for the users based on the road/street function and the cycle facility type, generally as follows:

- LTS 1 – Most children can feel safe riding on this facility;
- LTS 2 – The mainstream 'interested but concerned' adult population will feel safe riding on this facility;
- LTS 3 – Riders that are 'enthused and confident' will still prefer to use this facility; and
- LTS 4 – Very experienced and confident riders may use this facility, despite high speed limits, multiple travel lanes, limited cycle facilities.

Apply empirical LTS assessment to facility type, modal segregation (pedestrians, bicycle riders) and on-street (carriageway) or off-street facilities. This may ultimately inform the width of such facilities.

Correlate the cycle network hierarchy to Level of Traffic Stress (LTS) criteria for cyclists as recently developed by DTMR (note - this is not yet published).

2.3.2 Type of Cycle Facility

Identify the type of cycle facility necessary to accommodate the appropriate:

- volume of users (one way and passing);
- type of users (children, confident);
- function/purpose (commuter, recreation);
- hierarchy (level of importance); and
- Level of Traffic Stress (LTS).

Notes

The following types of cycle facilities on particular street types/road hierarchy can be used as a guide:

- Off-road path – can achieve LTS 1 or 2;
- Access or Local Access street with shared path or no facility – can achieve LTS 2 or 3;
- Collector street (with parking and driveways) with shared path or cycle lanes – can achieve LTS 3;
- Major Collector street (with no parking and no driveways) with shared path or cycle lanes – can achieve LTS 2 or 3;
- Major Collector street (with no parking and no driveways) with cycle track – can achieve LTS 1;
- Sub-arterial or Arterial road (with no parking and no driveways) with cycle lanes, and no more than 60 km/h operating speed – can achieve LTS 3;
- Sub-arterial or Arterial road (with no parking and no driveways) with shared path – can achieve LTS 2; and
- Sub-arterial or Arterial road (with no parking and no driveways) with cycle track – can achieve LTS 1.

Road function	Vehicle operating speed (km/h)		Cycle tracks appropriate?	Explanation
Access function for example, local access street (with or without parking)	Up to 30 km/h		No	Mixed traffic is appropriate in low-speed environments, including cycle streets and advisory bicycle lanes.* Cycle track with limited vehicle access may be appropriate (refer Section 3.2.4)
			Maybe	Bicycle lanes or cycle tracks are preferred on a primary bicycle route.
Collector function for example, minor collector	Up to 50 km/h	No kerbside parking		Bicycle lanes with no parking or cycle tracks are suitable.
		With kerbside parking	Yes	Cycle tracks preferred over bicycle lanes due to door zone conflicts (refer Section 3.4.1)
Through traffic function for example, arterial road or trunk collector	More than 50 km/h		Yes	High-quality parallel off-road separated or shared path or cycle tracks preferred over bicycle lanes due to high speed difference of <20 km/h or more
Regional through traffic function for example, urban motorway	More than 70 km/h		No	High-quality parallel off-road separated or shared path with grade separated, signalised or priority crossing at intersections is appropriate.

* Refer to Transport and Main Roads' Supplement to Austroads Guide to Traffic Management Part 8 Local Area Traffic Management, Traffic and Road Use Management (TRUM) Manual Volume 1 Part 8.

Table 2.3.1: Urban road bicycle facility selection depending on road function
Source: TMR, Selection and design of cycle tracks, 2019

2.3.3 Access Streets/Places

Within Access Places and Access Streets, design for cyclists on-street due to the low traffic volume and low design speed. The verge cross-section should allow for construction of a footpath on at least one side of all access street types.

Tip

Special provision is generally not required for cyclists to safely share the carriageway with motor vehicle (on Access Streets or Access Places).

2.3.4 Collector Streets

Within Collector Streets, the higher traffic volume and higher traffic speed typically necessitates the provision of cycle lanes or a dedicated cycle facility (cycle track, cycle path or dual-use (pedestrian and cycle) path) within the verge on at least one side. The verge cross-section should allow for construction of a pedestrian footpath on both sides of all Collector Streets and above.

2.3.5 Major Roads

Where cycle (and pedestrian) routes follow Major Roads, provide:

- **Cycle tracks** provide for users of all ages and abilities. One-way cycle tracks on each side of the road are preferred as safe intersection treatments can more easily be provided. Two-way cycle tracks work very well in areas where there are limited intersections on one side of the road;
- **Shared paths** are suitable where very low volumes of pedestrians are expected and there are no conflicts with driveways;
- **On-road cycle lanes** must be used in conjunction with shared paths to provide for less experience riders. They should generally be avoided in areas with on street parking or where speeds exceed 60km/hr; and
- Separate off-carriageway cycle paths with appropriate crossing facilities.

Tips

1. *The cycle network plan should consider the suitability of on-road or off-road cycle paths, as well as shared paths. Refer Element 2 of Part 1 for development of network plans.*

2.3.6 Cycle Facility Widths

Provide suitable widths for cycle facilities to cater for the projected volume and user type.

Cycle lane widths (no adjacent parking) are typically:

- 1.5 m minimum for a low-use, low priority cycle corridor on a low speed (no more than 50 km/h) street; and
- 2.5 m for a high-use, high priority cycle corridor on a low speed (no more than 50 km/h) street.

Cycle track (separated cycle track) widths are typically:

- 2.0 m minimum for a one-way low-use, low priority cycle corridor;
- 3.0 m for a one-way high-use, high priority cycle corridor;
- 3.0 m minimum (or 2.4 m in constrained locations) for a two-way low-use, low priority cycle corridor; and
- 4.0 m for a two-way high-use, high priority cycle corridor.

Cycle pathway widths are typically:

- 2.5 m minimum for a low-use, low priority, local cycle corridor (1.5 m for a one-way path);
- 3.0 m minimum for a regional cycle corridor; and
- 4.0 m minimum for a high-use, high priority, regional cycle corridor (2.0 m for a one-way path).

For shared pedestrian / cycle pathways, total widths are typically:

- 2.5 m minimum for a low-use, low priority corridor; and
- 4.0 m for a high-use, high priority corridor.

Cycle lanes adjacent to parking lanes, total widths are typically:

- 1.5 m bike lane, plus 0.4 m buffer zone plus 2.1 m for parking for minimum volume for a low volume cycling facility on collector street (no more than 50 km/h) street. Note, this facility will not provide for less experienced riders and must also be accompanied by a shared pathway facility (minimum width 2.5 m); and
- 4.5 m for a high use, high priority cycle corridor on a low speed (no more than 50 km/h) street. Note, this facility would also need to be accompanied by a shared pathway to provide for less experienced bike riders. Given this, it is more space efficient to provide a cycle track that provides for all bike riders, and a separate pedestrian path (1.5 - 1.8 m wide).

Note

Cycle facilities (including widths) should be designed using guidance provided by IPWEAQ Standard Drawings, Austroads Guide to Road Design and Department of Transport and Main Roads "Guideline: Selection and design of cycle tracks".

2.3.7 Gradients and Crossfalls

Gradients on principal cycle paths (or cycle tracks) should desirably not exceed 1.5%, other than in constrained situations where no other alternative is feasible (see below for further guidance). Crossfalls on cycle paths (or cycle tracks) should typically be in the range 2.0-2.5% but may be slightly higher on asphalt surfaces in some situations.

Note

Maximum longitudinal gradient of cycle paths to be no greater than any adjacent street pavement. Steeper gradients than 1.5% may be provided where the length of the steeper section is limited, as follows:

- 2% for 450 m maximum;
- 5% for 90 m maximum; and
- 10% for 30 m maximum.

2.3.8 Construction Materials

Construct pathways using hard durable surfaces, typically being concrete or asphalt.

Note:

For further detail on path construction materials, refer to relevant guidelines produced by Austroads and Department of Transport and Main Roads.

Tip

Constructing separated cycling facilities from asphalt or dark pavement, makes them look more similar to the street carriageway, making them less likely to be used by pedestrians.

2.3.9 End of Trip Facilities

Provide the necessary and appropriate end of trip facilities at major public transport stations and key land uses. End of trip facilities for cyclists should include (subject to demand, user types, land use types):

- Bike lockers.
- Bike racks;
- Shower/toilet facilities;
- Personal storage lockers;
- Water fountains; and
- Bike maintenance facilities.

Ensure that land uses with such facilities have good quality direct access to/from major cycle routes.

2.3.10 Cycle Crossings

Where cycling facilities intersection with roads, crossings should be provided consistent with the Safe System and Austroads Guidelines. See Sections 2.2.9 and 2.2.10 for guidance.

Note

For further detail on crossing types (and their appropriate application), refer to IPWEAQ Standard Drawings, relevant guidelines produced by Austroads and Department of Transport and Main Roads (e.g. "Guideline: Selection and design of cycle tracks" and "Raise Priority Crossings for Pedestrian and Cycle Paths").

Tip

Cycle lanes, tracks or paths on major roads should have the same priority across side roads as the major road. Treatments to support this include:

- signalised intersection treatments where pedestrian/cyclist crossings rest on green;
- raised Priority crossings at side roads for cycle tracks or cycle paths;
- incorporating high quality intersection treatments for cycling facilities consistent with TMR "Guideline: Selection and design of cycle tracks"; and
- grade separation where it provides direct and convenient access to networks.

Facility	Example
<p>Footpaths are designed to be used by pedestrians, including those with a disability, and by low speed cyclists (typically children). Footpaths are only appropriate if there is an alternative cycle route that provides for cyclists with a broad range of abilities.</p>	
<p>Pathways adjacent to roads or shared pathways are designed to accommodate pedestrians, including those with a disability and cyclists of varying abilities. The types of cyclists who use pathways varies, according to the pathway location, time of day, alternative on road route options and the pathway design.</p> <p>Shared pathways are unlikely to provide for all cyclists in urban areas and should usually be accompanied by an on-road facility.</p>	
<p>Extended pathways away from the roads can provide for a greater variety of cyclists, as riders do not have to slow down for driveways and frequent intersection crossings.</p>	
<p>Bike Lanes define a dedicated space for cyclist on roads and streets. They are defined by white bicycle symbols and a white edge line. They are more commonly used by experienced and confidence cyclists.</p>	

Facility

Low speed, low traffic streets, depending on traffic volumes, may be used by less experienced, through to experienced cyclists.

Example

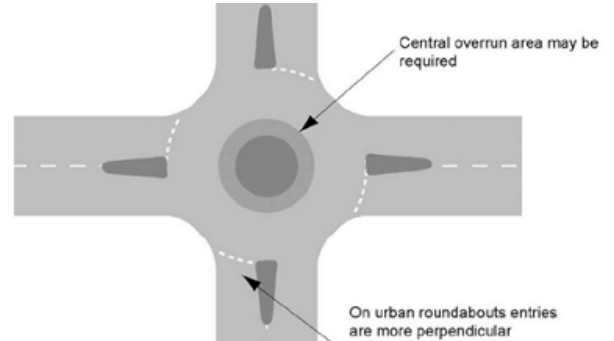


Separated bike lanes, can provide inexperienced through to experienced cyclists if they are installed along with appropriate intersection treatments.

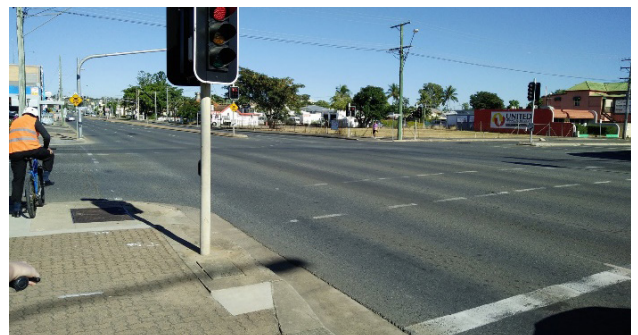


Low Speed Intersection Designs

Intersections, specifically high-speed roundabouts have been identified as places in the network that make people feel unsafe. TMR Cycle Note 136 provides guidance on ways to address issues at roundabouts and emphasizes the importance of managing entering traffic speeds.



Signalised intersections Provide opportunities for vulnerable road users to cross major roads and streets.



Facility	Example
<p>Grade Separated Intersections:</p> <ul style="list-style-type: none"> • in lieu of two-lane roundabouts; • where terrain dictates them as a logical solution; or • for railway crossings. <p>Good practice to include in road design when roads are raised or lowered.</p>	
<p>Crossings can be used in conjunction with local area traffic calming to create low speed, pedestrian and cycle friendly environments. Integral to improving permeability of the network.</p>	
<p>Refuges and Splitter Islands slow down vehicle turn movements, reduce crossing distances, break down cognitive load for pedestrians and provide physical protection. Important consideration at unsignalised intersections between higher and lower order streets.</p>	
<p>Bicycle Awareness Zones (BAZ) in low speed environments or on narrow bridges. These are used to raise awareness of cyclists and encourage cyclists to claim the lane in areas where there is insufficient room for a vehicle to pass safely.</p>	



Facility	Example
<p>End of Trip Facilities, may be required to enable people to commute to workplaces.</p> <p style="text-align: right;"><i>Source: www.pflspaces.com</i></p>	
<p>Signage is particularly useful in drawing riders attention to on road cycle routes, or routes that contain both on road and off road segments.</p>	

Figure 2.2.5: Types of Cycling Infrastructure



3. PUBLIC TRANSPORT

Overview

Access to public transport is an integral part of creating a walkable neighbourhood. During the neighbourhood planning phase, consideration is given to the location of bus routes internal to the street system and/or on the adjacent road system.

Key requirements of the design of neighbourhood streets are:

- accommodate buses on nominated routes by providing carriageway (pavement) widths that can accommodate bus movement while minimising or avoiding delays to street users;
- include a continuous accessible path of travel on every street that enables people of all ages and abilities convenient and safe access to public transport services; and
- provide bus stops that are accessible and minimise disruption to the other street movement functions.

While most neighbourhoods will not have direct access to mass transit modes of public transport such as trains, light rail, busways, etc, connectivity to these options (if available) should be considered as part of the active and public transport network.

3.1 BUS ROUTES

Objective

To provide bus routes on the appropriate category of roads and streets in the hierarchy, to enable an efficient bus service/timetable. Bus routes should:

- have carriageway (pavement) widths that can accommodate bus movement while minimising delays; and
 - locate bus stops to be safe and accessible while minimising disruption to the other street movement functions.
-

Strategies

3.1.1 Bus Route Network

Apply an appropriate philosophy for the bus route network, for example:

Local or Neighbourhood bus routes should typically be on collector streets;

Secondary bus routes should typically be on collector streets and above; and

Principal bus routes should typically be on major collector streets and above, or within a separate road corridor.

Notes

1. *Bus route selection should be done in consultation with Translink.*
 2. *Timetabling and bus service efficiency is generally set by Translink.*
 3. *Where relevant (typically for high volume routes) the road carriageway should accommodate bus priority measures (e.g. bus lanes, bus queue jumps) to ensure the efficiency of public transport (refer to Translink requirements for warrants to guide priority measures).*
-

3.1.2 Accessibility for Buses

Provide a street cross-section such that there is a clear width for two-way travel of moving vehicles (at low speed). Accessibility for buses can be achieved when:

- the likelihood of on-street parking and the width of streets does not prejudice/constrain the passage of buses;
- any necessary traffic control devices (e.g. roundabouts, LATM) are designed/installed to accommodate buses; and
- bus stops are designed/positioned:
 - on a straight section of street, away from horizontal/vertical curves;
 - where a suitable crossing point exists; and
 - such that when a bus is stopped there is a clear width for at least one travel lane for passing traffic.

Notes

1. *Design Collector Streets for buses to comfortably navigate the street environment.*
2. *Collector Streets should be designed to cater for buses to accommodate future changes to bus routes.*
3. *On Collector Streets, the clear width should accommodate two-way travel of moving vehicles (at low speed i.e. below 40 km/h).*
4. *On Major Collector Streets, the clear width should accommodate two-way travel of moving vehicles (at the posted speed).*
5. *Bus stops are generally in an indented bus bay or within a marked kerbside lane/bay, with the following typical dimensions:*
 - *3.5 m for an indented bus bay; and*
 - *3.0 m for a bus bay within a marked kerbside lane/bay.*
6. *Bus bays should be designed to meet Translink requirements - use the Queensland Public Transport Infrastructure Manual as the basis for design.*

Tips

1. *Bus drivers regularly use the shoulder, particularly off-peak, to improve passenger comfort. Designing geometry that is comfortable for buses eliminates the need to do this.*
2. *Limit the use of vertical speed control devices on bus routes, such as speed platforms, except for speed cushions – speed cushions and bus-friendly flat tops maintain passenger comfort. Rubber speed cushions can be trialled and easily removed for resurfacing.*

3.2 PEDESTRIAN ACCESSIBILITY

Objective

To accommodate bus routes within neighbourhoods and to include a continuous accessible path of travel on every street that enables people of all abilities to use the public transport services in a safe and convenient manner.

Strategies

3.2.1 Walkable Access

Provide neighbourhood layouts and bus routes, so that at least 90% of residents are within 400 m of the bus route, with a network of cycle and pedestrian facilities and pathways to connect with bus stops and major public transport stations.

Note

Where relevant, provide neighbourhood layouts, so that generally 90% of residents are within 800 m of a major public transport or mass transit stop (busway, rail, etc).

3.2.2 Parking and End-of-Trip Facilities

Where appropriate, provide Park-n-Ride and Kiss-n-Ride facilities at major public transport or mass transit stations, as well as end-of-trip facilities (subject to demand and user types):

Note

End of trip facilities may include:

- bike lockers.
- bike racks;
- shower/toilet facilities;
- personal storage lockers;
- water fountains; and
- bike maintenance facilities.

Tip

Provide sufficient facilities for the comfort and convenience of pedestrians, particularly on principal routes to/from major public transport stations, including seating, rest areas, shade and water fountains.

3.3 BUS STOP INFRASTRUCTURE

Objective

To provide bus stops and pedestrian accessibility such that residents have safe and convenient access to bus services. Bus stops should be located to maximise accessibility, performance, and safe crossing opportunities, along with the provision of bus stop kerbing that complies with accessibility requirements and the Public Transport Infrastructure Manual.

Strategies

3.3.1 Bus Platforms and Facilities

Ensure the bus platform height allows for easy ingress and egress to buses and is designed for the comfort of users.

Note

Bus stops and associated infrastructure such as signage, timetable information, shelter and seating should be designed to meet Translink requirements - use the Queensland Public Transport Infrastructure Manual as the basis for design.



Figure 3.3.1: Indicative residential bus stop concept. Source: Public Transport Infrastructure Manual, Department of Transport and Main Roads, Chapter 5 – Bus stop infrastructure, June 2020

Tips

1. At bus stops, use minimum 150 mm barrier kerb.
2. Barrier kerb and channel that is 200 mm or 250 mm allows easier ingress and egress and means that buses do not need to kneel. Low floor buses generally can kneel at stops to improve accessibility. An example of higher barrier kerb is at the Broadbeach South station in BROADBEACH QLD.
3. The Brisbane City Council standard drawing BSD-3216 is a good example of a bus capable speed platform.

3.3.2 Bus Stop Locations

Locate bus stops where the walkable catchment is maximised, services are not delayed, and on the downstream side of pedestrian crossings or signalised intersections. Consider the bus stop types described in Table 3.3.1.

Bus stop types	Description
Bus stop bays	Bus stop bays may be suitable for roads that are 60 km/h or higher where located on the far side of a signalised intersection. They may also be used where the bus stop is a timing point, a bus driver change-over point, or at locations where loading can take several minutes.
Kerbside bus stops	Kerbside bus stops require enough clearance front and back to manoeuvre in and out of the shoulder.
In-lane bus stops	In-lane bus stops take up less kerbside space and momentarily hold up general traffic flow. They provide more kerbside car parking and allow buses to depart the stop without waiting for general traffic to give way.

Table 3.3.1: Description of bus stop types

4. MOTOR VEHICLES

4.1 TRAFFIC VOLUME

Objective

To understand likely traffic volumes throughout the street network and ensure the application of appropriate street types within the neighbourhood.

Strategies

4.1.1 Undertake a traffic analysis

Undertake a traffic analysis to estimate the motor vehicle traffic volumes in each section of each street in the network.

4.1.2 Adopt appropriate traffic generation rates

Use appropriate traffic generation rates for each land use within the neighbourhood.

Tip

The generation rates used must be regarded as being appropriate by professional traffic engineers and may vary from the typical generation rate referred to in the table below.

