Design and Planning Guidelines for Public Transport Infrastructure

Bus Route Planning and Transit Streets

Public Transport Authority
Government of Western Australia

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PROJECT ABSTRACT:

Bus Route Planning and Transit Streets Guidelines is a best practice guide for transport and town planners, engineers and bus service providers who are planning and providing for current and future public transport infrastructure and services. The practical and useable guidelines are presented in three general sections:

- Urban transport planning principles and government policy (Section 2);
- Overview of current road planning environment and Transperth operating systems (Sections 3 and 4); and
- A series of issues and guidelines designed to resolve conflicts and/or inconsistencies between transport network and land development planning, and bus operations and service (Sections 5, 6 and 7).

This document is intended to guide developers and government agencies during development planning and as a reference when considering traffic management strategies.

ACKNOWLEDGMENTS:

This guideline has been prepared in close consultation with representatives from:

Department for Planning and Infrastructure.
Public Transport Authority (Transperth group).
Local Government representatives.
Main Roads Western Australia.

Contents

1. Introduction

1.1 Purpose and Scope of These Guidelines

Bus Route Planning and Transit Streets Guidelines is a best practice guide for transport and town planners, engineers and bus service providers who are planning and providing for current and future public transport infrastructure and services.

The potential benefits from adopting these guidelines are public transport services that are attractive to the public, cost efficient and sustainable. Worldwide best practice has been reviewed (see Section 10 Bibliography) to identify common issues and strategies in urban and transport network developments that support public transport.

However, while practices from around the world are worth considering, any solutions for Perth must reflect local political, economic and social parameters. This document proposes Perth-specific design standards and development controls and changes, where appropriate.

The practical and useable guidelines are presented in three general sections:

- Urban transport planning principles and government policy (Section 2);
- Overview of current road planning environment and Transperth operating systems (Sections 3 and 4); and
- A series of issues and guidelines designed to resolve conflicts and/or inconsistencies between transport network and land development planning, and bus operations and service (Sections 5, 6 and 7).

This document is intended to guide developers and government agencies during development planning and as a reference when considering traffic management strategies.

The principles and guidelines within this document can be used to guide planning in new development areas, as well as retrofitting for transit streets in established areas.

Although the guide addresses bus route planning in terms of transit street selection, it does not cover planning of system-wide network services.

The guide defines a transit street and what is needed to create one (ie street and development treatments). It suggests features and their appropriate application to support high-quality bus services.

For the purposes of this report a “transit street” is a not one with exclusive public transport facilities or priority. Rather it is a general access street with an extensive volume of public transport, and one for which improved access and operation would produce increases in patronage and operating efficiency.

Transperth requires the support of local and state government to deliver the best service possible. Local authority sustainability goals can be supported by a public transport service with high levels of patronage.

1.2 Relationship to Other Manuals

Guidelines for bus priority facilities (including transitways, busways, buslanes, and queue jumps) are provided in the Bus Priority Measures module.

2. Principles

This guide has been prepared for the six partners in urban transport planning in Perth: local authorities, Main Roads WA, Transperth, Public Transport Authority, private industry and the Department for Planning and Infrastructure (DPI). These agencies all understand the need to coordinate planning decisions and develop a sustainable urban form and infrastructure strategy to achieve their specific goals. Private industry also has an important role to play.

This Section outlines the current policy environment and professional practitioner view in relation to urban transport and land development planning

2.1 Strategic Agreement

The partners have reached consensus on a number of important principles including:

- The need to create a sustainable urban environment where development is transit–oriented and decisions support a public transport network.
- This principle is based on the analysis in the *Metropolitan Transport Strategy* (Department of Transport, 1995), it is not economically, environmentally or socially viable to continue to provide for the current level of car mobility as the population grows in the future.
- There will be issues where the various partners' goals will be inconsistent or incompatible. In these circumstances negotiation will be required between the partners to achieve consensus on the most appropriate way forward.
- Transperth is currently not able to provide increased services for all local authority requests. Commonly agreed criteria should be developed against which future bus service proposals will be evaluated and which will include transport network and urban development features.

The Strategic Agreement has a strong emphasis on sustainability. The WA Government has adopted the following definition of sustainability: *"Sustainability is the simultaneous achievement of environmental, economic an social goals"*. (Sustainable Policy Unit, 2001).

Sustainability can be considered in terms of the triple bottom line view of making public policy. Reducing private vehicle travel is appealing on all three levels:

- **Economic.** Because governing bodies need to manage funding, successful bus planning provides numerous opportunities for economic benefits – most notably reduced investments in roads.
- **Environmental.** Although the benefits are known in terms of air quality and protection of non-renewable energy resources, the incremental environmental impact will be realised over the long term and shared across the larger society.
- **Social.** An effective public transport system that reduces car dependency and traffic provides an opportunity to build more sustainable and liveable communities. Greater use of public transport can also contribute to improved general levels of health.