Parameter	Laneway	Local Access	Access	Collector		Major Collector	Sub- Arterial	Arterial
				< 6,000	< 7,500			
Typical max. volume (vpd ¹)	< 400	< 1,000	< 3,000	< 6,000	< 7,500	< 10,000	< 30,000	> 20,000
Direct residential lot access for vehicles	Yes	Yes	Yes	Yes ²	No ²	No	No	No
Indicative range of reserve widths (m)	6.5 – 8.0	13.5 ³ – 15.5	15.5 – 16.5	18 – 20		20 – 25	20+	25+
Desired max. length (m)	140	250 ⁴	250 ⁴	n/a		n/a	n/a	n/a
Intersection spacing min. (m)	n/a	40	40	60 – 100		100	200 – 300	300 - 500
Pedestrian paths	Shared	One side	One side ⁵	Both sides		Both sides	Both sides	Both sides
Cycle paths, either • Cycle lanes on carriageway • Off carriageway shared paths • Separated cycle track	Shared No No	No ⁶ No ⁶ No ⁶	No ⁶ Yes ⁷ Possibly ⁷	Yes ⁷ Yes ⁷ Yes ⁷		Yes ⁷ Yes ⁷ Yes ⁷	Possibly ⁷ Yes ⁷ Yes ⁷	Possibly ⁷ Yes ⁷ Yes ⁷
Bus route	No	No	No	Possibly		Likely	Yes	Yes
Street trees	Possibly	Both sides	Both sides	Both sides		Both sides	Both sides	Both sides

Notes

- A. *The street category should be determined by the function it performs and not just the motor vehicle traffic volume.*
- B. *The determination of the appropriate type of cycle path and its dimensions should be the outcome of an analysis of the types and volumes of cyclist activities and the motor vehicle speeds in the street.*
- C. *Street trees should be provided at an average spacing of 15 m to both sides of every street but not laneways.*
 1. *For concept planning purposes, a guide for traffic generation is a rule is 8 vpd/dwelling. (The historical rate of 10 vpd/dwelling has proved overly conservative for neighbourhood planning).*
 2. *Direct vehicle access from residential lots is typically acceptable up to 6,000vpd. Above this traffic volume, direct access might be acceptable depending on the number of driveways, parking, and moving lane configuration. Usually, no direct access is appropriate where traffic volumes exceed 7,500vpd.*
 3. *Local access street reserves of 13.5 m with narrower carriageways of 5.5 m are suitable for local access streets for up to 50 contributing lots, providing traffic volumes are low and there is low potential for conflict between lot access/egress and on-street parking (e.g. few narrow frontage lots). For greater than 50 contributing lots a carriageway width of 7.5 m is recommended.*
 4. *For Local Access and Access streets, this refers to block length to achieve good pedestrian access.*
 5. *Unless required as part of the pedestrian movement network or in the near vicinity of community facilities, parks, or schools where footpaths both sides are appropriate.*
 6. *Unless required as part of the cycling movement network or in the near vicinity of community facilities, parks, or schools where the circumstances indicate this is a preferred solution.*
 7. *Dependent upon the desired lines, cycle hierarchy plan road speed and estimated pedestrian and cyclist demand.*

Table 4.1.1: Typical Road and Street Concept Design Parameters (Part 1 Table 2.1)

4.1.3 Volumes for Street Type

Ensure the traffic volumes in each street do not exceed the typical maximum daily volumes for the nominated street type in Table 4.1.1 above, unless a traffic report demonstrates to the approving authority that higher volumes are acceptable for that street.

4.2 VEHICLE SPEEDS

Objective

To ensure motor vehicle speeds are consistent with a speed environment for each street type that encourages walking and cycling and allows all users – pedestrians, cyclists and motorists – to proceed safely and without unreasonable delays.

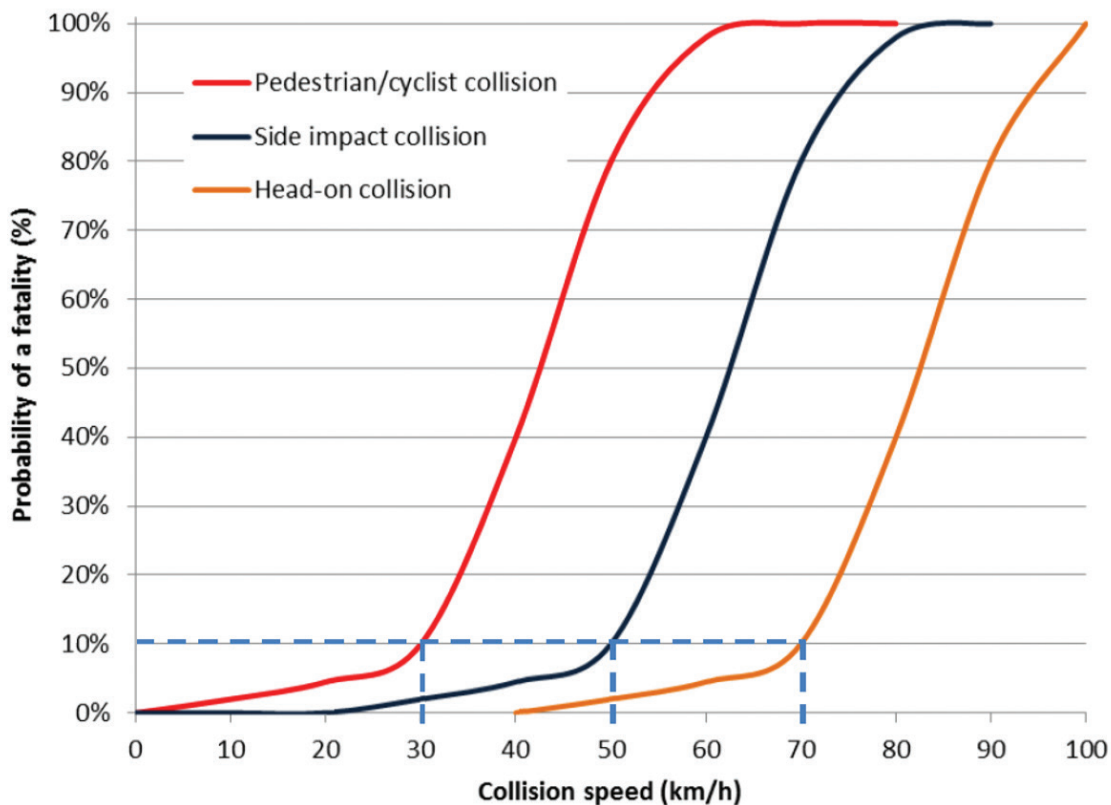
Strategies

4.2.1 Apply Safe System Principles

Apply the Safe System approach to the planning and design of street infrastructure wherever vehicles and other street users share the same space. The Safe System acknowledges street users will continue to make mistakes and that mistakes should not result in death or serious injury.

4.2.2 Vehicle Speed – Road Trauma Relationship

The planning and design of street network and infrastructure should have regard to the effect of motor vehicle speed on the potential survivability of death or serious injury in the event of a crash. This is illustrated in Figures 4.2.1 and 4.2.2



Source: Jurewicz, Sobhani et al. (2015) and based on Wramborg (2005)

Figure 4.2.1: Relationships between collision speed and probability of a fatality for different crash configurations – Source: Austroads Research Report AP-R560-18, Towards Safe System Infrastructure – A Compendium of Knowledge

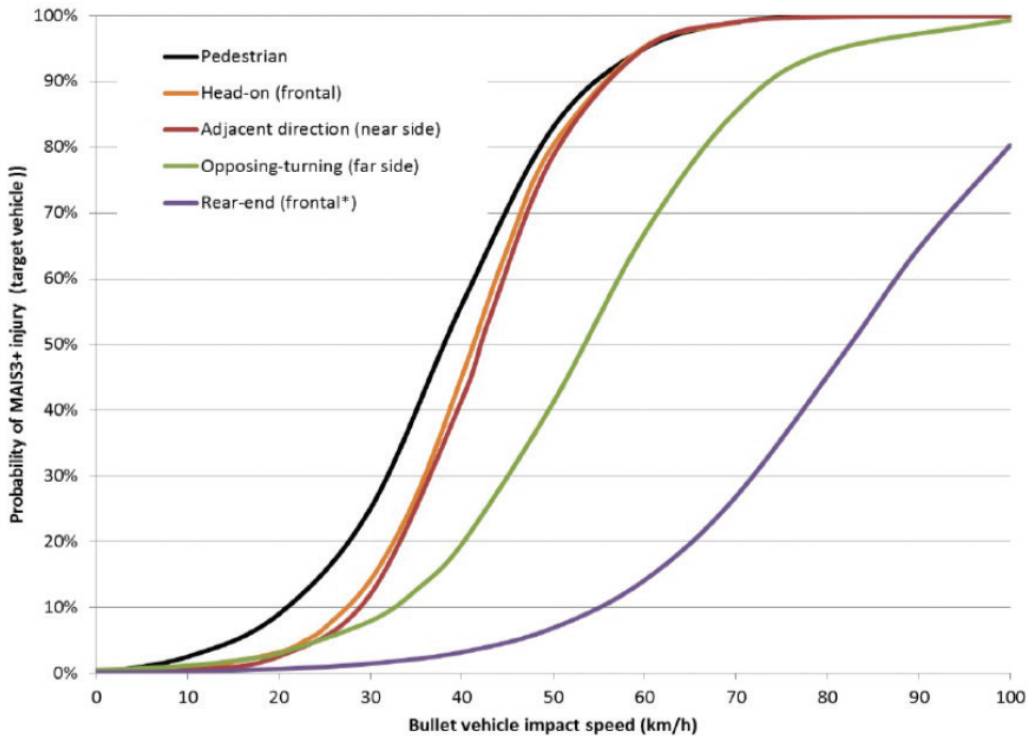


Figure 4.2.2: Relationships between bullet vehicle impact speed and probability of a MAIS 3+ injury to a target vehicle occupant for different crash configurations. Source: Austroads Research Report AP-R560-18, Towards Safe System Infrastructure – A Compendium of Knowledge

Notes

These figures illustrate the importance of motor vehicle speeds on pedestrians and cyclists in the event of a crash, as well as the influence of crash angle between motor vehicles. The kinetic energy that must be dissipated in a crash is dependent on vehicle mass and the square of the speed. The crash angle affects the relativity of the vehicle speed and the kinetic energy to be dissipated. The figures also demonstrate that motor vehicle occupants are more protected than pedestrians and cyclists because some kinetic energy dissipation occurs within the motor vehicle itself.

Motor cyclists represent another vulnerable group who are extremely over-represented in road trauma statistics relative to their number and distances travelled. The speed of the motorcycle, whether isolated or in crashes involving others, and the speed other vehicles involved in a motorcycle crash be important influences on the outcomes of motorcycle crashes.

4.2.3 Benefits of lower speeds

The planning and design of street networks and their infrastructure should have regard to the range of benefits of reducing motor vehicle speeds on the actual and perceived traffic safety on pedestrians and cyclists, particularly those that are more vulnerable.

Tips

As well as improving the amenity of streets for all users, some of the traffic safety benefits of reducing motor vehicle speeds include:

- *vehicle braking distances;*
- *better pedestrian crossing opportunities;*
- *improved ability to judge vehicle speeds (in particular young children);*
- *improved peripheral vision for drivers; and*
- *reduced stress levels.*

Refer also to Austroads: Guide to Traffic Management Part 8: Local Street Management

4.2.4 Design Speeds and Target Speeds

Apply Target and Design Speeds appropriate to the street type and location.

The concept of Target Speed for street design is intended to represent the speed environment desired to be achieved in the street. On the other hand, the Design Speed is the speed used for the safe design of street geometry.

The following are definitions of those speed parameters and related speed parameters.

Speed Limit:

The Speed Limit is the regulated speed limit (i.e. not to be exceeded by law) for the relevant section of the street. If a speed limit sign does not exist, the default speed limit for urban streets is 50 km/h.

Target Speed:

Target Speed is the desired maximum speed at any location in a street.

Design Speed:

Design Speed is the chosen speed for the geometric parameters used in the safe design of street infrastructure elements. It must be based on the 85th percentile free-flow vehicle speed that is expected to occur.

Even though the Design Speed may be the same as the target speed, it is inappropriate to assume they will be the same. The street layout may not achieve the (desired) Target Speed and therefore the detailed geometric design should be based on the appropriate Design Speed for that location.

Tip

Although the single Design Speed is usually adopted along a specific section of street, there is no reason why different Design Speeds cannot be used for the safe design of geometric elements at different locations, providing there is a sound technical basis for doing so.

4.2.5 A supportive street environment

Control vehicle speeds by ensuring every aspect of the streetscape strongly reinforces to motorists that it is a residential neighbourhood.

Note

The supportive streetscape character requires the appropriate combination of streetscape elements. Some streetscape elements that can assist include:

- extensive planting of canopy street trees creating a sense of enclosure;
- tight distances between the built form – houses built close to the street and tight street reserve widths;
- active transport infrastructure reminding motorists of the likely presence of pedestrians and cyclists;
- on-street parking;
- appropriate intersection treatments;
- carriageway pavement cues – texture change, colour contrast, threshold treatments;
- minimising the clutter of traffic signage and linemarking;
- aesthetic treatments of hard landscaping and street furniture;
- short lengths of straight street sections; and
- tight curves in the street alignment.

4.2.6 Regulatory Speed Signage

Provide regulatory speed signage where it is necessary to reinforce the desire to achieve Target Speeds below the default speed limit (50 km/h).

Tips

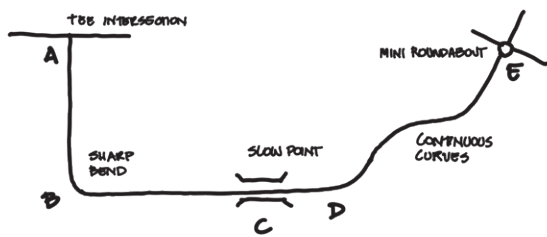
1. It is generally acknowledged that, unless they can be regularly enforced, speed signs have little influence on drivers' speeds.
2. It is the overall character of the street – it is streetscape and geometrics that are the main influencers of motor vehicle speeds.
3. It is desirable to support the speed limit signs with pavement marking showing the speed limit.
4. Streetscaped entry statements at the entry points of a neighbourhood precinct may be able to influence vehicle speeds in that precinct, particularly if combined with regulatory speed signage and pavement markings and/or pavement treatments.

4.2.7 Manage the Speed Profile

Manage the speed profile in each residential street through design of the street geometry, e.g. vehicles slow at entry intersections, accelerate to a maximum, then decelerate to the end of the street, another intersection, speed control device or tight radius bend.

Tips

1. The principal means for achieving speed limitation in residential streets are either by limiting the street section length or by tightly curved alignments.
2. Accordingly, speed control devices should be used sparingly.



Street Layout

Target Street Speed

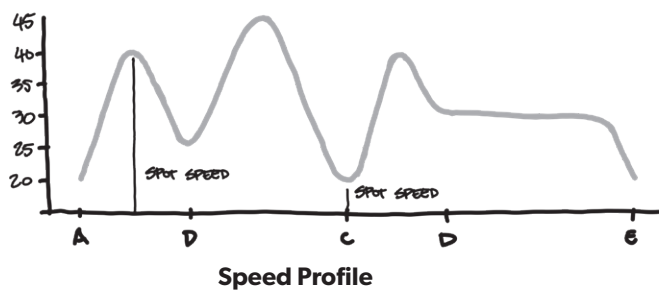


Figure 4.2.3 Speed profile in relation to Street Design

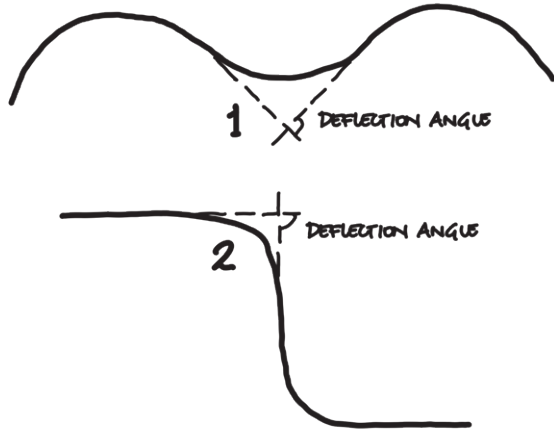
4.2.8 Manage the carriageway geometry

For each street type, ensure the carriageway width and horizontal alignment are appropriate to the Target Speed. Vehicle speeds are primarily influenced by the width of carriageway, vertical and horizontal alignment, or a combination of these design inputs.

Tips

1. The sight distance available through the vertical alignment of a street carriageway is not readily judged by drivers. Therefore, the vertical alignment should not be relied upon to limit speed.
2. Vehicle speeds on long straight streets are controlled only by the width of the carriageway. On a single-lane carriageway the street speed may be expected to be limited to 25 to 30 km/h, due to the constriction of carriageway width, and likelihood of having to slow or stop for opposing traffic.
3. No single component of street design should be relied on to control traffic speed.
4. The presence of on-street parking will also influence vehicle speed.

BENDS OR CURVES
TABLE 2.3.C



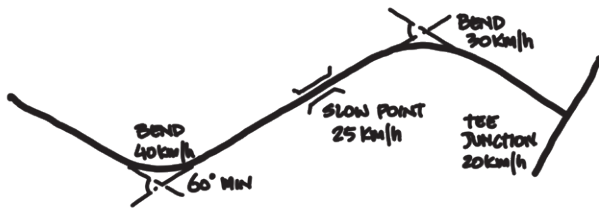
Desired Max'm Vehicle Speed (km/h)	Curve	Radii
	Continuous Series of Bends(1) (metres)	Isolated Bends or in a Chicane(2) (metres)
20	15	10
25	20	15
30	30	20
35	50	30
40	90	40
45	105	50
50	120	60
55	140	70
60	160	80

(1) Based on field surveys (Stapleton, 1988)
 (2) $E+F = 0.35$
 (AMCORD D15, page 54)

Notes

- *Radii on carriageway centre line
- * May not be effective with deflection angles less than (say) 60 degrees

Figure 4.2.4: Traffic Speeds-Bends or Curves.



NEGOTIATION SPEED OF BEND ETC., (Km/h)	LENGTH OF STRAIGHT(m) BETWEEN RESTRICTIONS TO LIMIT DESIGN SPEED TO (Km/h).						
	25	30	35	40	45	50	60
20 or less	40	75	100	120	140	155	180
25	-	45	75	100	120	140	165
30	-	-	45	80	100	120	150
35	-	-	-	50	80	100	135
40	-	-	-	-	55	80	120
45	-	-	-	-	-	60	105

(Amcord - D17, page 56 - modified)

Figure 4.2.5 Combination alignment table.

4.2.9 Limit Carriageway Section Lengths

Limit the length of sections of carriageway between speed control locations to influence vehicle speeds on a street.

Speed (km/h) **Street Leg Length (m)**

Notes

- End Condition – 20 km/h or less
 - For grades of 5 to 10 % - Add 5 km/h
 - For grades of over 10% - Add 10 km/h
- (AMCORD – D13, D14, Page 54, modifies)

25	40
30	75
35	100
40	120
45	140
50	155
60	180

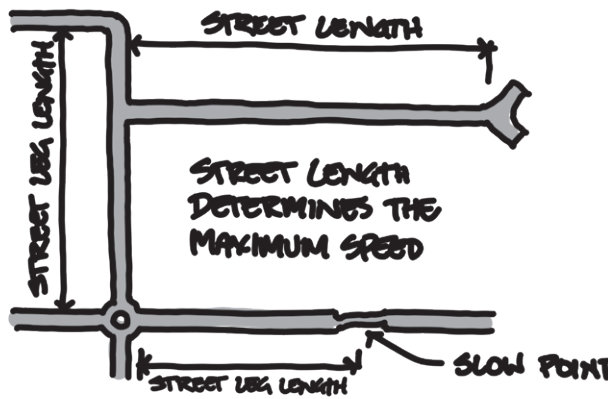


Figure 4.2.6: Traffic Speed.

Queensland Streets 1993 suggested appropriate street leg lengths for various Design Speeds. Complete Streets adopts these as maximum lengths however these guidelines suggest that where possible shorter options be considered. Tables 4.2.1 and 4.2.2 below shows the 1993 and 2010 comparisons.

Speed km/h	Max Steet (leg) length (m) (Qld Streets 1993)	Desirable length (m)
25	40	40
30	75	75
35	100	100
40	120	100
45	140	100
50	155	100
60	180	150

Table 4.2.1: Short straights and short distances between intersections.

Speed at the controls at each end of the straight (km/h)	Length of straight (m) between restrictions to limit speed to:						
	25 km/h	30 km/h	35 km/h	40 km/h	45 km/h	50 km/h	60 km/h
20	40	75	100	120	140	155	180
25	-	45	75	100	120	140	165
30	-	-	45	80	100	120	150
35	-	-	-	50	80	100	135
40	-	-	-	-	55	80	120
45	-	-	-	-	-	60	105

Note

Table 4.2.2 provides the data based on Queensland Streets Table 2.3.D and modified from Amcord.

Table 4.2.2: Lengths of Straight Section between Speed Controls.

4.2.10 Influence of carriageway widths

Carriageways should be no wider than necessary for normal vehicle movements, including buses to be carried out at the chosen Target Speed, with abnormal movements possible at reduced speed (e.g. trucks and larger vehicles).

Tips

1. Road designers must be conscious of over-sizing the carriageway for its intended purpose.
2. Wider carriageways than necessary can encourage higher vehicle speeds.
3. Excessive width can lead to ambiguity in use of the pavement space where it can lead to belief that the available width can accommodate a vehicle being able to pass two cars parked side by side.

4.2.11 Speed control devices

Locate speed control devices at intersections and/or mid-block where needed to control motor vehicle speeds occurring in long, straight sections of street.

Tips

1. There have been many studies in Australia and internationally on the influence of various speed control devices in motor vehicle speeds. Most relate to the retrofitting LATM devices in existing streets, with very few applying to new streets. There does not appear to be much work on influence of street character in combination with the use of these devices. Nevertheless, the available literature can assist in the design of speed control devices for greenfield developments.
2. Conclusions that can be reached from various studies of speed control devices include:
 - with most devices, other than speed humps, deflected T-intersections, one-way raised angled slow points and roundabouts, it is difficult to achieve 85th percentile speeds below 30 km/h and mean speeds below 25 km/h;
 - the influence zones for the start of speed reduction for speed tables and speed humps are similar and quite sharp, being 50 - 55 m; and
 - the zone of influence represents the distance between the device and the location where the speeds start to slow prior to the device. This information is presented in the following two tables.

Device	85 th Percentile Operating Speed (km/h)	85 th Percentile Street Speed (km/h)	85 th Percentile Speed Difference (km/h)	Zone of influence (m)
Speed hump	21	43	21	50
Speed table	35	46	11	55
One-lane Angled slow point (flush)	40	55	15	110
One-lane Angled slow point (raised)	30	50	20	110
One-lane Midblock Narrowing (flush)	51	53	3	44
One-lane Midblock Narrowing (raised)	45	48	3	40
Two-lane Midblock Narrowing	51	52	1	40

Table 4.2.3: 85th percentile Operating Speeds, Design Speeds and Zone of Influence for Single Traffic Calming Devices

Device	Mean Speed at the Device (km/h)	Mean Street Speed (km/h)	Mean Speed Difference (km/h)
Speed hump	18	37	19
Speed table	25	40	16
One-lane Angled slow point (flush)	34	47	14
One-lane Angled slow point (raised)	23	42	19
One-lane Midblock Narrowing (flush)	44	47	2
One-lane Midblock Narrowing (raised)	34	41	6
Two-lane Midblock Narrowing	44	45	1

Note

All numbers are rounded to the nearest whole number

Table 4.2.4: Mean Speeds for Single Traffic Calming Devices

4.2.12 Recommended Target Speeds

Adopt Target Speeds appropriate to the street category, street character and street environment desired for the residential neighbourhood.

Note

Table 4.2.5 lists recommended Maximum Target Speeds for the different street categories. Adopting lower Target Speeds than listed in this table may be consistent with the character and street environment desired in some neighbourhoods and will improve safety in those streets.

Street Category	Maximum Target Speed
Lane	20 km/h
Local Access Street	30 km/h
Access Street	40 km/h
Collector Street	50 km/h
Major Collector	60 km/h

Table 4.2.5: Recommended Maximum Target Speeds

4.3 CARRIAGEWAY LANES AND WIDTHS

Objective

To provide sufficient width of carriageway to allow streets to perform their designated functions within the street network, while minimising street construction and life cycle costs, and without compromising efficiency of land use, safety and amenity objectives.

Strategies

4.3.1 The number of lanes

Provide the number of vehicle lanes, i.e. moving vehicles plus parking, in any street length sufficient to provide for:

- the necessary number of motor vehicle moving lanes (one or two);
- an appropriate facility for cyclists where traffic (motor vehicle and /or cycle) speeds and volumes exceed a certain level of traffic stress;
- the required level of on-carriageway parking; and
- reasonable opportunity for passing of opposing vehicles.

Tips

1. Designers must be conscious of not over-sizing the carriageway for its intended purpose.
2. Excessive width can lead to ambiguity in use of the pavement space where it can lead to belief that the available width can accommodate a vehicle being able to pass two cars parked side by side.
3. Wider carriageways can also encourage higher vehicle speeds.
4. Single lane carriageways should be used by exception only, on a case by case basis, such as at single lane slow points or where a significant tree is to be preserved.
5. The carriageway, in terms of the number of lanes, to be not less than as shown in the figure 4.3.1 below.

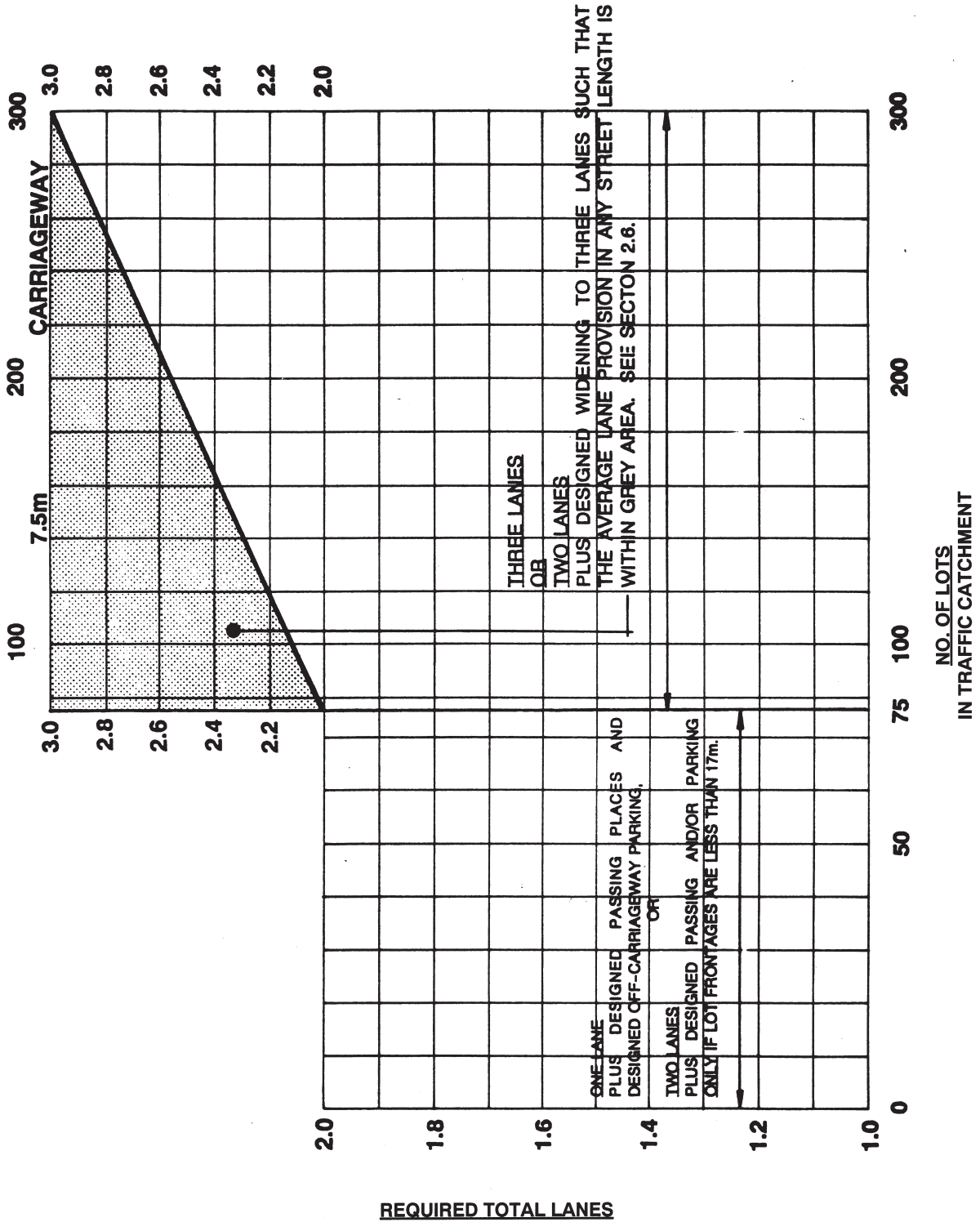


Figure 4.3.1: Lanes Required for No. of Lots. Source.

4.3.2 Widths

Subject to specific needs of the individual street, recommended carriageway width (measured between barrier kerb face or channel inverts) are:

- Single Lane - 3.5 m;
- Two Lane - 5.5 m to 6.0 m plus bike lanes or cycle tracks where required;
- Three Lane - 7.5 m to 8.0 m;
- Four Lane (incl. parking both sides) with cyclist mixing - 10.0 m to 11.0 m; and
- Four Lane (incl. parking both sides) with bike lanes or widening - 12.5 m to 14.0 m.

Tips

1. Moving motor vehicle lanes generally do not need to be wider than 3.0 m in any residential street.
2. For streets with very slow speeds and low volumes such as laneways and access streets, 5.5 m is adequate for two vehicles to pass one another.
3. Vehicles will park in a 2.0 m width if the parking bays are so marked.
4. 2.0 m unmarked widths are also adequate for parking when motor vehicle volumes and speeds are low but may need to be slightly wider for higher speeds and volumes.
5. For unmarked parking on streets with provision for two moving vehicle lanes, that have bicycles mixing with motor vehicles, the combination of moving lanes and parking can be 10.0 m for streets with relatively low volume traffic and slow vehicle speeds.
6. The narrowest width that should be provided for on-carriageway cyclists if it is desired that they be separated from mixing with motor vehicles is 1.2 m from lip of Kerb. Therefore, stormwater gully pits should be design with lip in line. The cyclist separation could be marked bicycle lanes or by using advisory bicycle lanes as per Traffic and Road Use Management (TRUM) Manual Volume 1 Part 8.
7. Depending on the street characteristics and the active transport network, wider provision for cyclists facilities may be necessary.
8. When the Level of Traffic Stress (LTS) becomes high-stress, it is undesirable for the bicycles and motor vehicles to mix in the same moving lanes, but marked separation locations for bicycles are considered unnecessary, a 4.2 m combined moving lane may be required to give better opportunities for vehicles to pass cyclists.
9. The nature, volumes and speeds of the bicycle and motor vehicle traffic should influence the type of treatment for bicycles and the combined carriageway widths.

4.3.3 Minimise Pavement Marking and Street Furniture

Provide sufficient pavement marking to provide the desirable cues for the safe movement of all street users, without detracting from streetscape aesthetics.

Tips

1. Minimise the extent of pavement marking to that needed for the safety of all users.
2. Line-marking to designate the location motor vehicle moving lanes should generally only be provided where the carriageway provides for bicycle lanes and/or recessed parking bays.
3. Selected use of coloured pavement can assist in providing cues to motorists of likely crossing locations for pedestrians and cyclists.
4. Pavement markings are generally more effective than traffic signs to warn motorists but need to be used sparingly and in a uniform manner to be effective.
5. Regulatory speed signs to designate streets with speed limits less than the default limit of 50km/h are more effective if supplemented with pavement markings showing that speed limit.
6. Where bicycle lanes are not provided, but it is highly desirable that motorists be aware of the likelihood of cyclists in specific locations, advisory cycle lanes could be used.
7. Minimise the amount of street furniture to that needed for the safety and amenity of all users.



4.4 ON-STREET PARKING

Objective

To provide sufficient and convenient parking for residents, visitors and service vehicles, while ensuring that parked vehicles do not obstruct the passage of vehicles on the carriageway or create traffic hazards.

Strategies

4.4.1 Demonstrate provision of appropriate parking arrangements

Demonstrate sufficient parking is able to be provided during the planning phase, and confirm during detailed design.

Note

Prepare drawings and calculations to show that appropriate parking and passing opportunities are provided within the proposed carriageway geometry, to complement lot layouts and projected traffic volumes.

4.4.2 Satisfy the parking needs

Provide resident and visitor carparking according to projected needs, taking into account:

- the total parking demand;
- parking opportunities within allotments; and
- non-residential and external parking generators.

Tips

1. Construct sufficient area within the street reserve to provide the following minimum level of parking:
 - separate dwellings and duplexes, where the Local Government Authority maintains control of the minimum level of parking within allotments - 0.5 spaces per lot;
 - separate dwellings and duplexes, where no such control is maintained - 0.75 spaces per lot; and
 - visitor parking should be located within 70 m of the lot.
2. Where there is a large proportion of multiple dwellings, additional on-street visitor parking may be required.
3. Shared driveways provide a great alternative to single driveways, however they can also reduce the amount of space otherwise available within each driveway for car parking due to manoeuvring requirements.
4. Refer to figures below for example situations:
 - On-Street Parallel - The "traditional" method, where the carriageway is of sufficient width to provide one or more moving lanes, and for parking on one or both sides. The on-street traditional parking method should be used where streets provide direct property access on both sides.

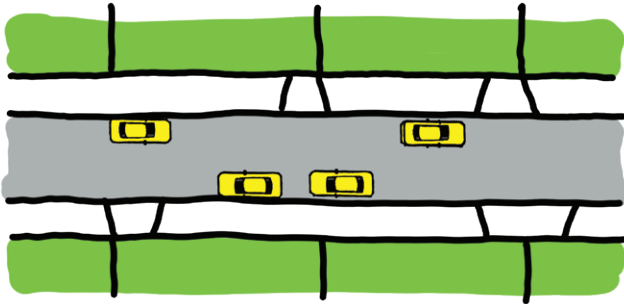


Figure 4.4.1: Parallel parking on-carriageway.

- Indented Parallel Parking Bays - A carriageway providing two moving lanes, or one moving lane with passing areas, may be supplemented by indented parking bays for parallel parking, on one or both sides of the carriageway.

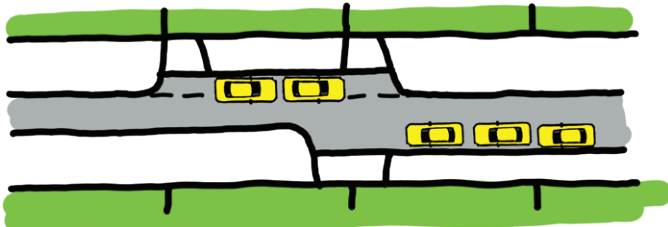


Figure 4.4.2: Indented parallel parking.

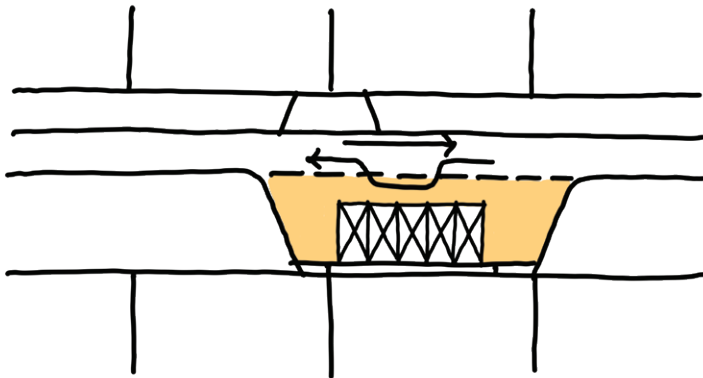


Figure 4.4.3: Indented 90° parking.

4.4.3 On-street parking must be effective and safe

On-Street Parking is provided to ensure:

- no obstruction or danger to pedestrians or to the passage of vehicles on the carriageway;
- potential conflicts with on-road cycle lanes are mitigated;
- safe and convenient vehicle manoeuvring in and out of parking spaces can be achieved;
- sufficient parking in the vicinity of cul-de-sac ends, clear of turning areas;
- efficient design of parking spaces and accesses; and
- sufficient clearance to allow convenient manoeuvring to and from driveways.

Tips

1. Provide at least one car space within 70 m of each allotment (measured between the closest points).
2. Car spaces may either be provided on the carriageway (to ensure vehicle passing) or in constructed/indented bays within the verge. Where indented parking bays are proposed in the verge, a continuous accessible path of travel must be provided between the parking bays and the property boundary.
3. Dimensions of all parking spaces and access to parking spaces in accordance with AS2890.1 (2004).
4. Special Parking bays may be provided in areas such as in the centre of cul-de-sac turning circles, combined with “hammerhead” or “V” turning areas, or within wide medians.
5. When designing indented (or recessed) parking bays consider providing reverse crossfalls together with an invert channel between the parking bay and carriageway.
6. Examples of On-Street Parking Configurations are in the following figures.

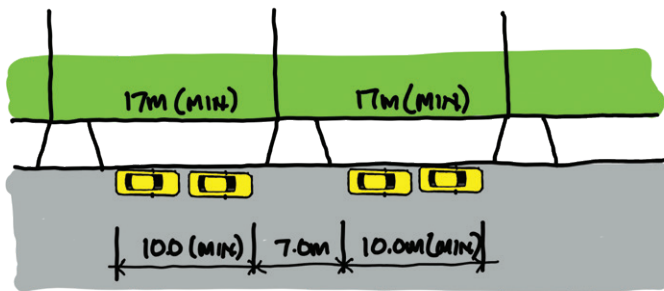


Figure 4.4.3.1: For average frontages of 17m, the parking capacity is variable with driveway location, e.g.

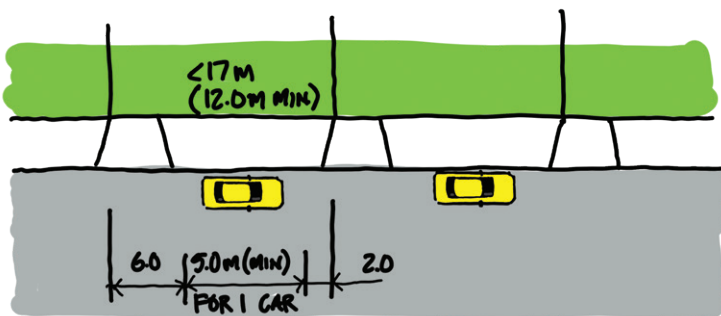


Figure 4.4.3.2: For average frontages of less than 17m, the parking capacity is variable with driveway location, Driveways same side. Capacity 1.0 Space per Lot.

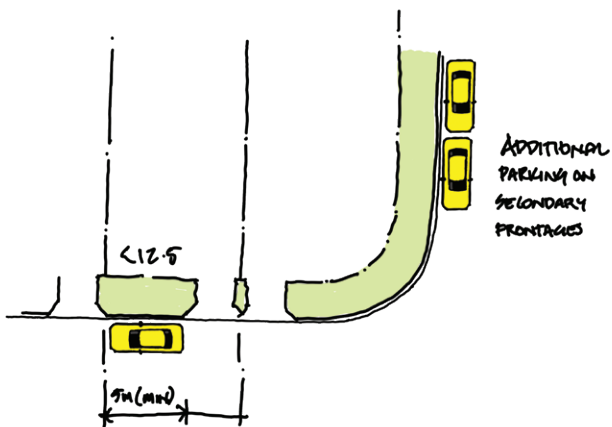


Figure 4.4.3.3: for average frontages of less than 12.5 m the parking capacity is limited and variable with driveway locations.

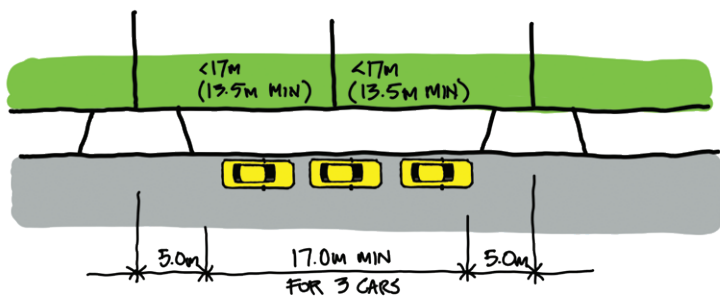
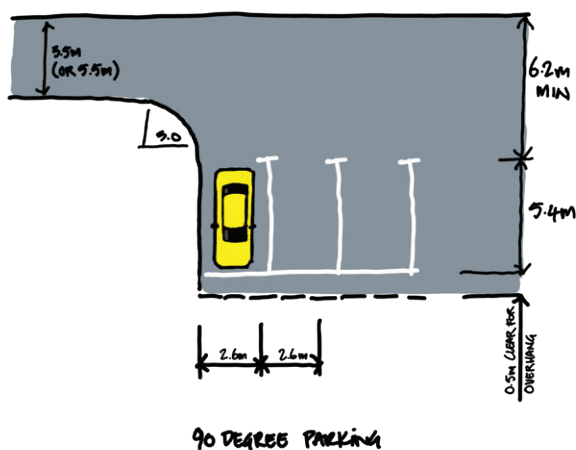
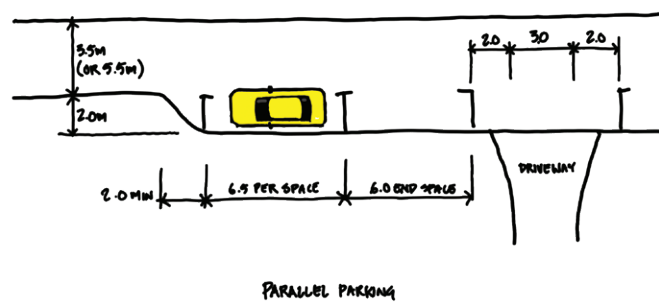


Figure 4.4.3.4: For average frontages of less than 17m, the parking capacity is variable with driveway location. Driveways Paired, Capacity 1.5 Spaces per Lot.



90 DEGREE PARKING



PARALLEL PARKING

Figure 4.4.3.5: Typical Street Parking Detail.

4.5 PROVISION FOR PASSING

Objective

To provide sufficient and safe opportunities for vehicles to pass other vehicles travelling in the opposite direction.

Strategies

Provide passing opportunities to reduce delay

Where there is a restriction in the number of moving lanes of traffic due to narrow carriageways or the presence of on-street parking, provide passing opportunities to ensure that delays from opposing traffic are acceptable to the majority of drivers.

Tip

Passing opportunities should be provided so that the increase in travel time in any street length is limited to a maximum of 10%.

Notes

Single lane carriageways should be used by exception only, on a case by case basis, such as at single lane slow points or where a significant tree is to be preserved.

For a Single-Lane Carriageway:

- number of allotments in traffic catchment - 5 maximum (effectively a shared driveway);
- provide indented visitor parking bays;
- passing places to be specifically designed for either sole or dual use, consider co-locating with driveways;
- minimum length of each passing place - 10.0 m; and
- use different materials such as concrete and provide amenity landscaping.

For a Two-Lane Carriageway:

- number of allotments in traffic catchment – 300 maximum
- additionally, where lot frontages are less than 17 m, either:
 - designed passing spaces to be provided as for a single lane carriage way; or
 - additional indented parking spaces to be provided.

For a Three-Lane Carriageway:

- number of allotments in traffic catchment – 600 to 750 maximum;
 - minimum of two lanes to be provided at any point, unless a “Slow Point” is deliberately designed; and
 - where three lanes are provided, the minimum length of three-lane section to be 35 m.
-

4.5.2 Supply and Demand for Passing Opportunity

Provide sufficient passing opportunities to meet the demand of the specific street type and location.

Notes

The demand for passing opportunities is a function of the number of vehicles travelling in the opposite direction which a driver will encounter in a trip between home and the major road system.

Tips

The “Incidence of Opposing Meetings” varies with:

- Traffic Volume of opposing traffic, which in turn will vary with:
 - Number of lots in the traffic catchment;
 - Time of day (Peak or off-peak traffic);
- Travel Time which will vary with the travel distance and travel speed.

The worst Case will be a trip between the extreme end of the street system and the major road system, “against the tide” of the peak hour traffic; while the Average Case is a trip from the mid-point of the street system, in an average hour.

Figure 4.5.1 below gives an indication of the number of meetings with opposing vehicles which could be expected to occur under various circumstances, for a typical residential subdivision layout.

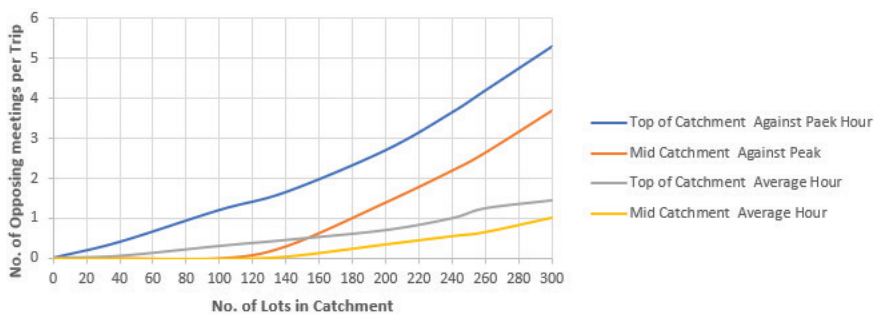


Figure 4.5.1: Expected meetings with opposing vehicles.

Notes

Since the number of meetings with opposing vehicles increases with the number of lots in the “traffic catchment”, the supply of passing opportunity should also increase with the number of lots, from a minimum at the head of the catchment (i.e. nominally zero at the end of each cul-de-sac street) to a maximum at the connection(s) to the major road system.

Tips

1. An under-supply of opportunity will result in increasing delays to traffic, and in the extreme to virtual blockage of traffic trying to travel “against the tide”.
2. On the other hand an over-supply is wasteful of carriageway area, and undesirable for the reasons described elsewhere in this Manual.
3. **For a Single-Lane Carriageway:**
 - a. For a single-lane carriageway the only passing opportunity is provided by designed passing places at appropriate intervals.
 - b. Generally the spacing will be within the range of 30 m to 80 m, a lesser spacing being uneconomical and a greater spacing making it difficult for drivers to judge the location of an opposing vehicle. Passing places must also be intervisible.
 - c. Passing places must be designed to minimise the risk of their being made ineffective by incorrect parking.
 - d. For opposing meetings in this situation, in most cases one vehicle will be in transit between passing places and hence will suffer no delay while the other must wait until the first clears the single lane section, and hence will suffer a delay dependent on the distance between passing places.
4. **For a Two-Lane Carriageway:**
 - a. A Two-Lane Carriageway with small lot frontages (i.e. less than 17.0m average) and high parking demand carries the risk that only a slight excess of parking demand could result in loss of passing opportunity and hence virtual blockage of traffic movement.
 - b. In such cases there are two possible approaches.
 - c. Designed Passing Places to be provided as for Single Lane.
 - d. Additional Parking Spaces to be provided clear of the two-lane carriageway, to increase the availability of random passing opportunity. These spaces may be provided either by widening the carriageway locally to three lanes or in 90 degree indented bays.
5. **For a Three-Lane Carriageway:**
 - a. A three-lane carriageway provides for two moving lanes and one parking lane, or two parking lanes and one moving lane. Hence free passing of opposing vehicles is obstructed only when parked vehicles are located opposite each other or close enough to prevent both moving vehicles from weaving their courses between them.
 - b. Even with a higher level of parking (0.75 vehicles per lot) two free lanes will be available over much of the street length, and delay will only occur when two opposing vehicles meet at, or in close proximity to, vehicles parked opposite each other.
 - c. The majority of passing movements will occur without any delay other than perhaps a momentary slowing.

The Design Charts Figures 4.5.2 and 4.5.3 are derived on the bases of the above figures

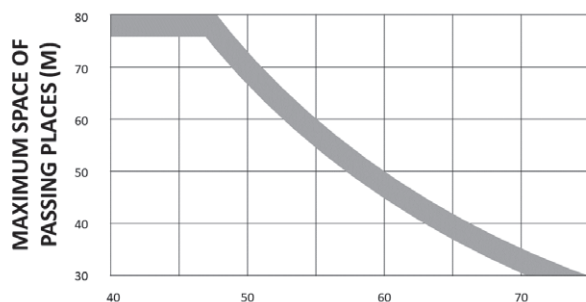
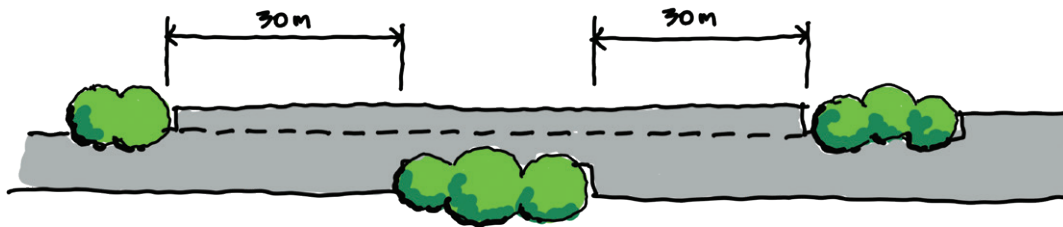


Figure 4.5.2: Maximum Spaces of Passing Places.

Allotment Frontages	Additional Parking Spaces per lot
17	0.00
15	0.10
13	0.20
12	0.25
10*	0.30

*Special design required.

Figure 4.5.3: Additional Parking Places for Lot Frontages.



Minimum length 3 lane Section

Figure 4.5.4: Minimum Length of Three-Lane Section.

4.6 GEOMETRIC DESIGN

Objective

To establish fit-for-purpose geometric design criteria for the detailed design of the street, to provide for the safety, amenity and convenience for all users, with maximum economy of construction and maintenance.

Strategies

4.6.1 General Design Guidelines

Geometric design should comply with relevant Austroads Guidelines.

Note

Except where a parameter, method or approach is specifically covered by this Manual, the geometric design should comply with the following Austroads Guidelines. Where sections are nominated, it is generally only those nominated sections that should be applied to the geometric design of streets.

- *Guide to Roads Design Part 3 Geometric Design:
Section 5 Sight Distance, Subsections 5.1, 5.2, 5.3;
Section 8 Vertical Alignment, Subsections 8.2, 8.6;*
 - *Guide to Road Design Part 4 Intersections and Crossings, General:
Section 5 Design Vehicle;
Section 8 Pedestrian Crossings; and
Section 9 Cyclist Crossings;*
 - *Guide to Road Design Part 4A Unsignalised and Signalised Intersections:
Section 1 Introduction;
Section 2 Layout Design Process; and
Section 3 Sight Distance;*
 - *Guide to Road Design Part 4B Roundabouts; and*
 - *Guide to Road Design Part 6A Paths for Walking and Cycling.*
-

4.6.2 Design Vehicles

Ensure that all vehicles that have a reasonable reason to use the street carriageway can proceed safely along the street; without unreasonable delays; and without damaging street infrastructure, including trees.

Tips

1. The geometric design of street carriageways must make provision for the following vehicle types:
 - Emergency vehicles, occasionally;
 - Refuse trucks weekly or twice-weekly services;
 - Delivery trucks of various dimensions, including an occasional semi-trailer;
 - Buses on planned routes;
 - Passenger cars;
 - Motor cycles;
 - Motorised bicycles and similar motorised vehicles, on-carriageway; and
 - Non-motorised bicycles and other non-motorised vehicles, on-carriageway.
2. Geometry must accommodate the dimensions and appropriate clearances for those vehicles that use the street frequently throughout each day. For those vehicles that are likely to use the street infrequently (generally less than daily), the geometrics need only provide for manoeuvrability at very low speeds (less than 10 km/h).
3. Austroads Guide to Road Design Part 4 Intersections and Crossings General - Table 5.1 provides the list of design vehicles whose geometrics should generally be used for the geometric design of street intersections, and streets generally.
4. The carriageway width and turning movement geometry must be no wider than necessary for normal vehicle movements.
5. Target Speeds should not be compromised by having to accommodate manoeuvring of extremely rare vehicles such as semi-trailers. Options for accommodating infrequent large vehicles should be examined, such as the ability of these vehicles to mount central islands (constructed to resist the forces exerted by the vehicle).

4.6.3 Design Speed

Determine the Design Speeds for the geometric design of street infrastructure.

Tips

1. Although the Target Speeds and Target Device Speeds should be used to ensure the street layout is functional and safe, the detailed geometric design, particularly in terms of having adequate sight distances, requires the application of the appropriate Design Speed.
2. Refer to Part 2 Section 1.4, Safe System Design.

4.6.4 Sight Distance

Provide sufficient sight distance for safe operation of motor vehicles at the Design Speed.

Tips

1. Apply all relevant sight distance provisions in the previous listed sections of the Austroads Guides to Road Design.
2. Guide to Road Design Part 3 Geometric Design, Table 5.2 recommends use of Reaction Time = 1.5 seconds for most urban street situations.

4.6.5 Horizontal Alignment

Provide horizontal alignment in accordance with Austroads guidelines, to complement the adopted street network.

Note

The street layout will be as described in Part 1, subject to minimum standards for the horizontal curves generally as described in Section 1.

Tips

1. Adequate sight distance is a significant factor in designing. The general minimum sight distance for Crest Vertical Curves should be twice the stopping distance for the Design Speed of the street.
2. The desired maximum Design Speed is maintained by intentionally designing a restrictive horizontal alignment.
3. Sharp curves should generally be avoided, while the following requirements must be considered to allow for safety and convenience of larger vehicles:
 - Minimum curve radius (carriageway centreline) – 10 to 15 m depending on Street type
 - Carriageway widening (also known as the 'elbow treatment') - 0.5 to 1.0 m depending on curve radius and generally in accordance with Figure below:

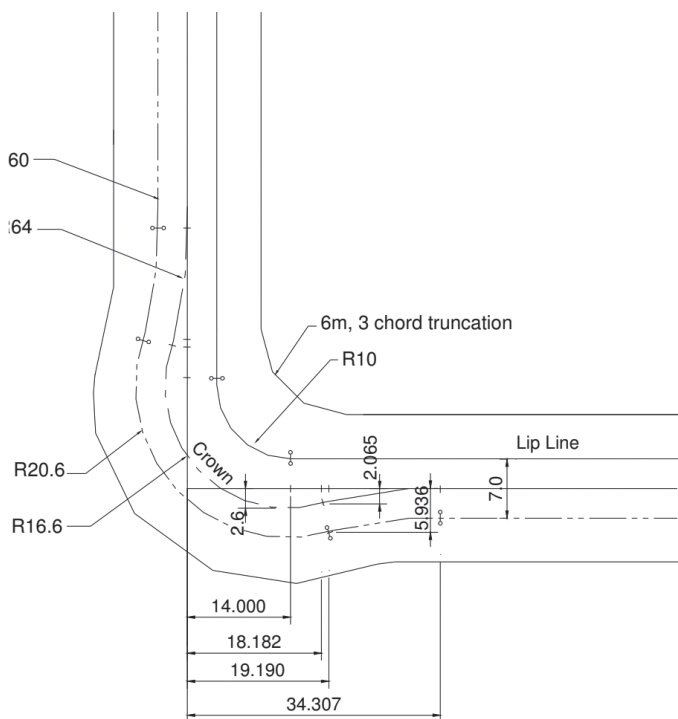


Figure 4.6.1: Typical widening at right-angle bend (property boundaries should coincide with chords angles where practical).
Source: Redland City Council Planning Scheme V7.1 2016)

4.6.6 Gradients

Design street grades that are the minimum possible, while appropriate for stormwater drainage, for safety and convenience of all road users.

Tips

1. The planning of the street network, subject to other planning and design considerations, should aim for the lowest practical gradients, particularly those streets which will be heavily used by pedestrians and cyclists.
2. The maximum longitudinal grade on any street should generally not exceed 12% to assist pedestrian walkability.
3. The absolute maximum grade for all streets is 16%. However where this grade cannot be reasonably achieved, a steeper grade can be used for a short length on Access Streets, subject to the agreement of the approving authority.
4. The desirable minimum longitudinal grade should be 0.5% based on construction tolerances and drainage requirements. An absolute minimum longitudinal grade of 0.3% may be appropriate, subject to the agreement of the approving authority.

4.6.7 Crest and Sag Vertical Curves

The geometric design of crest and sag vertical curves should comply with *Austrroads Guide to Roads Design Part 3 Geometric Design Section 8 Vertical Alignment, Subsections 8.2, 8.6.*

4.6.8 Crossfalls

The carriageway cross-section must provide good surface drainage, driver comfort, practical allotment access and not hinder pedestrians crossing the street (particularly people with a disability).

Tips

1. Generally, two-way crossfall is preferred.
2. One-way crossfall may be considered on access streets, laneways and car parks, provided no stormwater connections are made to kerb on the high side of the street; Adopt freeboard requirements in QUDM for lots on the low side.
3. Centre channels are generally not supported unless for shared driveway/single lane carriageways.
4. The desirable cross falls across carriageways are:
 - Maximum 2.5%
 - Minimum 2.0%
5. The minimum net slope (crossfall plus longitudinal gradient across intersections should desirably be 2.0%.
6. Recessed parking bays can be provided with reversed crossfalls together with an invert channel between the parking bay and traffic lane.
7. It is generally unnecessary and inappropriate to include superelevation on carriageways around curves and corners.

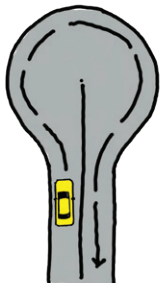
4.7 Turning Areas

Provide for the turning of vehicles at the end of culs-de-sac with maximum safety and convenience of operation, visual and noise amenity, at minimum construction cost and land area requirement.

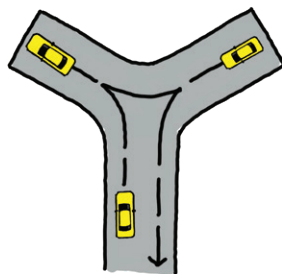
Tips

1. Make provision for a turning area (either single-movement or three-point turn) at the end of every cul-de-sac:
 - A Refuse Collection Vehicle (RCV) is generally used to determine the required dimensions of the turning area or cul-de-sac based on its turning circle (approximated by an MRV). The local waste management authority should be consulted for appropriate RCV dimensions and turning circles.
2. All turning areas accommodate the design vehicle appropriate for the street type:
 - Some local waste management authorities may allow for RCV to 'reverse in' in order to access an area, providing it is safe to do so.
3. Turning areas result in the minimum area of carriageway and require the minimum area of land necessary:
 - A cul-de-sac or a 'bulb'-shaped turning areas should be avoided where possible and should not be used solely for a provision of turnaround manoeuvre. A three-point turn area (exclusive of parking bays) should be considered as the most economical alternative, providing it is safe.
4. Design turning areas to discourage parking within the area needed for turning movements:
 - Designers must consider a real possibility of a turning area becoming an extension of 'on-street' car park used by local residents and visitors. Co-sharing of turning areas can be considered in controlled environments such as the areas controlled by "No Standing" yellow line marking or similar; and
 - early consultation and engagement with local laws or parking rules enforcement authority may be necessary to guide the best possible outcome when trying to discourage parking within turning areas.

Single movement turn

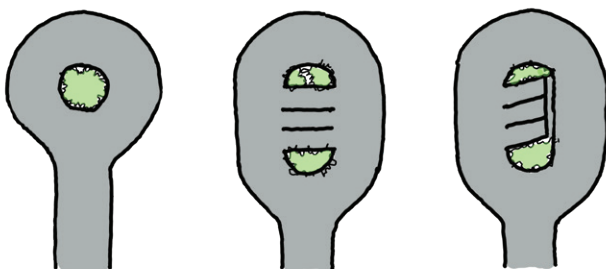


Three-point turn



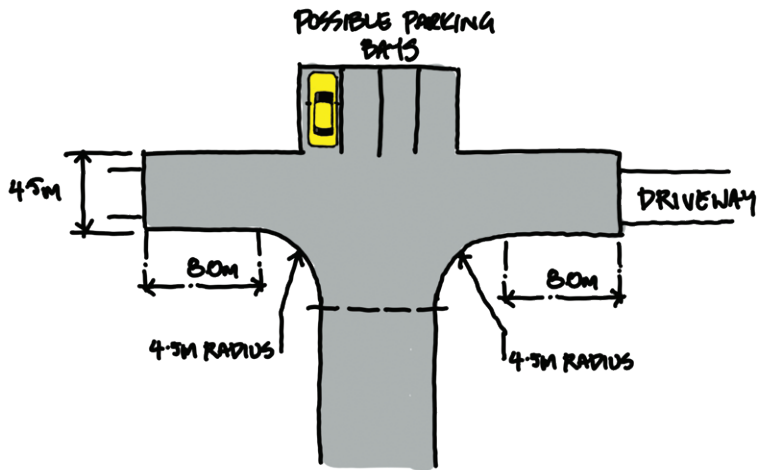
Landscaping or parking bays in the centre of the circle to reduce the visual expanse of carriageway

Three-point turn configurations





Parking areas to accommodate design criteria



Turning areas to accommodate design criteria

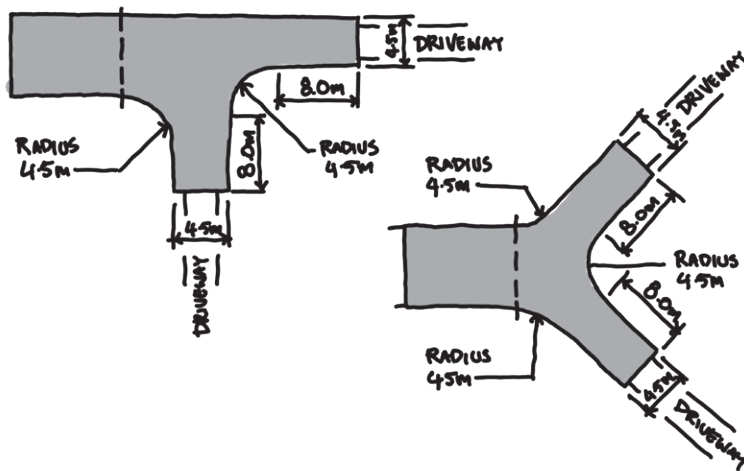


Figure 4.7.1: Turn design considerations – Multiple examples.

4.8 SPEED CONTROL DEVICES

Use appropriate speed control devices where needed to achieve the Target Speed desired for the street.

Tips

1. Speed control should be achieved by street alignment wherever possible with the use of speed control devices regarded as a last resort, rather than a routine measure:
 - Minimising the use of speed control devices will reduce the capital and maintenance cost of residential streets, as well as being less impactful on access for residents.
2. Control vehicle speeds in the street by the following:
 - In designing the speed control devices, always consider accommodation of larger vehicles, especially if the road is a bus route; and
 - if using landscaped traffic islands or build outs, select suitable plant species to ensure their height does not restrict visibility and their maintenance requirements are considered.

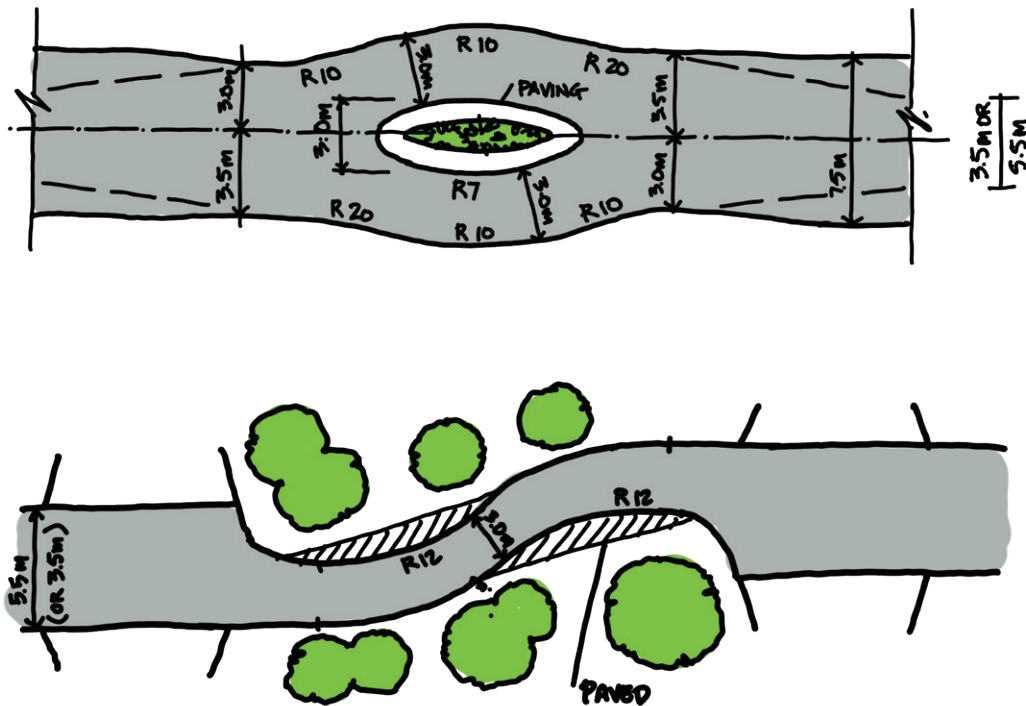


Figure 4.8.2 Example Speed Control Devices.

4.9 PAVEMENT DESIGN

Objective

To design the carriageway pavement for the long term, so that it remains smooth and structurally adequate to perform its function without undue cracking or distortion, and only requires routine resurfacing as the only major rehabilitation work.

Strategies

4.9.1 Pavement Design Guidelines

Design residential street pavements in accordance with “Austroads Guide to Technology Part 2: Pavement Structural Design (2012) and “Pavement Design for Light Traffic: A Supplement to Austroads Pavement Design Guide”.

Notes

When designing pavements for lightly trafficked streets, the following matters are relevant:

- potential for a greater effect from environment;
- potential for higher variation in subgrade type and moisture conditions;
- lower traffic speeds in urban locations; and
- potential for significant pavement damage resulting from a small number of passages of heavy vehicles.

Once a residential street has been constructed, its alignment or level are unlikely to change significantly, as the layout of lots is unlikely to change. As a result, the life of a residential street may be in excess of 100 years. Designers should consider a future maintenance and rehabilitation strategy to take account of the following:

- social constraints, such as impact on local residents in terms of noise and restricted property access;
- physical constraints, such as the fixed level of verges and kerbing; and
- pavement levels should allow for drainage of crossovers and footpath areas

These constraints may largely determine a practical strategy for design and will inform the selected pavement design life, noting that individual Councils may have policies for specific minimum design life and/or minimum pavement depths.

Tips

1. Consider the provision of sub-soil drainage for pavements, which are usually “boxed” construction at or near natural surface level.
2. Construction stage traffic (i.e. during the house building phase) can be a considerable proportion of the design traffic for residential streets.

Staged construction of subdivision developments can also result in some sections of road being subject to extended periods of construction traffic (if used as haulage routes or access for later stages under construction).

5. THE RESIDENTIAL STREET

5.1 VERGES

Overview

The space between the property boundary and the carriageway, the verge, must allow for a multitude of functions including:

- pedestrian movement;
- cyclist and non-motorised (or low powered MMDs) vehicles movement;
- vehicle access;
- street trees and planting;
- stormwater quality;
- utility services (including emerging technologies);
- lighting; and
- other landscape elements.

In some cases, in addition to the carriageway capacity, car parking and street furniture may also need to be accommodated.

To encourage walkability in our contemporary neighbourhoods:

- the pedestrian infrastructure must be present to provide safe, continuous paths of travel; and
- street trees are provided at regular and frequent intervals to ensure a pleasant, shaded pedestrian experience.

Historically these functions in the verge may have taken a subservient role to the provision of infrastructure, however for this manual, these functions are primary design elements.

Objectives

Verges that:

- provide pedestrian infrastructure that ensures a safe, continuous accessible path of travel within the verge;
 - achieve significant, sustainable street tree planting to increase shade cover and attractiveness of the streetscape from early in a neighbourhood's life; and
 - are of sufficient width to allow for all expected infrastructure while minimising overall road reserve width, and without significantly adversely compromising ease of access to infrastructure for future maintenance.
-

Strategies

5.1.1 Pedestrian infrastructure

Pedestrian paths catering for a low pedestrian volume should be a minimum of 1.5 m wide.

Pedestrian paths catering for medium/high pedestrian volumes are designed for the specific situation.

Paths have a minimum crossfall of 2% to achieve drainage and a maximum crossfall of 2.5%.

Tip

Refer to IPWEAQ Standard Drawing No. RS - 065

Ensure that accessible kerb ramps are aligned with the path of travel at all street crossings.

Kerb ramps have a slip resistant finish and have:

- a maximum rise of 190 mm;
- a length not greater than 1.52 m; and
- a gradient not steeper than 1 in 8 (12.5%) located within or attached to the kerb.

Paths are constructed of a smooth non-slip finish that is easy to maintain.

Tips

Plain or full depth coloured concrete are preferred finishes.

Other surface finishes such as bitumen, tiles, or paving may be used where non-slip and well maintained.

Exposed aggregate should not be used as it does not cater for the diversity of pedestrians.

Ensure continuity of appearance, design crossfall is achieved and trip hazards are avoided, by constructing pedestrian paths ahead of driveways.

While a standard pedestrian path might be constructed of 100 mm thick concrete, where driveways may occur, the paths in these locations should be increased to 125 mm thick

Use barrier (upright) kerb and channel on high pedestrian movement streets to:

- protect pedestrians by obstructing vehicles from mounting the kerb;
- provide stronger edge definition between the carriageway and verge to encourage better driving and parking behaviour (adjacent to parks or pedestrian connections);
- provide easier access to and from vehicles for people with a disability and the elderly;
- provide more ground surface area for street trees;
- set the relative levels for pedestrian facilities and utilities within the verge; and
- accommodate bus stops, which require barrier kerb.

Notes

Mountable kerbs became common practice in Australia during the 1980's as they were

- cheaper and eliminated the need for formal crossovers;
- allowed formal or informal car parking on the verge; and
- provided for service vehicles in narrow streets.

In practice mountable kerbs have been used inappropriately in many situations, encouraging parking on the verge and can be a hazard for people with a disability.

5.1.2 Designing for Trees

Design for an average of one street tree every 15 m on both sides of all streets ensuring compatibility with allotment crossovers, street lighting, and service crossings.

Tips

1. Provide sufficient space between kerb and any path for medium-sized street trees (8 m crowns), which require about 20 m² of ground surface area and ensure street trees do not present head clearance hazards for people with a disability and people who walk or ride.
2. To achieve 20 m² planting area, a 1500 mm clearance provides for medium-sized street trees at 15 m centres or an 1800 mm clearance provides for medium-sized street trees at 12 m centres (based on 150 mm back of barrier kerb).
3. An iterative design process will be required to minimise the chance of infrastructure and driveway clashes and avoid the tree planting location being compromised.
4. Where site circumstances do not allow the achievement of the desired density of street trees in a section of the neighbourhood, additional road reserve areas in close proximity should be identified at the design stage to provide sufficient street tree planting to achieve the required average density of street trees.

At the initial neighbourhood design process, seek to identify additional planting areas within the road reserve throughout the neighbourhood to achieve the desired average density, particularly to reinforce the major pathway network, complement the open space network and existing vegetation, including:

- widened verges against open space;
- pedestrian connections between streets and parks;
- indented car parking bay areas;
- stormwater infrastructure; and
- slow points.

Allow non-standard verge profiles to accommodate retention of existing trees where their retention is warranted due to their type, age and condition.

Tips

1. The above strategies enable the opportunity to either plant or retain trees that will be a much larger tree than the standard verge tree planting.
2. Strict application of standard road cross sections will generally preclude existing tree retention due to the impact of cut on the tree roots hence the need to consider non-standard verge profiles.
3. Practice Note 2, *Increasing trees in our neighbourhoods*, provides commentary and examples on these aspects.

Ensure the health and longevity of street trees by:

- selecting appropriate species to grow effectively within the streetscape conditions taking into account location, soil and climate for healthy growth;
- have their planting area appropriately prepared; and
- ensuring their adequate protection during the building process.

Tips

Where the density of development or lack of control during the building process may lead to street trees being removed, damaged or have their growth adversely affected, street tree planting after building construction is a recommended approach.

However, if this approach is adopted, the same upfront design process to identify street tree plant locations is required, soil conditioning at subdivision stage is undertaken, and the locations are clearly identified and protected from unwanted encroachment of other infrastructure before the planting occurs.

5.1.3 Verge widths

Design the verge to comply with the IPWEAQ standard drawings with sizing of each infrastructure corridor to recognise the specific infrastructure required for a particular verge within the neighbourhood.

Tips

1. For a local access street with low pedestrian traffic and standard infrastructure requirements, the minimum verge width will be around 4.25 m with barrier kerb or 4.5 m with mountable kerb:
 - a. This verge width achieves the minimum height difference of 100 mm between the back of kerb and property boundary to achieve freeboard under the Queensland Urban Drainage Manual (QUDM) without exceeding a verge crossfall of 2.5%; and
 - b. Where freeboard is not required under the QUDM the verge width may be reduced only where a continuous path of accessible travel is catered for. An example of this is a 3.75 m verge on the high side of a street with a one-way crossfall.
2. For circumstances where wider pedestrian paths are required, or large trunk infrastructure is required specific design is required to determine the appropriate verge width.

Locate urban public utilities (telecommunications, reticulated water, and reticulated sewerage) underneath footpaths wherever possible to keep verges to a minimum width and to maximise area for street tree planting.

5.2 DRIVEWAY CROSSINGS

Objective

To provide driveway accesses that are safe for motor vehicles to cross pedestrian and cyclist paths.

Strategies

5.2.1 Continuity of pedestrian path

Design driveways to prioritise pedestrian movement over vehicular movement through the provision of a continuous accessible path of travel and continuous footpath pavement material across driveways.

5.2.2 Driveway texture and colour

Where practical, the driveway texture and colour should differ from the path, to provide a cue to drivers of the path.

5.2.3 Driveway Profile

The path cross section should be maintained at the driveway.

The layback at the kerb side of the cross section should be as short as possible to ensure footpath level and crossfall are maintained. Where the driveway may also serve as a pedestrian access location for pedestrians, the driveway profile should meet ramp profile requirements.

5.3 STREET RESERVE WIDTHS

Objective

To identify the spatial needs of all the movement, utility infrastructure (including stormwater infrastructure) and place-making (including streetscaping) functions, and their location within the verges and carriageway.

Strategies

5.3.1 Efficient use of resources

The total width should be no more than necessary to perform its required functions in the interests of:

- the efficient use of land;
 - minimising whole-of-life costs:
 - optimise the whole of life costs of infrastructure;
 - in doing so, recognise the limited financial resources of the future public authority asset owners to undertake operation, maintenance and rehabilitation of infrastructure; and
 - limit the costs of constructing the street infrastructure in the overall community interest.
-

5.3.2 Optimise the joint use of space

Optimise the joint use of space for the required functions to reduce the street reserve width, for example:

- joint use of carriageway space for the movement functions where appropriate and safe to do so, such as
 - motor vehicle movement and parking adjacent to the kerb on access and collector streets;
 - bicycles and motor vehicles mixed use of the same movement lane (only on streets with low traffic volumes and vehicle speeds); and
 - shared cyclist and parking lanes; and
 - joint use of movement infrastructure in the verges:
 - shared bicycle and pedestrian paths (dependant on user volumes);
 - joint use of utility infrastructure space:
 - shared trenching;
 - placing utility infrastructure under paths and paved areas; and
 - poles, street furniture and trees on the same alignment.
-

5.3.3 Determine verge widths

Determine verge widths that will accommodate the required space for the utility plant and services, movement functions and streetscaping (including planting) while ensuring the overall street space is aesthetic and creates a desirable sense of place.

- For most street types, the minimum width of verge needed for the necessary utility infrastructure functions plus appropriate tree planting is 4.25 m to the face of barrier type kerb and channel.
 - The 4.25 m width can accommodate a path up to 2.0 m wide, located 0.9 m from the property boundary (but preferably 0.6 m from the boundary), and have a suitable width for tree planting.
 - Where paths need to be wider than 2.0 m, the verge will also need to be widened by the same amount.
 - Verges on local access streets and access streets that do not need a path can normally fit the type of utility infrastructure required in those streets within a 3.5 m wide verge, providing that a 4.25 m wide verge is on the opposite site.
-

5.3.4 Determine carriageway width

The carriageway must consist of sufficient width to accommodate the following, but no more than necessary.

- Moving lanes for motor vehicles can be 2.75 m to 3.0 m, depending on the vehicle speeds and volumes.
- Passenger cars can be accommodated within 2.0 m, but 2.2 m is typically adopted for the width between the kerb face and the line when the bays are line marked.
- Parking/loading areas/stops for trucks and buses need widths of 2.4 m to 2.7 m. When special provision is made in the carriageway for shared parking/cycle lanes or cycle lanes with separation strips (for car door opening), this extra width can be accommodated in those areas.
- Bicycle movement provision may be:
 - joint use within the motor vehicle moving lanes;
 - extra widening of the moving lane for the motor vehicle to pass the cyclist;
 - widening of the parking lane to create a joint use parking/cycle lane; or
 - separate cycle lanes, line marked accordingly with a separation strip (for door opening).

Tip

Wider than necessary carriageways promote increased motor vehicle speeds.

5.3.5 Additional or localised widening

Additional or localised widening of the street reserve may be required for:

- preservation of existing vegetation;
- at source stormwater quality management infrastructure;
- special intersection treatments;
- speed control devices; and
- corner truncations needed to take paths and utility infrastructure around corners.

5.3.6 Mountable kerb and channel

The verge and carriageway widths in this Manual apply to the use of barrier type kerb unless otherwise stated. These widths (measured to channel invert) for mountable kerb and channel differ from that for barrier type kerb and channel. However, the overall street reserve width will be the same.

The verge widths to the back of the kerb will be the same for both types. The width of the carriageway between the channel lips will also be the same for both types (in circumstances where the widths of the kerb plus channel are the same). Therefore, for the mountable type kerb and channel, the verge widths to the channel invert will be approximately 175 mm more, and the carriageway width between the channel invert will be approximately 350 mm less, than shown in the table for the barrier type.

The justification for adopting this approach is that drivers tend to park and drive their motor vehicles further from the invert of barrier kerb and channel than for the mountable type. This is to avoid damage to tyre walls, wheel trims and front wheel alignments which does not occur with mountable kerbs. This driver behaviour is compensated for by adopting the same overall street width but having the different invert to invert carriageway widths.

Symbol	Street Composition	Laneway	Local Access	Access	Collector	Major Collector
V0-C2-V2	2 lane Carriageway + no paths	6.5 - 7.5	13.25	-	-	-
V0-C3-V2	3 lane Carriageway + local access path one side only	-	15.75	15.75	-	-
V0-C3-V2.5	3 lane Carriageway + commuter path one side only	-	16.25	16.25	-	-
V2-C3-V2	3 lane Carriageway + local access path both sides	-	16.5	16.5	-	-
V2-C3-V2.5	3 lane Carriageway + local access path + commuter path	-	17.0	17.0	-	-
V2.5-C3-V2.5	3 lane Carriageway + commuter path both sides	-	17.5	17.5	-	-
V2-C4-V2	4 lane Carriageway (2 moving mixing with cycle +2 parking) + local access path both sides	-	-	19.0	19.0	-
V2-C4-V2.5	4 lane Carriageway (2 moving mixing with cycle +2 parking) + local access path + commuter path	-	-	19.5	19.5	-
V2.5-C4-V2.5	4 lane Carriageway (2 moving mixing with cycle +2 parking) + commuter path both sides	-	-	20.0	20.0	-
V2-C4pp-V2	4 lane Carriageway (2 wider moving +2 parking) + local access path both sides	-	-	21.0	21.0	21.0
V2-C4pp-V2.5	4 lane Carriageway (2 wider moving +2 parking) + local access path + commuter path	-	-	21.5	21.5	21.5
V2.5-C4pp-V2.5	4 lane Carriageway (2 wider moving +2 parking) + commuter path both sides	-	-	22.0	22.0	22.0
V2-C4pc-V2.5	4 lane Carriageway (2 moving +2 parking/cycle) + local access path + commuter path	-	-	22.5	23.0 – 24.0	23.0 – 24.0
V2.5-C4pc-V2.5	4 lane Carriageway (2 moving + 2 parking) + commuter path both sides	-	-	23.0	23.5 – 24.5	23.5 – 24.5
V2-C4cl-V2.5	4 lane Carriageway (2 moving +2 cycle lanes +2 parking/cycle) + local path + commuter path	-	-	22.5	23.0 – 24.0	23.0 – 24.0
V2.5-C4cl-V2.5	4 lane Carriageway (2 moving +2 parking/cycle) + commuter path both sides	-	-	23.0	23.5 – 24.5	23.5 – 24.5

Table 5.3.1: Typical Street Reserve Widths (distances in metres)

Notes

The following qualifications and comments relate to Table 5.3.1.

- 1. The widths in bold-underline are indicative of likely common street reserve widths.*
 - 2. Refer to Practice Note 7 – Build-a-Street to determine an appropriate street reserve width for other combinations of cross-sectional elements.*
 - 3. Street reserve widths may be rounded up to the nearest 0.5 m.*
-

5.4 INTERSECTIONS AND CROSSINGS

Overview

Intersections and crossings of neighbourhood streets involve the interaction of various travel modes with one another. Those interactions can be categorised as described in the following table.

Category	No. of Intersecting Street Junctions	No. of Motor Vehicle Legs	No. of Pedestrian &/or Cyclist Legs	Description
A	4	4	4	4-way
B	4	3	4	Modified 4-way
C	3	3	3	3-way
D	4	2	4	Pedestrian/cyclist crossing only
E	3	2	3	Pedestrian/cyclist crossing only

Table 5.4: Intersection Groups

Notes

1. *Street Junctions* refers to street (road) reserves and can include park reserves.
2. Signalised intersections will almost invariably not be required in neighbourhood streets. In the event that a signalised intersection is considered necessary, the designer should go to other sources for information, such as the State road authority and Austroads.
3. Refer to Section 4 Motor Vehicles for Geometric Design and Design Vehicles information

5.4.1 Intersection Design Principles

Objective

To design all intersections and crossings to be safe for all users, whilst not being perceived as an impediment to people who wish to walk or cycle.

Notes

On access streets use T-intersections, four-way intersections (with Safe System treatments such as raised platforms or driveway links), and roundabouts only where people who walk and cycle are catered for (such as raised priority crossings).

On collectors use roundabouts only where speed and volumes support priority treatments for people who walk, cycle or use other forms of active transport.

Tip

Signalised intersections should be provided with separate left and right-turn phases and priority crossings on all legs of the intersection for people who walk, cycle or use other forms of active transport.

Strategies

5.4.1.1 Desirable attributes

Well-functioning and safe intersections that are perceived as suitable to use by pedestrians and cyclists, including the more vulnerable users, will have the following attributes:

- a low likelihood of a crashes;
- little likelihood of fatalities or serious injuries in the event of a crash;
- a forgiving outcome to user errors;
- limited conflict opportunities;
- predictability of intended movements for all modes of travel and their priority;
- clearly identified crossing routes for all travel mode manoeuvres;
- the required sight lines; and
- low motor vehicle speeds.

Tip

Useful information on the safety of intersections as they apply to neighbourhood streets is provided from Austroads Research Report AP-R560-18, Towards Safe System Infrastructure – A Compendium of Knowledge.

5.4.2 Relative safety of different categories

In choosing the intersection type and treatment options, the designer must have regard to the collision risk and resultant severity risk.

Tip

The number of conflict points with different intersection categories are listed in the following table.

Category	Motor Vehicle to Motor Vehicle				Motor Vehicle to		
	Crossing	Turning	Merge/ Diverge	Total	Pedestrian	Off-carriageway cyclist	On-carriageway cyclist
Roundabout 4-way	0	0	8	8	16	16	8
A (non- roundabout)	4	12	16	32	16	16	32
B	0	3	6	9	9	9	9
C	0	3	6	9	9	9	9
D	0	0	0	0	4	4	0
E	0	0	0	0	4	4	0

Table 5.4.2: Number of major conflict points at typical street intersections

Note

This table is based on streets having relatively tight carriageways and differs from what may apply to wider road carriageways.

Other factors are also important in understanding the relative safety of intersection categories and their types of treatment. These include:

- whether the intersection type inherently controls motor vehicle speeds;
- the collision angles in crashes; and
- what other treatments are possible to mitigate the possibility of a crash and/or its severity.

5.4.3 Uncontrolled Intersections

Objective

To consider the use of an uncontrolled intersection where it can be demonstrated that the motor vehicle volumes and speeds, together with the type and numbers of potentially vulnerable users, will on balance achieve acceptable safety objectives.

Strategies

5.4.3.1 Locational Criteria

This type of intersection should only be located where:

- pedestrian volumes are low;
- cyclist volumes and speeds are low;
- motor vehicle volumes are low;
- where the Target Speed on each intersecting street is less than 40 km/h; and
- the overall streetscape and other cues clearly indicate that Mean Spot Speeds at the intersection will be no more than 30 km/h.

5.4.3.2 Suitable Intersection Types

Subject to complying with the above criteria, uncontrolled intersections may be suitable for Category Types B, C, D and E intersection groups, but generally not Category Type A. Type A intersections that have two legs being Laneways may be acceptable, although it would still be preferable to use stop signs or give way signs for this intersection type.

5.4.3.3 Additional treatments

Where this intersection type is proposed, additional measures that increase its safety should be considered, including:

- narrowing of carriageways at the intersection approaches;
- raised platforms or speed cushions on the intersection approaches providing that major drainage paths are not compromised;
- raised platforms within the intersection, providing that major drainage paths are not compromised; and
- cues on the pavement such as threshold treatments or painted pavement treatments.

Tip: Raised priority treatments are generally limited to posted speed limits of 50 km/h or below. Where a posted speed limit is 60 km/h or higher intersections should generally be signalised.

5.4.4 Sign-controlled Intersections

Objective

To decide what additional traffic signs will mitigate crashes or their severity at uncontrolled intersections.

Strategies

5.4.4.1 Locational Criteria

This type of intersection should and only be located where:

- pedestrian volumes crossing the uncontrolled legs are low;
- cyclist volumes and speeds crossing the uncontrolled are low;
- the overall streetscape and other cues clearly indicate that Mean Spot Speeds of through vehicles will be no more than 30 km/h; and
- stop signs and /or give way signs are used on each leg that has a Target Speed on that street above 30 km/h.

5.4.4.2 Suitable Intersection Types

Type A intersections should generally not be used as sign-controlled-only intersections, but Type A intersections that have one or two legs being Laneways may be acceptable.

5.4.4.3 Additional treatments

Where this intersection type is proposed, additional measure that increase its safety should be considered, including:

- narrowing of carriageways at the intersection approaches;
 - raised platforms or speed cushions on the intersection approaches providing that major drainage paths are not compromised;
 - raised platforms within the intersection, providing that major drainage paths are not compromised; and
 - cues on the pavement such as threshold treatments or painted pavement treatments.
-

5.4.4.4 Manual of Uniform Traffic Control Devices

Give Way and Stop signs must fully comply with the placement criteria in the Manual of Uniform Traffic Control Devices.

Tip

An overarching principle of the Manual of Uniform Traffic Control Devices is uniformity of application. Failure to comply with that manual impacts on the overall safety risk across the whole of the street and road network.

5.4.5 Traffic Island Controlled Intersections

Objective

To install traffic islands to channelise vehicle movements to more defined paths and/or to deflect the paths of motor vehicles to improve the intersection safety.

Strategies

5.4.5.1 Channelisation

Consider whether there are safety and/or operational benefits from channelising the intersection.

Tips

1. Apart from roundabouts and modified T-intersections, installation of traffic islands is unlikely to modify vehicle speeds at most street intersections.
 2. Some street intersection types, particularly those at higher-order streets, may benefit from some forms of channelisation to confine the routes taken by vehicles through the intersection.
 3. In these cases, it may be necessary to design the traffic islands so they can be mounted by infrequent larger vehicles.
-

5.4.5.2 Modified T-intersections

Consider whether the safety of T-intersections can be improved by the installation of traffic islands to modify motor vehicle routes through the intersection in a manner that reduces motor vehicle speeds and/or changes the priority.

Tips

1. *Austrroads Guide to Traffic Practice Part 8: Local Street Management* provides the following information on Modified T-intersections.
2. Figure 5.4.5.1 illustrates the two main types of modified T-treatment: to change priority and to act as a traffic calming device. Examples of a modified T-intersection channelisation are shown in Figure 5.4.5.2.

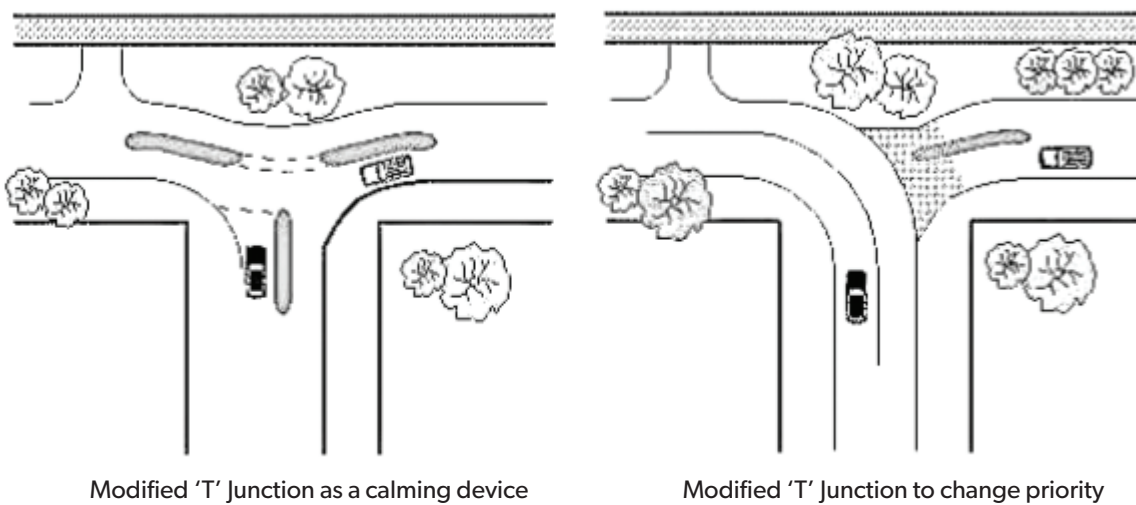


Figure 5.4.5.1: Examples of modified 'T' Intersections.
Source: *Austrroads Guide to Traffic Practice Part 8: Local Street Management*.



Figure 5.4.5.2: Examples of modified T-intersection channelisation.
Source: Examples of modified T-intersection channelization from page 106 of *Austrroads Guide to Traffic Practice Part 8: Local Street Management*. Supplied by City of Monash and Moreton Bay Regional Council. .

5.4.6 Roundabouts in Streets

Objective

To consider the use of roundabouts at four-way and three-way motor vehicle intersections where alternative treatments are unable to achieve the appropriate level of safety, or in preference to those alternative treatments.

Strategies

5.4.6.1 Roundabout safety considerations

Adopt roundabout characteristics that will result in overall safety benefits.

Tips

1. Research has demonstrated that roundabouts exhibit significantly better overall safety than alternative forms of intersection. Much of the concerns about their safety relates to poorly-designed roundabouts that are located on roads where speeds on the approaches and through the roundabout are relatively high, providing lesser opportunities for gaps in the vehicle stream for pedestrians to cross. Also, the higher motor vehicle speeds at these locations make it much more likely that a crash with a pedestrian or cyclist will result in a fatality or serious injury. The low motor vehicle speeds that can be achieved with residential street roundabouts means that the fatality and serious injury rates in the event of a collision will be almost zero. The lower vehicle speeds and tighter carriageway widths on street roundabouts also make them more conducive for use by pedestrians and cyclists. Care should therefore be given to transposing information that relates to higher speed road environments to neighbourhood street environments.
2. The installation of well-designed roundabouts in neighbourhood street intersections are likely to have a significantly better safety outcomes overall, including for pedestrians, but special consideration needs to be given in the design for motorcyclists and bicyclists using the roundabout carriageway.

5.4.6.2 Geometry to reduce motor vehicle speeds

The roundabout geometry should aim to achieve a Target Device Speed of less than 25 km/h (preferably 20 km/h), while making provision for all motor vehicle types likely to use the intersection; safety for on-carriageway cyclists; and safe crossings for pedestrians and off-carriageway cyclists.

Tips

1. The radii of the curves of the path followed by a passenger car (theoretically 2.0 m wide) travelling through the roundabout touching the outside kerbs entering and leaving and the outer edge of the roundabout should be R16m for Target Device Speeds of 20 km/h and be R25m for Target Device Speeds of 25 km/h.
2. Higher Target Device speeds are generally inappropriate for street intersections but are applicable for the design of arterial and sub-arterial roads.
3. The following table which may be used where it is appropriate to adopt other Target Device Speeds:

V (km/h)	Radius (m) for:	
	E + F = 0.20	E + F = 0.35
20	16	9
25	25	14
30	36	20
35	49	28
40	64	36
45	81	46
50	100	56

Table 5.4.6.1: Vehicle Speed-Curve Radius relationship

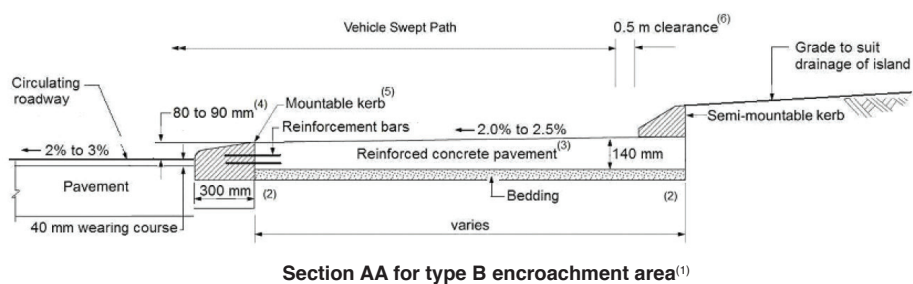
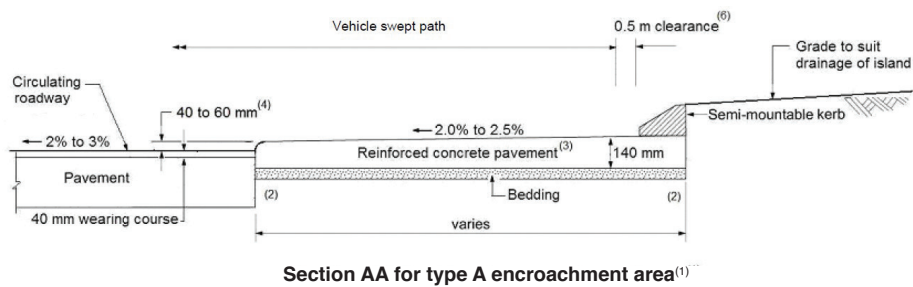
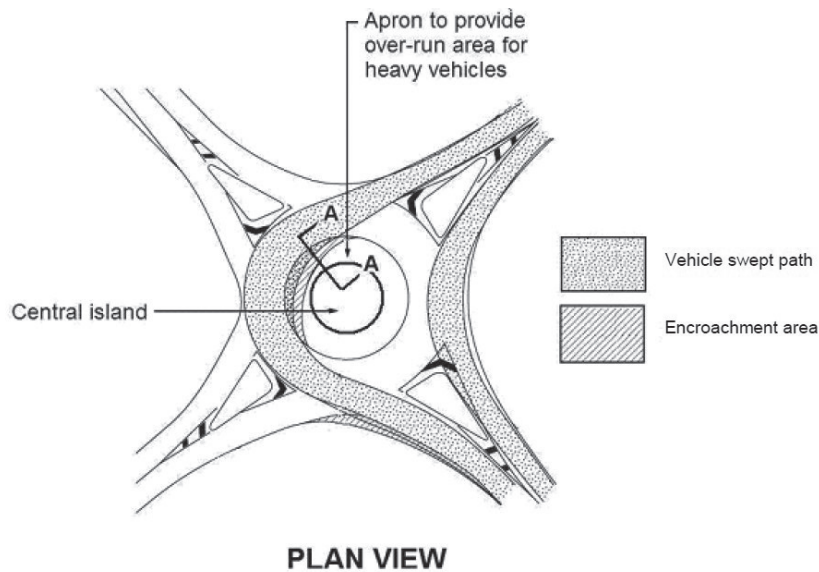
Notes

1. E + F = 0.20 should be used for Target Device Speed, whereas E + F = 0.35 is more applicable to 85th percentile speeds.
2. The table lists radii similar to the "rounded" numbers in Queensland Streets. The E + F = 0.20 column is similar to that for continuous bends originally reported by Stapleton (1988) from actual surveys.
3. The table is consistent with standard practice to adopt R100m for roundabouts designed for 50 km/h maximum desirable through speeds.
4. Approach-lane widths should desirably be 3.0 m to discourage motor vehicles overtaking on-carriageway cyclists.

5.4.6.3 Central Islands

The relatively tight street reserve and carriageway widths that are applicable to neighbourhood streets may allow the installation of central islands less than the minimum 5.0 m radius recommended in Austroads Guide to Road Design Part 4B Roundabouts and still comply with the provisions in the previous section and other mandatory design criteria.

Central islands can take the form of traffic circles or mini-roundabouts, which may need to be fully paved or have a "poached egg" form with the outer ring. This allows larger vehicles to negotiate the roundabout by mounting the central island. Examples of the cross sections for roundabout central islands with paved outer rings are in Figure 4.11 of Austroads Guide to Road Design Part 4B Roundabouts, see Figure 5.4.6.1 below.



1. Alternative profiles that discourage drivers of passenger cars from mounting raised area that is designed to enable relatively smooth passage by heavy vehicles.
2. Subsoil drainage may be required in these zones.
3. Reinforced concrete pavement. Thickness and reinforcement designed for appropriate loading. Alternative surfacing may be used on top of the pavement.
4. Height may vary within this range depending on jurisdictional requirements.
5. Mountable kerb to jurisdiction profile must be tied to reinforced concrete pavement to prevent differential movement. Dimensions shown are examples only.
6. Clearance is measured to the vehicle swept path, not to the wheel path.
7. Source: Based on Department of Main Roads (2007)⁷.

Figure 5.4.6.1 Typical encroachment area detail at a roundabout.
Source: Austroads Guide to Road Design Part 4B Roundabouts

5.4.6.4 Design Vehicles

Refer to the relevant section in Motor Vehicle Infrastructure for the standard vehicle for design and standard vehicle for checking.



Figure 5.4.6.2: Front overhang on low-floor bus.
Source: Austroads Guide to Road Design Part 4B Roundabouts



Figure 5.4.6.3: Areas behind kerbs should be kept clear of objects.
Source: Austroads Guide to Road Design Part 4B Roundabouts

5.4.6.5 Sight Distance Sight Distance

Austroads Guide to Road Design Part 4B, Section 3 identifies three sight distance criteria to be applied to the combination of vertical and horizontal geometry at roundabouts. Criterion 1 and Criterion 2 are both mandatory requirements. Criterion 3 is not mandatory and generally does not need to be applied for roundabouts on streets.

5.4.6.6 Gradient through the roundabout

To avoid the likelihood of vehicles with high centres of gravity overturning, the maximum net gradient through a roundabout is usually set at 3 %. However, where the horizontal geometry of the roundabout severely restricts the speed of these vehicles, the maximum net gradient may be increased to 5 %, which is also the maximum desirable negative crossfall for conventional vehicles using the intersection.

Tips

1. Larger vehicles that mount the outer ring of the centre island will increase their cross-slope by approximately 1 % for every 20 mm increase in elevation that the outer ring is over the projection of the normal circulating carriageway crossfall.
2. This is likely to be an important consideration if buses need to mount the outer ring of the central island of roundabouts that are built on a relatively steep gradient.

5.4.6.7 Pedestrians

Provide a safe means for pedestrians to cross the carriageway.

Tips

1. For roundabouts having high motor vehicle volumes, consideration should be given to locating the crossing 6.0 m (i.e., one passenger car length) clear of the circulating carriageway.
2. Cues are needed for the pedestrian before crossing the carriageway of the possibility of a vehicle colliding with them. See Section 5.4.8 for further details.
3. Cues are needed for drivers of motor vehicles and on-carriageway cyclists of the possibility of a pedestrian crossing the street. See Section 5.4.8 for further details.
4. For further information on the treatment of raised platform crossings, see Section 5.4.8.

5.4.6.8 Off-carriageway Cyclists

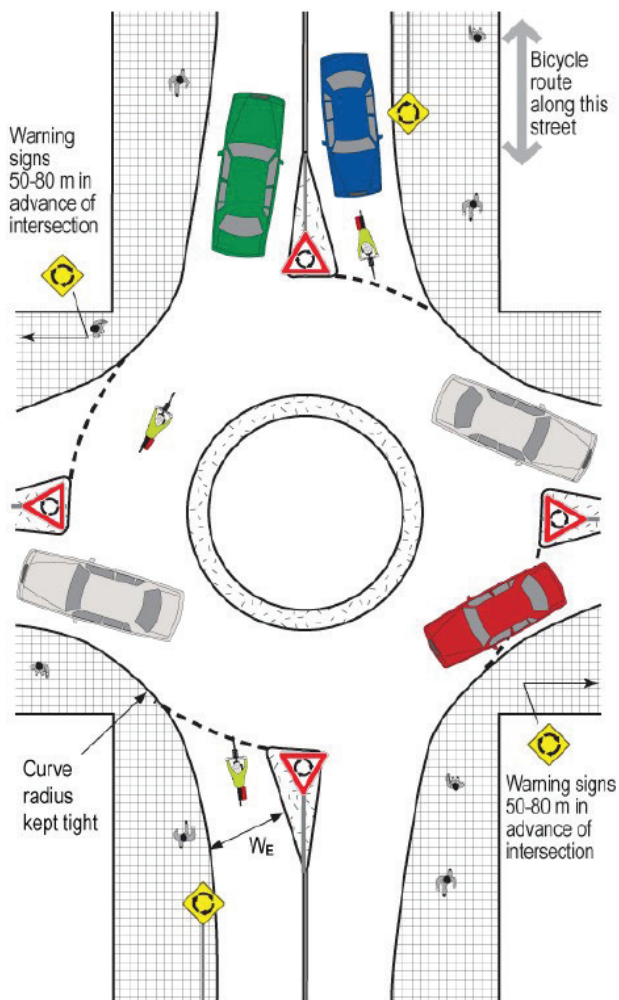
Provide a safe means for cyclists who are using verge paths to cross the carriageway.

Tips

1. Cyclists who are likely to be less experienced should be encouraged to dismount before crossing.
 2. The tips that apply for pedestrians are also applicable for off-carriageway cyclists undertaking crossing manoeuvres.
-

5.4.6.9 On-carriageway Cyclists

Include design criteria and elements that improve the safety for on-carriageway cyclists.



Note

The width of the entry W_e should cater for the design vehicle, e.g. service vehicle or fire truck. However, it is preferable that W_e be less than 3.0 m so that drivers do not attempt to enter the roundabout alongside cyclists and 'squeeze' them into the kerb.

Source: Adapted from Roads and Traffic Authority (2005).

Figure 5.4.6.4: Bicycle route through single-lane roundabout – no bicycle facility
Source: Austroads Guide to Road Design Part 4B Roundabouts

Tips

1. On-carriageway cyclists are a particularly vulnerable group that is more exposed when interacting with motor vehicles at intersections of all types.
2. Approach-lane widths should desirably be 3.0 m to discourage motor vehicles overtaking on-carriageway cyclists.
3. Those on-carriageway cyclists who have concerns about using the roundabout carriageway have the opportunity to avoid using the roundabout carriageway by exiting and entering at the path crossing locations on each approach leg, and use the path system between the crossing locations.

5.4.6.10 Motorcyclists

Because motorcyclists are over-represented in crashes at roundabouts, additional issues to be considered include:

- the design should provide for early recognition of the approaching form of the intersection;
- visibility of the central island, particularly at night;
- visibility of splitter islands;
- skid-resistant linemarking and pavement marking;
- sight lines to motorcycles and sight lines of motorcyclists should not be blocked by landscaping, signage or island treatments; and
- the location of utility poles, particularly at exits from the roundabout.

5.4.6.11 Corner lot truncations

Truncations of corner lots will be needed to accommodate the roundabout geometrics.

Tip

In most instances 4.0 m single chord or 6.0 m three-chord truncations will be adequate.

5.4.6.12 Lighting

All roundabouts should have appropriate standards of lighting.



Figure 5.4.6.5: Example of a landscape treatment at a small local street roundabout
Source: Austroads Guide to Road Design Part 4B Roundabouts.



Figure 5.4.6.6: Example of a landscape treatment at a small local street roundabout
Source: Austroads Guide to Road Design Part 4B Roundabouts.

5.4.7 Kerb Returns

Objective

To design kerb return radii at corners and intersections that are no greater than necessary to accommodate the turning manoeuvre of a standard design vehicle for the relevant street, to reduce the speeds of motor vehicles undertaking left turns.

Strategies

5.4.7.1 Kerb returns

The radius will generally not need to be greater than 3.0 m, but lower radii should be attempted.

Tips

1. Consider whether kerb lines can be built out to reduce the carriageway width at turn areas.
2. There are additional benefits with tight turning radii, such as greater ability to install compliant kerb ramps; shorter path crossing distances; more room in the verge for services.
3. Truncations of corner lots will be needed to allow services to be taken around corners via the truncations (minimum radii are necessary to pull electrical and telecommunications cables around the corner).

5.4.8 Pedestrian and Cyclist Crossings

Objective

To design locations where pedestrians and cyclists can conveniently and safely cross street carriageways.

Notes

Intersections and Crossings must be designed in accordance with the Safe System and not create severance for pedestrians and cyclists. Austroads "The Guide to Traffic Management Part 6: Intersections, Interchange and Crossings" provides a detailed description of each intersection type and assessment criteria against the Safe System.

Strategies

5.4.8.1 Design principles

The crossing must be safe for pedestrians and cyclists, as well as being perceived to be safe by those using the crossing. In doing so, pedestrians and cyclists should be discouraged from having a mind-set that they can travel across the carriageway without checking for vehicles and should be discouraged from assuming that vehicles will always stop for them, particularly children.

Notes

On access streets use T-intersections, four-way intersections (with Safe System treatments such as raised platforms or driveway links), and roundabouts only where people who walk and cycle are catered for (such as raised priority crossings).

On connectors use roundabouts only where speed and volumes support priority treatments for people who walk and cycle.

Signalised intersections, where used, should be provided with separate left and right turn phases and priority crossings on all legs of the intersection for people who walk or cycle.

Tip

Raised priority treatments are generally limited to posted speed limits of 50km/h or below. Where a posted speed limit is 60km/h or higher intersections should generally be signalised.

Tips

1. Many traffic crashes are caused by inattentiveness by road users.
2. Cues are needed for pedestrians and cyclists before crossing the carriageway of the possibility of a vehicle colliding with them. Cues may include:
 - a. Pavement colours and/or textures on the carriageway that differentiate the path in the verge from the path at the carriageway crossing location;
 - b. The Kerb and Kerb ramp at the interface (if a raised platform crossing is not used); and
 - c. Not having the crossing directly in line with the street path.
3. Cues are needed for drivers of motor vehicles and on-carriageway cyclists of the possibility of a pedestrian crossing the street. Cues may include:
 - a. Pavement colours and/or textures on the carriageway either side of the crossing location which clearly encourage special attention by the driver or cyclist; and
 - b. Raised crossings can more easily create a mind-set in some inattentive pedestrians and cyclists that they can cross the carriageway without checking for motor vehicles. They therefore require special attention in terms of cues to alert the pedestrians and cyclists.
4. Raised platform crossings should not be located where they interfere with the major and minor drainage requirements. Accordingly, there are limited locations where raised crossings can be used, e.g. when the crossing is at a crest or the contributing stormwater catchment is small.

5.4.9 Signalised Crossings

Where applicable, provide appropriate turn phases at signalised intersections to ensure safe crossing of all legs for pedestrians and cyclists. Avoid the use of left-turn slip lanes.

Notes

Left-turn slip lanes are generally difficult to navigate and dangerous for people with limited mobility. Where a dedicated left-turn facility is required it is preferable to use a dedicated left-turn lane with separate phase for high pedestrian traffic at signalised intersections.

Traffic signs must fulfil a need, be detectable in a complex environment, be legible at the appropriate distance, and be easily understood in order to be effective. Care must be taken not to overload drivers with too many signs at one location or with too much information on one sign. Signs to warn drivers should be placed to allow plenty of time to respond, by changing speed, changing lanes, and the like.

Pedestrians are often the “forgotten road users”, as infrastructure design tends to favour vehicles. They need to have enough time to cross at signalised intersections, so walking speeds should be assumed to be about 1 m/sec to accommodate older pedestrians. Countermeasures such as leading pedestrian interval and stop lines well back from the intersection can increase safety.

5.4.10 Priority raised crossings

Subject to consideration of matters covered in the previous strategy, give consideration to the appropriateness of treatments similar to those described in the Queensland Department of Transport and Main Roads Technical Guideline – Raised priority crossings for pedestrian and cycle paths.

Tips

1. The treatment used may need to be amended to comply with the issues raised in the previous strategy.
2. Give consideration whether the crossing should be a priority crossing and if not, many of the treatments described in that technical guideline may still be useful for a non-regulatory priority crossing.

5.4.11 Threshold treatments

It is desirable for threshold treatments in the form textured pavement surfaces and/or coloured pavement treatments be provided either side of the path of the crossing to alert drivers of the presence of potential for pedestrians or cyclists at that location.

Where a raised platform is provided at the crossing path, the vertical taper between the threshold treatment should be constructed in black (usually in asphalt) with the recommended white pavement markings to demote the change in pavement level.

5.4.12 Crossing distance

Where practical, minimise the crossing distance across the street carriageway by use of kerb build-outs.

5.4.13 Pedestrian Zebra Crossings

Pedestrian zebra crossings should only be located where the Manual of Uniform Traffic Control Warrants can be met.

5.4.14 Speed Cushions

If it is considered desirable to slow motor vehicles approaching a crossing that is not a raised crossing and speed cushions might be useful.

Tip

Although speed cushions will act as a constraint on the major stormwater flows along a carriageway, it may not be a significant issue in many locations.

5.4.15 Kerb ramps at crossings

Kerb ramps in accordance with the following should be provided at all kerb crossings:

- designed to accommodate all pedestrians without hazard;
- oriented in the direction of travel with ramps on both sides of a carriageway must be aligned to one another and the direction of travel;
- the crease between the ramp and the wings must align with the safe direction of travel to allow people who are blind or have low vision to orient themselves in the direction of travel;
- kerb ramps should be designed to be detectable to people who are blind or have low vision. Kerb ramps complying with AS1428.1 and having a slope between 1 in 8 and 1 in 8.5, are regarded as sufficiently detectable that Tactile Ground Surface Indicators (TGSIs) are generally not required, but should be given consideration if it is not practical for the ramp to comply with the provisions of that standard; and
- the kerb ramp should be located so that there is sufficient kerb length beside it for ambulant people who are unable to negotiate the ramp slope to step vertically between the verge and carriageway.

5.4.16 Mid-block crossings

Although mid-block crossings are not subject to the added safety complication of motor vehicle turning movements, they are often located in a section of the street where motor vehicle speeds are the highest.

- Addressing the issue of vehicle speeds may be the important consideration in the design of these crossings, but treatments described in the previous strategies are still applicable; and
- Lighting will be needed to highlight pedestrians/cyclists on the crossing at night.

5.4.17 Refuge islands

Where a refuge island is provided to offer pedestrians and/or cyclists opportunities to cross streets in a staged manner (typically used when a street carriageway is very wide), it should comply with the following:

- refuges (and medians) should be a minimum of 2.0 m wide at the crossing;
- refuges must have a kerb;
- refuges in crossings should be cut through level with the street or have kerb ramps at both sides and be aligned with corresponding kerb ramps on the footpath; and
- cut throughs should be a minimum of 3.0 m.

Tips

1. It is generally inappropriate to install refuges in residential streets because the lengths of the refuge island together with the chevron pavement marking required in advance of the island creates problems with driveways and on-street parking. A better alternative is generally to apply carriageway narrowing (to approximately 6.0 m width) to shorten the crossing distance.
2. In order to accommodate a bicycle which is typically 1.75 m long, it is desirable that a refuge be at least 2 m wide. However, 1.8 m may suffice in tight situations.
3. Where there are concentrated cyclist demands at certain periods of the day (e.g. secondary schools) a wider and longer storage area may be required within the refuge to provide additional space and separate areas for cyclists and pedestrians.
4. For typical treatment of pedestrian refuges, refer to NSW Roads and Marine Services TDT 2011/1a Pedestrian Refuges. However, the designer should review for opportunities to reduce the length of the island and chevron treatment that might be appropriate for the target and design speeds for the street the refuge will be installed.
5. Further information on Refuges is provided on Commentary C in Austroads Guide to Road Design Part 4 Intersections and Crossings – General.

6. DESIGN DETAIL – RELATED INFRASTRUCTURE

Overview

In addition to infrastructure required for the movement and place functions in neighbourhood streets, provision must be made for infrastructure that services and protects properties and occupants, as well as infrastructure that is supplementary to movement and place functions.

Key infrastructure items to consider as part of the detailed design process are:

- Public Utility Services
- Lighting
- Stormwater Management
- Kerbs and Channels
- Signs and Pavement Markings
- Landscape Works

This element provides guidance on matters to consider with respect to this infrastructure during the design process.

6.1 PUBLIC UTILITY SERVICES

Overview

Public utility services that may be provided in streets, together with services to lots from this utility infrastructure, include:

- Potable Water - reticulated mains and trunk mains;
- Recycled (Non-potable) Water - reticulated mains and trunk mains;
- Sewerage - sewer mains, trunk sewer mains and rising (pressure) mains;
- Electricity - low voltage and high voltage;
- Gas reticulation mains; and
- Telecommunication lines – various.

- **Potable Water and Sewer Reticulation**

Water and sewer reticulation services are provided in most urban residential streets. These services can be accommodated within the local authority or IPWEAQ standard alignments, however for those areas that such service is provided by SEQ water distributor – retailer the reader is referred to the SEQ Code for guidance. Trunk mains are generally placed on alternative alignments.

- **Provision for Interconnection of Water Reticulation Mains**

The street network should provide interconnectivity to avoid dead-end water service and provide alternate routes through pathways and park strips.

- **Curvilinear Sewer Mains**

Historically, sewer mains were laid straight between manholes and must cut across verge and or carriageway, unless an unreasonable number of manholes are provided. However, contemporary material products allow a more flexible approach with sewer mains now able to be laid on a curvilinear alignment, in which case the service allocation can then generally follow the standard property alignment without the need for additional structures.

- **Electricity**

Most new developments are provided with underground electrical reticulation, however where new lots front existing roads, electricity poles and overhead wires may be present. High voltage electricity lines are generally provided overhead due to cost constraints and are either located in easements or medians of higher order divided roads.

- **Gas**

Reticulated gas is not available in all areas. Where this utility is provided, a separate service corridor allocation must be provided.

- **Road Crossing**

Road crossings for the above utility services are necessary where the alignment of the reticulation service is located on one side of the road only. Conflict between service crossings and other underground infrastructure (such as stormwater drains) or street trees/landscaping should be managed as part of the detailed design process.

- **Chambers, Pits and Surrounds**

Where, chambers, pits or maintenance shafts are located within the constructed concrete footpath, the finished surface level of the chamber and surround must be flush with the pathway to prevent any trip hazard. It is preferred that the access chamber lid be a concrete infill type. Above ground infrastructure, such as cabinets, poles or service pillars, should be located outside of constructed pathways, with appropriate clearances.

Objective

To ensure that public utility services are located for ease of access for connections, maintenance and emergency repairs and that the street design accommodates the necessary space for such utilities and integrates with other road reserve functions.

Strategies

6.1.1 Standard Service Alignments

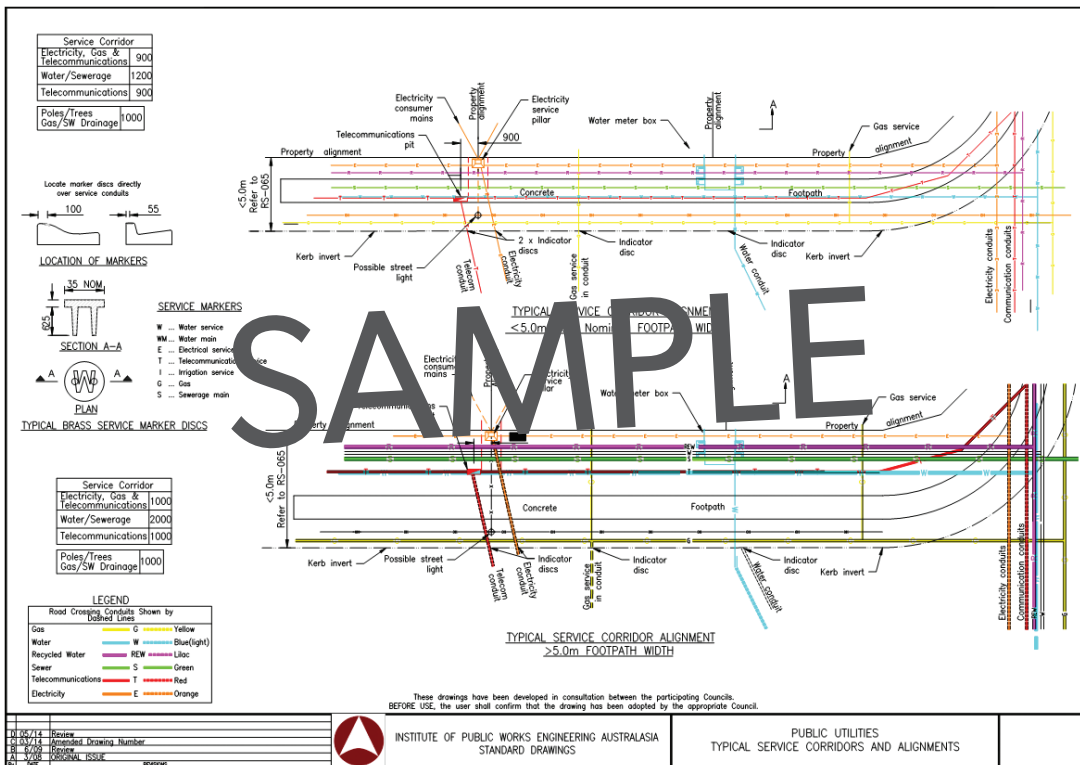
Provide for a standard alignment for each type of underground service to avoid conflicts between services and other components of the street, whilst considering the potential for joint shared trenching for services, and appropriate sharing of space with other infrastructure.

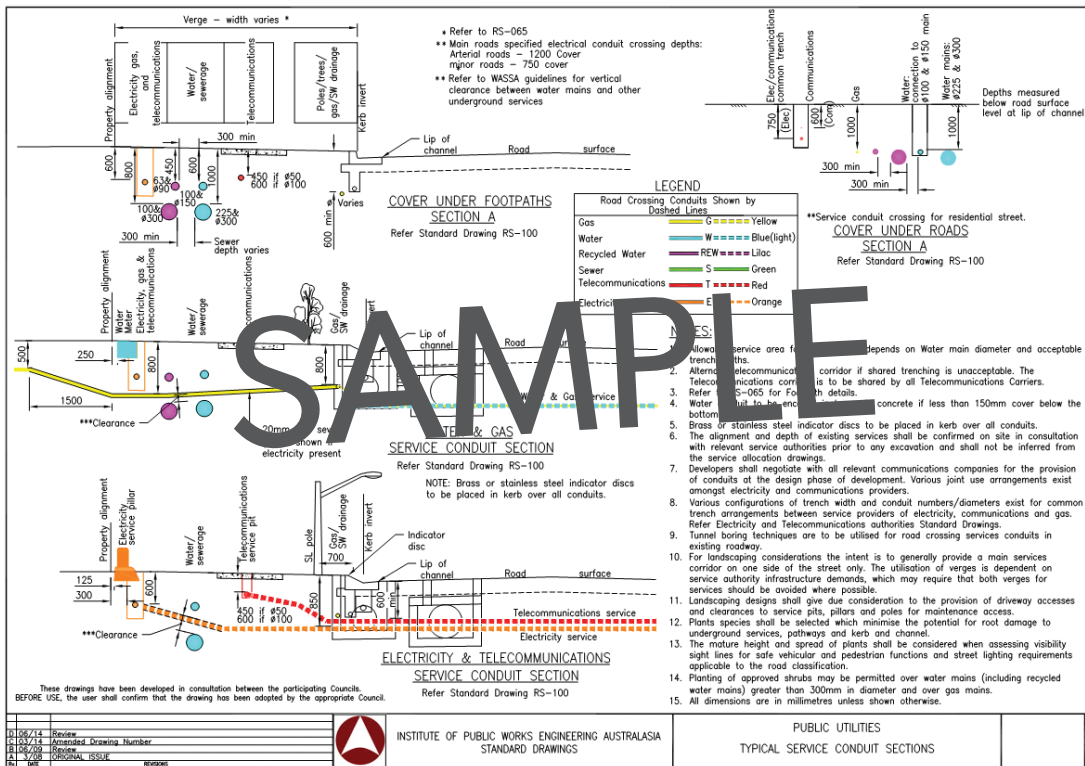
Note

Many councils have their own standard alignments or adopt the relevant IPWEAQ Standard Drawings (see the examples below) for the preferred location for underground utility services in the street reserve.

Tips

1. A minimum verge width of 4.25 m is typically required to provide the space needed for utility services and tree planting, however this width can be reduced to 3.0 - 3.5 m when no path is to be provided and limited utility services are required in that verge.
2. To optimise use of space, utility services should be located under paths.
3. Consider safety of maintenance workers when proposing to reduce verge width by locating services in carriageway.
4. Historically, sewer mains were laid straight between manholes. Contemporary products allow a more flexible approach with sewer mains able to be laid on a curvilinear alignment, in which case the service allocation can then generally follow the standard property alignment potentially reducing the number of manhole structures.





Figures 6.1.1 and 6.1.2 IPWEAQ Standard Drawings: Public Utilities – Typical Service Corridors and Alignments and Public Utilities – Typical Service Conduit Sections

Note

This is a sample drawing only, please ensure the latest versions are used in practice.

Tip

While these standard service alignments serve well to effectively maximise available verge space and provide service provider desired clearances, it is considered best practice to co-locate services in a common trench or share the allocated corridor, but only where the relevant service provider permits. Note that electrical and water services are often viewed by both respective authorities as being not compatible, due to potential for damage and danger during access for maintenance and repairs. However, this is common practice overseas (e.g. Japan) and is an opportunity for innovation in Australia.

6.1.2 Services in Laneways

Apart from lighting, public utility service infrastructure should be avoided in rear laneways.

Note

In instances where it is unavoidable to service properties from a rear laneway, the utility services should generally comply with the corresponding standard alignment and offset from property boundary and achieve the required minimum road cover for the respective service.

Where a laneway services properties that front a park, it is desirable for a 4.0 m wide strip of land be dedicated as street (road) reserve between the properties and the park, for the pedestrian path servicing those properties, delivery of mail and to enable public utility services to be installed on standard alignments relative to the property boundaries.

For other laneways, utility service infrastructure should generally be limited to that necessary to service only those properties fronting the laneway, with the utility service alignments being generally in accordance with the standard alignments for other street types. Importantly, service connections should be underground and not protrude above the laneway finished surface level and be positioned outside likely vehicular trafficable areas.

Tip

Where the electrical service provider permits, electrical service pillars should be avoided in laneways as they can be susceptible to damage by laneway traffic and may require bollard protection in such circumstances.



Figure 6.1.3 Laneway electrical service pillar with bollard protection

6.1.3 Trunk Infrastructure

Where trunk infrastructure is located in residential streets it should be located beneath the carriageway.

Note

In most streets only local reticulation services will be needed for public utilities, but in some locations trunk services will also be required. The need for trunk services in any street will have to be considered on a case-by-case basis. Locating some trunk services, (particularly water or sewer trunk mains which are additional to reticulation mains) in the carriageway/median should be investigated, otherwise the verge will need to be widened to accommodate the trunk service, and any associated infrastructure such as watermain thrust blocks and large valve pits).

Tips

1. If infrastructure that requires infrequent access for operations and maintenance e.g. trunk water supply mains, trunk sewers, rising mains and 33kV electricity (which may also require wider alignments) is placed under verges, it will result in wider verges and street reserves, and inefficient use of land.
2. Where trunk infrastructure is located in the carriageway, it is recommended that the location/alignment considers the ability to undertake maintenance/repairs whilst maintaining normal traffic flow conditions (for undivided road) or merge traffic and maintain a minimum one traffic lane (for divided road). Refer example below, where the regional water main is located under the cycle lane which permits the outer lane to be used for access and the inner lane to be kept opened (with likely reduced interim posted speed and lane width) to through traffic whilst repairs are occurring.



Figure 6.1.4 Example of verge widening to accommodate regional trunk watermain.



Figure 6.1.5 SEQ Regional grid watermain located under the on-road cycle-lane. (Left-turn slip lanes as shown in this Figure should be avoided - see Section 5.4.9 Signalised Crossings).

6.1.4 Alignments at Street intersections

Ensure the location of utility infrastructure at street intersections does not compromise the location of other utility infrastructure or the design of the intersection to cater for the movement of pedestrians, cyclists and motor vehicles.

Tips

1. Truncations on corner lots must be adequate for utility infrastructure and the utility infrastructure alignments around the corner must make maximum use of the verge area afforded by the truncation.
2. Service chambers and pits should desirably be located outside the verge areas adjacent to the truncations.

6.1.5 Chambers, Pits and Surrounds

Ensure that access chambers, pits or surrounds are located at the correct finished level in the verge or carriageway and will maintain that level.

Tips

1. It is important that the finished surface level of the chamber and surround is flush with the pathway to prevent hazards to pedestrians and cyclists.
2. To avoid problems with verge and path construction, the finished levels of the corners of all chambers and pits should be given to the relevant service authority installing that facility.
3. When in a concrete path, it is preferred that access chamber lids be a concrete infill type.

6.1.6 Transverse Crossings

Coordinate the location of transverse utility service and stormwater infrastructure with longitudinal utility service and stormwater infrastructure.

Tips

- 1. The depths of some infrastructure, e.g. gravity sewers, stormwater, subsoil drains, are constrained in terms of their vertical location.*
- 2. Minimal depths of cover also apply to each infrastructure type.*
- 3. Some infrastructure, e.g. gas, electricity, recycled water, requires vertical and horizontal clearances from other infrastructure for health and safety reasons.*
- 4. Modern design packages provide the opportunity to optimise the locations for all infrastructure and prevent clashes between transvers and longitudinal infrastructure.*

6.1.7 Above-ground Infrastructure

Provide appropriate clearances from above-ground infrastructure, such as cabinets, poles or service pillars, to constructed pathways.

Tip

Paths on verges having low-speed low-volume cyclist use can be located adjacent to above-ground infrastructure.

6.1.8 Utility Infrastructure Installation

Ensure that utility service infrastructure is installed in a manner that does not cause subsequent subsidence of paths, verges, carriageways, chambers, pits and surrounds and minimises adverse impacts on existing or proposed future street trees.

Tips

To avoid future settlement of paths, verges, carriageways and other infrastructure, service authorities should be advised of the appropriate backfill compaction standards.

To minimise adverse impacts, avoid or minimise damage to the root systems and trunks of existing trees and avoid over compaction of the root zones of existing and future trees.

6.1.9 Regulations and Codes of Practice

Have regard to the relevant utility authority codes of practice and some statutory regulations relevant to space requirements and clearances.

Tip

Design practitioners should be aware of those regulations and parts of the codes of practice that affect the design of other infrastructure in the street, particularly those relating to health and safety of workers.

6.2 LIGHTING

Objective

To ensure that street lighting provides a lighted environment that is conducive to safe movement of vehicular, cyclist and pedestrian traffic for night or adverse conditions where visibility is restricted.

6.2.1 Public Lighting Design Compliance

Lighting for street, cycle and pedestrian areas shall be in accordance with requirements of AS/NZ 1158. The minimum street lighting category for urban streets is P4.

Tips

1. Where authorised CC-TV security cameras are in operation for surveillance a higher illumination standard for pedestrian areas is usually required to facilitate high resolution. Guidance from the system architect is recommended.
2. Many Councils specify the use of LED lighting and may require the lighting system to become a Council asset on the Rate 3 Tariff. Check with the relevant Council prior to undertaking detailed design.
3. Pedestrian (zebra) crossings require special lighting.
4. Additional lighting may also be appropriate where other high-volume pedestrian movements occur across carriageways.
5. Additional lighting should always be provided to highlight the presence of traffic islands and roundabouts.

Notes

Preferably, the design form outcome should where practicable be consistent and uniform in terms of luminaire type, lamp type, wattage, mounting height, outreach size and spacing. Additionally, specific design consideration of upward light projections and height restrictions is required for areas located within 6km of an airport in accordance with Civil Aviation Regulation 1988.

6.2.2 Street Trees

Coordinate the lighting and street tree designs to ensure adequate lighting is provided for pedestrians at night.

Tip

Many pedestrians desire to walk in the early evenings and many commuters have to walk home during the evenings, both of which can be after dark. Inadequate lighting will act as a deterrence to do so.

6.2.3 Lighting Pole Placement Guidelines

Ensure lighting poles are located where they will not cause a hazard or conflict with other necessary services, driveways, street trees, etc. In particular, consider the potential impact on illumination levels from the canopy of mature street trees.

Notes

For use and placement of lighting poles refer to AS/NZ 1158.1.3 Appendix B. In addition to these guidelines for urban areas, street lighting poles should be located:

- *to avoid conflict with future driveways;*
- *to not obstruct visibility;*
- *preferably the same side as pedestrian footpath or path with higher order classification where there is footpath both sides;*
- *sufficiently clear of street trees (at maturity) so as not to diminish the design illumination levels;*
- *clear from any overhead power line (refer to local electrical authority for required vertical and horizontal clearances);*
- *to provide minimum offset clearance from cycle track; and*
- *to facilitate practical maintenance access.*

Tip

Where lighting poles have hinged base in order to lower for maintenance of luminaire etc, ensure that it is free from any obstructions for direction of lowering and can be accessed when lowered for the pole run-out length.

6.2.4 Luminaire Obtrusive Lighting

Manage potential nuisance associated with street lighting in residential streets.

Notes

Lighting design should look to minimise lighting intrusion on existing and future residential dwellings – to be no greater than an analysed reading of 1 lux vertical illumination at 1.5 m height on adjacent windows (using a maintenance factor of 0.7). Siting allowance of dwelling should generally be assumed as 4.0 m setback from property boundary.

Tips

1. *Shields, covers, aeroscreen, shrouds or direction-controlled LED luminaires can reduce the effects of intrusive lighting, however these devices should be assessed for reduction of stray light and potential loss of visual performance for drivers/cyclists/pedestrians.*
2. *Before using these devices, check whether the local government authorities has any policies about their use.*

6.3 STORMWATER MANAGEMENT

Objective

To ensure that the open space and street networks provide for conveyance of both minor and major stormwater flows in a safe manner and without inundating private property, and that the stormwater quality management objectives are achieved with minimum whole-of-life cost and efficient use of land.

Note

Floodplain management and stormwater conveyance and quality management should inform the initial neighbourhood development footprint and street planning phase – refer Part 1.

6.3.1 The Major (Overland Flow) System

Provide capacity within the street reserve to convey the major stormwater flows via the open space and street network to the nominated point of discharge, in accordance with a stormwater management plan:

- major stormwater flows to be accommodated within the street cross section in accordance with QUDM;
- avoid the minor drainage system needing to be upgraded to a higher standard than necessary to comply with specified flow width and depth limits from QUDM;
- comply with the kerb flow depth and freeboard provisions of QUDM (Note care should be exercised to ensure that assumptions about the building floor levels relative to the adjacent street levels will not be compromised at a later stage).
- avoid overland flow diversions and restrictions, including the creation of trapped sags; and
- identify locations where it is inappropriate to install LATM devices such as raised platforms, central islands or narrowing in the carriageway (it may be necessary to review the LATM and active transport networks in this regard, including nominated crossing points).

Tips

1. The primary purpose of 'freeboard' is to address uncertainties in flood level, conversion of water's kinetic energy into potential energy and the effects of water action.
2. Where potential flow restrictions or diversions are introduced to an overland flow path, then the consequences of such restrictions or diversions shall be considered for flows in excess of the specified Major Storm. The reader is directed to QUDM and AR&R 2016 for guidance concerning determination of PMF.
3. Care should be taken in the design of surface flows at T-Junctions adjacent to steep slopes. In cases where the surface water enters a T-junction via a steep gradient roadway, the high-velocity surface flow may fail to follow the desired flow path through the intersection. In the worst-case scenario, the flow passes across the road junction—causing a traffic safety hazard—then enters the down-slope property potentially causing flooding and property damage.
4. Where the required freeboard for the major drainage cannot be achieved for a laneway, the overland flow path for the major drainage system must not be directed along the laneway (Note the overall major drainage system should be designed so that water levels in the laneway comply with the major drainage freeboard requirements).

6.3.2 The Minor (Piped) System

Design the minor street drainage system in accordance with QUDM, with the following desired outcomes:

- the underground piped system follows the street system and overland flow paths wherever possible;
- kerb inlet locations should take account of the consequences of malfunctions or blockages in the piped system.
- kerb inlets for underground pipes are located to capture design flows and minimise bypass flows that may impact on intersections and pedestrian facilities; and
- drainage structures and inlets should not be located where pedestrians will cross a street and should avoid conflict with other infrastructure including:
 - street trees;
 - bus stop landing platform;
 - driveways; and
 - service crossings.

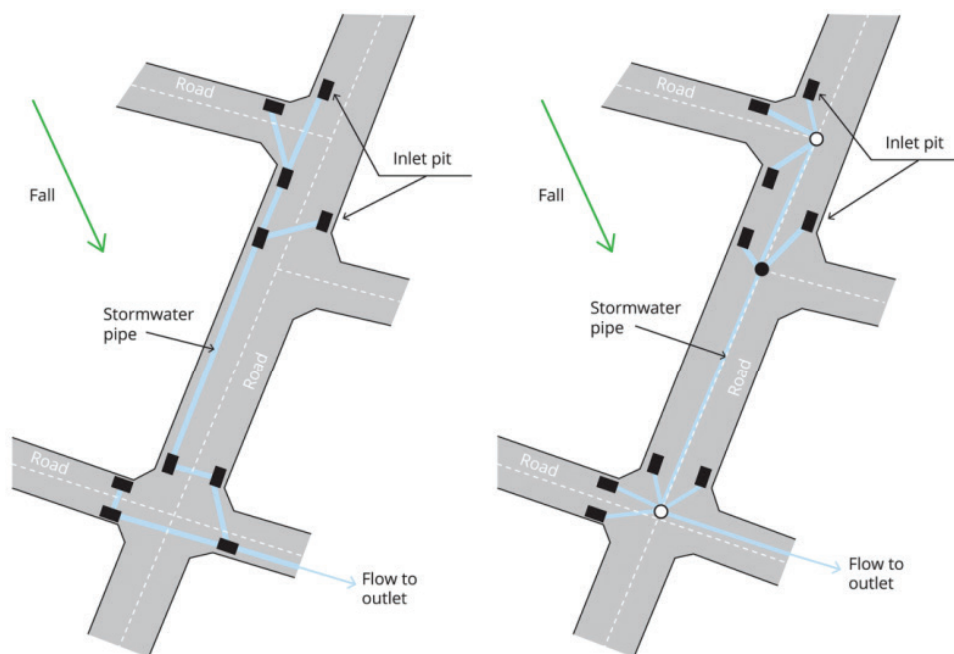


Figure 6.3.1 Typical pipe drainage configurations - 1 (Source Austroads, 2016).

Source: Commonwealth of Australia, Geoscience Australia, *The Australian Rainfall and Runoff: A guide to flood estimation (ARR)2016*.

Tip

Various factors influence intersection sag drainage design and configuration to ensure compliance with QUDM standards. Notably, key influences are:

- the grading of the intersection and positioning of sag gully pit and inlet, e.g. typically, gully inlets are placed outside kerb return for constructability, avoiding conflicts with kerb ramps and ensuring compliance with flow width and ponding depth (minor and major) requirements, creating a relatively deep sag and requiring increased pipe size/inlet capacity to ensure compliance with QUDM requirements;
- an alternative is to grade the road and intersection to ensure the kerb gully inlet is on-grade, which is achieved by ensuring the downstream kerb return crest (point A) is lower than the intersection sag (point B);
- crossfall grade may be locally reduced to minimum 2%, however a crossfall less than 2% can incur pavement maintenance issues with poor drainage leading to increased moisture ingress and premature pavement failure; and
- this may still be impractical owing to steep grading and topography constraints, in which case a trapped sag with increased inlet capacity and pipe size to satisfy maximum water ponding depth and lot freeboard is acceptable.

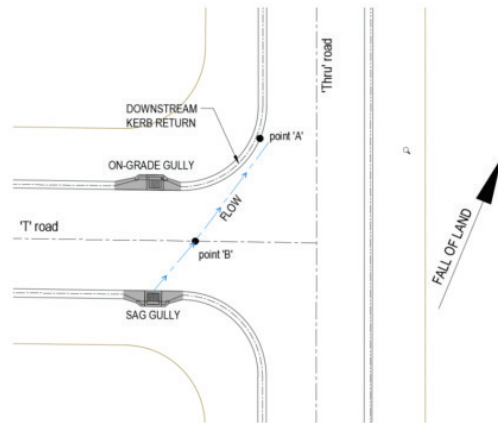


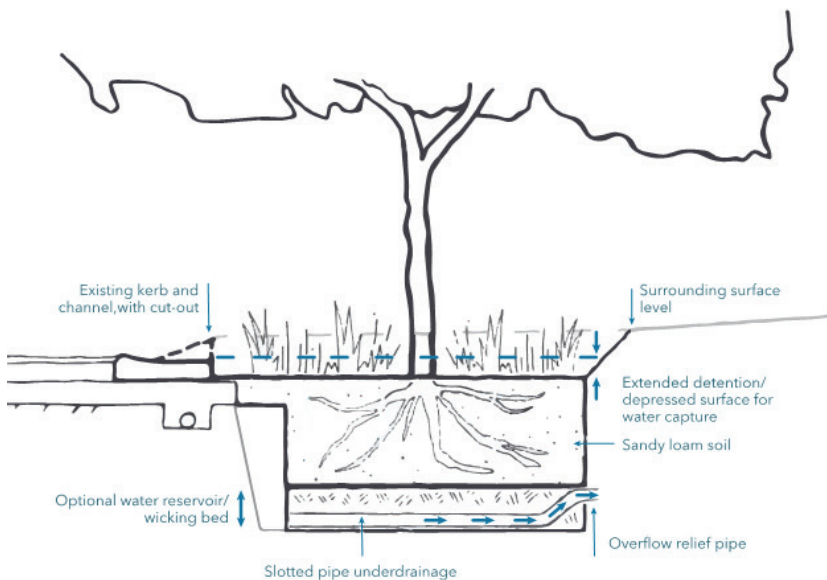
Figure 6.3.2 Typical pipe drainage configurations - 2 (Source Austroads, 2016).
Source: Arcadis Design and Consulting, Queensland.

6.3.3 Stormwater Quality Management (WSUD)

Locate and size Water Sensitive Urban Design (WSUD) devices to collect an optimal amount of runoff for the protection of receiving water quality.

While end-of-line devices are preferred (where topography permits), street based WSUD devices that may be suitable include:

- swales with or without bio-retention zone;
- porous pavement systems;
- rain gardens or biopods; and
- passive irrigated street trees (including propriety tree pit products).



Source: E2Designlab

Figure 6.3.3 Waterwise Street Tree Configuration. Source from WbD document, but E2Designlab.

Tips

1. Streetscape devices sited within the verge area and adjacent to paths/carrageways should not present a hazard to street users. In particular, avoid abrupt drops, steep batters and use landscaping to separate pedestrians from drop-offs.
2. *Water by Design Tools and Resources* provides design and layout guidance for WSUD. Further, other guidance and case studies are available from the CRC for Water Sensitive Cities website.
3. When planning street layout and configuration, it is important to implement measures which interrupt drainage connectivity and extent of impervious surfaces which can also offer and deliver a range of other benefits including urban greening and amenity. Additionally, such measures can assist with micro-climate outcomes such as Urban Heat Island (UHI) affect and moderating human thermal comfort.
4. The inclusion of street-oriented treatment devices within the street network will be grade and cross-fall dependent and consideration of street layout and likely grades should be considered to:
 - identify locations for water quality treatment devices;
 - identify required additional road reserve width to accommodate swale or treatment device dimensions;
 - maintain lower flow conditions (typically 1% to 4% longitudinal grade); and
 - to position the bioretention zone of swales relatively horizontal to encourage uniform distribution.
5. Tip In addition to WSUD treatment devices in order to maximise urban water outcomes it is recommended to conserve natural areas wherever possible (i.e. don't pave all areas), make allowance for multiple street trees and scatter and fragment the drainage system (i.e. minimise pipe drainage and disconnect impervious areas where practical). The disconnection of impervious areas will present the opportunity for infiltration and evaporation and promote natural hydrology outcomes.

6.4 KERBS AND CHANNELS

Objective

To provide suitable carriageway definition and collection of drainage runoff in the street.

6.4.1 Kerb Profiles

Ensure the most appropriate kerb type is provided to fulfil the desired function (i.e. drainage, delineation of lanes, protection of other street users from vehicle encroachment).

Notes

There are three basic kerb profiles (for kerb and channel or kerb only) generally in use in residential streets:

- *Barrier (vertical or near vertical face);*
- *Semi-mountable;*
- *Mountable (also known as “layback” or “Driveover”)*

In addition to the above, flush kerb and inverts have specific uses in residential streets.

Many local authorities have their own standard kerb and channel profiles or have adopted the relevant IPWEAQ Standard Drawing.

Barrier type kerb profiles (for kerb and channel or kerb only) are preferred to the alternatives to define carriageway – verge interfaces as it:

- *provides a clear definition for the interface;*
- *better defines where on-carriageway parking should occur, better preventing part or full parking on the verge;*
- *is safer for pedestrians and cyclists using the verge;*
- *provides better protection of street trees and grassed verges;*
- *defines the required motor vehicle paths at intersections; and*
- *there is a tendency to construct non-compliant invert crossings at driveways with the non-barrier type profiles.*

Semi-mountable profiles are generally acceptable for traffic islands and medians.

V-channels may be suitable to convey stormwater across intersections or between the moving lanes and defined parking lanes, also facilitating reverse crossfalls for the parking bays.

Tip

Concrete V-channels and flush kerbs are prone to breaking up – 150 mm depth is rarely adequate to resist motor vehicle loads and depths of 250 to 300 mm are normally required.

6.4.2 Stormwater Drainage Function

Ensure kerb and channel is provided with adequate longitudinal fall in conjunction with suitable carriageway crossfall to collect stormwater runoff clear of the carriageway, and direct flows to the underground drainage system.

Notes

Preferably, an integral kerb and channel profile is used to provide a positively graded longitudinal flow path, with the following exceptions:

- the high side of a one-way carriageway crossfall; and
- medians and traffic islands.

The provision of kerb and channel also provides a point of connection for discharge of roofwater drainage to the street.

The relevant flow depths from QUDM, should be adjusted for the adopted kerb profile in use, to maintain the same maximum depth of flow at channel lip, and the same verge freeboard, as recommended by QUDM.

Tips

1. The desirable minimum gradient kerb and channel or channel only is 0.5%. Gradients less than 0.3% should only be used with the approval of the asset owner.
2. There are constructability and generally hydraulic benefits in using lip-in-line catchpits.
3. During the design stage, the preferred position of property drainage kerb adaptors (to be installed with the kerb and channel construction) should be determined.
4. In the interests of minimising subsequent damage and poor repair of paths, consideration be given to requiring the installation of the stormwater line from the property to kerb adaptor or stormwater inlet prior to the path construction.

6.4.3. Accessibility for Public Transport

Install appropriate kerbing at bus stops to assist in accessibility for passengers when boarding (refer Element 3 - Public Transport).

Notes

For public transport bus stops, the kerb profile should be barrier type with sufficient height to assist passenger boarding and disembarking the bus. Additionally, a barrier kerb is required to satisfy compliance with Disability Standards for Accessible Public Transport Act 2002 (DSAPT).

Tip

Standard B1 barrier kerb may not comply with DSAPT public transport service (e.g. Translink) requirement concerning kerb height for bus stop landing platforms. In such instances the barrier kerb should be specified as barrier type kerb with minimum 150mm measured from channel lip or road pavement surface (where negative crossfall) for the length of landing platform and transitioning to a standard profile height.

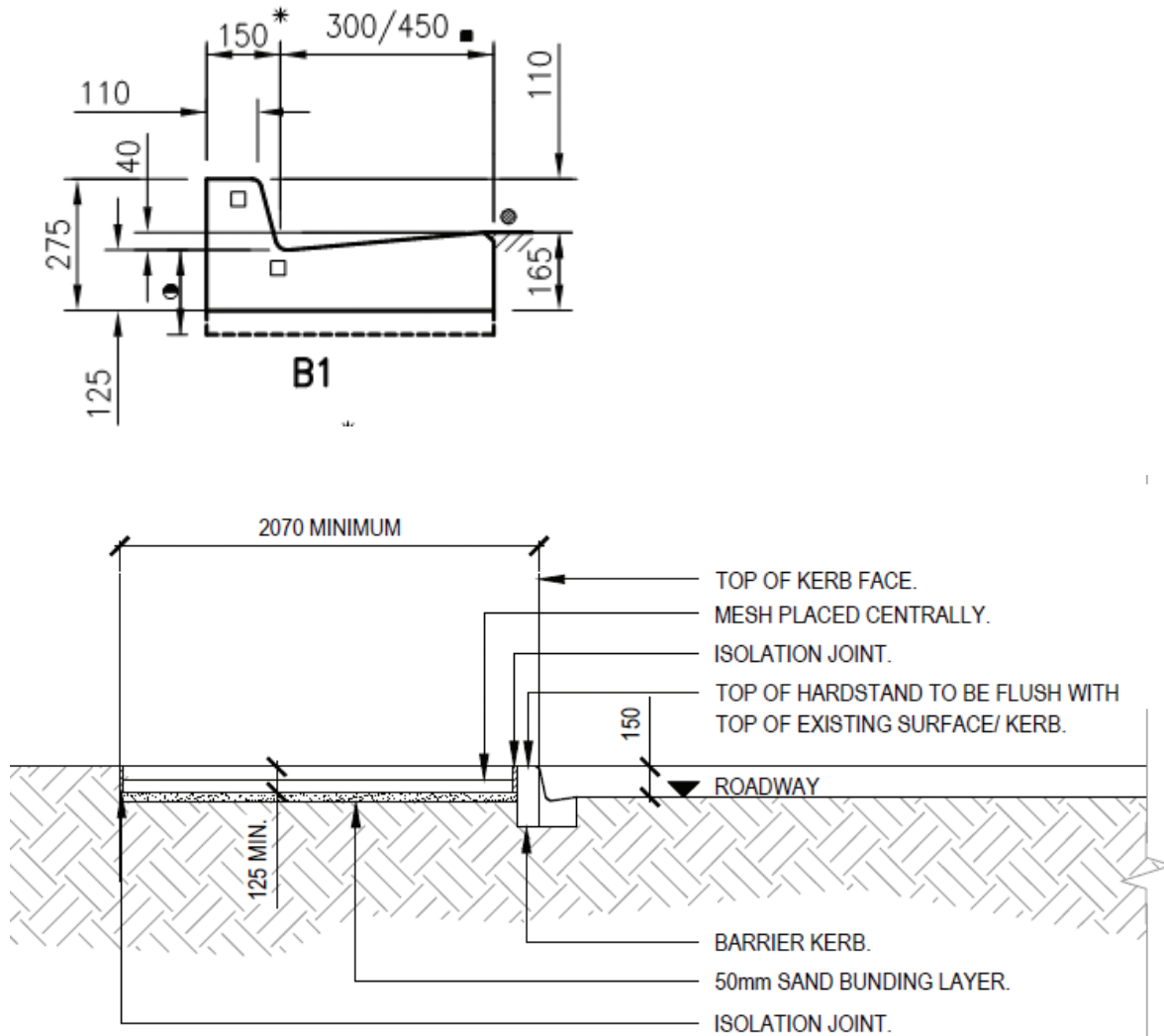


Figure 6.4.1 DSAPT compliant kerb profile for bus stop.

6.4.4 Maximising Frontage Kerbing

When designing lot frontages, particularly for small lots with narrow frontages, specify driveway locations and widths.

Note

In contemporary residential streets the kerb length is at a premium, both to maximise on-street parking capacity, and to provide for speed control devices, street tree planting, etc.

Hence the kerb length taken up by property accesses should be kept to the reasonable minimum, by:

- *Imposing a limit of one access per allotment, except perhaps for very large-scale development; and*
- *access widths to be no greater than necessary for operation.*

Tip

Local authorities may permit driveway crossovers of maximum 6.0 m to align with a double garage. However, such crossover width could be effectively limited to 2.5 m measured at kerb (plus splay – refer to the relevant IPWEAQ standard drawing RS – 049 and RS – 050) with transition to 6.0 m at/near property boundary. This will assist with the provision of on-street parking capacity and allow provision of street trees that are often deprived for space when competing with driveways and other street infrastructure.



Figure 6.4.2 Reduced crossover width.

6.5 SIGNS AND PAVEMENT MARKINGS

Objective

To provide signs and pavement markings that assist in guiding the safe movement of all users of the street.

Note

While signs and pavement marking must necessarily conform to the Queensland "Manual of Uniform Traffic Control Devices", and the Queensland Traffic Regulations, their use should be kept to the minimum needed for the safety and convenience of all users, to avoid adversely impacting on the visual amenity of the street or neighbourhood.

6.5.1 Clear Intent of Signage

Correct operation is designed into the movement network by ensuring that the intent and function of each component of the network and the network itself are clear to all users.

Tips

1. Line-marking to designate the location motor vehicle moving lanes should generally only be provided where the carriageway provides for bicycle lanes and/or recessed parking bays.
2. Selected use of coloured pavement can assist in providing cues to motorists of likely crossing locations for pedestrians and cyclists.
3. Pavement markings are generally more effective than traffic signs to warn motorists but need to be used sparingly and in a uniform manner to be effective.
4. Regulatory speed signs to designate streets with speed limits less than the default limit of 50km/h are more effective if supplemented with pavement markings showing that speed limit.
5. Where bicycle lanes are not provided, but it is highly desirable that motorists be aware of the likelihood of cyclists in specific locations, yellow bicycle symbol pavement marking could be sparingly used.

6.6 LANDSCAPE WORKS

Objective

To ensure that landscape works (street trees and other vegetated features) are installed to satisfy the intent of relevant guidelines and specifications while contributing to the amenity, sense of place, improved stormwater runoff quality and reduction of heat island effect within the streetscape.

Strategies

6.6.1 Landscape Elements

Landscape elements are given equal priority to all other infrastructure. The design of the verge, public utilities and landscape elements shall be considered as a whole to be delivered without compromise to the intent and long-term functionality of these elements.

Notes

A successful street landscape requires sufficient space for planting at installation and optimised room to cater for root and canopy growth as trees mature. Tree locations and clear trunking should be key considerations to ensure safe sight lines and distances are considered and planned. The growth of canopies is critical to the provision of shade, a key factor attracting users to footpaths and cycleways, as well as a positive response to heat island effect impacts within urban environments.

Landscape can be one of the most defining aspects of an urban streetscape, as it informs the character, amenity and naturally desirable neighbourhood. The following matters will assist in the successful implementation of landscape works within residential neighbourhoods:

- Tree species selection should be of an appropriate scale and size to suit the road environment and compliment the roadway experience, promote safe use and be supported by a driven landscape intent. Tree locations within the streetscape should not obscure sight-lines, embrace and extend, visual connections to key site attributes and community spaces for increased and active surveillance. Tree species selection must consider growth habits to minimise future potential impacts on structures and services.*
- To maximise establishment and growth of street trees, the extent of each tree pit or trench environment should consider adequate space for root growth, improved soil media conditions and consider stormwater capture devices to discharge directly to tree locations to optimise water supply and assist tree growth.*
- To maximise the planting zones via longitudinal trenching, parallel to road and kerb extents, provide the best opportunity to enhance root growth and tree performance. Often the requirement to protect verge infrastructure, including footpaths and service, restricts the available space for trees and root barrier protection directly reduces tree growth in a traditional radial pattern.*
- For ex-ground tree stock, soil from the procurement site should be collected and balanced into the immediate soil environment to reduce tree stress and provide a familiar soil condition throughout the trench extent, for continual plant growth. Ameliorated or imported soil can be used within all bag stock locations, to improve the existing site soil or provide a premium, nutrient rich growth media.*

The provision of stormwater inlet devices to allow higher flows to directly charge the soil zones around tree pits and landscaping has recognised benefits. Various devices are available for use within the kerb.

Median planting should consist of a combination of lower groundcovers next to the road and taller species within clear zones. Planting must be frangible unless behind a barrier installed as part of the engineering design. If native grasses are used planting should be set back 500 mm from the road edge to avoid overhang of the carriageway.

Tip

Many Councils include standard drawings for landscape works in streets. Some of the benefits, along with guidance on the use of passively irrigated landscapes is available at: <https://watersensitivecities.org.au/content/new-passive-irrigation-guidelines-to-cool-our-cities/>