The six partners understand that there are planning issues that will present seemingly incompatible goals and they will attempt to resolve these by being guided by the shared principles on sustainability.
Implementing measures that create winners at the expense of other users will be difficult to achieve.

- If limited resources are available to expand the public transport system, methods are needed to evaluate what investments will be most effective, and to articulate and balance benefits and impacts. Triple bottom line evaluation that takes into account economic, social

and environmental factors is becoming the accepted approach to making public policy and investment choices. It is preferred to the more limited and traditional cost-benefit analysis, which addresses only economic factors.

2.2 Government Policy

Following are established government land development policies and transport strategies that are public transport-supportive. The policies have varying levels of statutory requirements.

2.2.1 Strategic Plans

One of the Western Australian Planning Commission (WAPC) development control policies is *DC 1.6 Planning to Enhance Public Transport Use.* This policy aims to ensure that planning takes into account opportunities created by providing public transport, and that provision for public transport services is made in structure planning and subdivision design. The outcome of this policy should be to achieve maximum development potential on appropriate land within reasonable walking and cycling distance of public transport.

The policy is applied by the WAPC when:

- reviewing subdivision and development applications;
- advising on the preparation and amendment of town planning schemes;
- preparing structure plans for developing areas; and
- preparing amendments to the Metropolitan Region Scheme.

The primary focus is on land within 800 metres of public transport, which is the generally accepted distance people will walk to use public transport. This is an area of approximately 200 hectares.

The policy suggests that appropriate land use in public transport precincts should include medium to high-density residential and commercial development (such as office and retail), plus intensive recreation, education and leisure facilities. There is a presumption against using land within a public transport precinct for low intensity uses – such as showrooms, warehousing, general industry, low-density residential, and undeveloped public open space. These uses do not generate significant volumes of public transport patronage.

The Metropolitan Transport Strategy (MTS), adopted in 1995 establishes targets for improving the use of public transport, and more walking and cycling, including doubling the public transport share of all trips from six per cent to 12 per cent by 2029.

The *Better Public Transport: Ten-Year Plan for Transperth 1998-2007* was adopted as the implementation strategy for the agency's effort to achieve the targets.

The application of policies and development processes for local and state government, are discussed in Section 7.

2.2.2 Inter-governmental Agreements

In Perth, local and state governments have recognised the benefits of public transport and realise the need to work together to address the cross-jurisdictional issues of urban planning, a key feature of which is the multi-modal transport system.

In April of 2001 the *Integrated Transport Planning Partnering Agreement* was endorsed by all Perth metropolitan area local authorities and state agencies involved in urban transport planning. This partnering agreement established *"a shared strategic transport objective of reducing car dependence, recognised regional and local needs in developing solutions that minimise impacts of transport system decisions on local communities, and set protocol on how to do business, acknowledging their respective roles and responsibilities"*.

The *Metropolitan Functional Road Hierarchy, 1997*, a strategic road network plan created by Main Roads and metropolitan area local

authorities, is discussed in detail in Section 3.4.

2.3 Importance of Guidelines to Local Authorities

To maximise their value, *Design and Planning Guidelines for Public Transport Infrastructure* must be able to be implemented. A major responsibility of local authorities is managing the local movement network. Managing car-related impacts through strategies such as "traffic calming" can be counter-productive to efforts intended to increase use of public transport.

While bus-oriented facilities and policies are sometimes in conflict with local authority movement network management goals, public transport can meet ratepayers' desires for access and quality of urban environment.

Inner suburban councils have the special problem of regional trips that start outside their area and travel through it, especially during peak periods. Public transport can be part of the solution. For example, the Town of Vincent has worked with the DPI to develop an Integrated Transport Plan. This addresses both the local and regional movement functions on Charles Street by proposing bus priority as well as improved walking and cycling facilities.

A transport problem for outer suburbs is the extreme jobs-housing imbalance that results in a high level of regional commuting. Because of their distance from major employment centres some commuter alternatives are not viable (eg walking and cycling) and it is difficult financially and operationally to provide as effective a public transport service as in inner suburbs.

Local area traffic management plans (LATMP), which aim to limit general traffic volumes and speed, make through-movement less convenient and also have a negative impact on the ability of buses to move through and service communities effectively. Such LATMPs increase travel time and result in less comfortable rides for public transport patrons. These *Design and Planning Guidelines for Public Transport Infrastructure* suggest alternative ways to control traffic volume and speed while not reducing the attractiveness of public transport as a travel alternative. On-street parking, narrowing roadways and creating pedestrian oriented environments can be used as traffic-calming measures – instead of physical devices that affect bus operations and passenger comfort. The activity of buses on the street can, in itself, be a traffic management tool.

It is understood that local authorities operate in an environment where it can be difficult to implement initiatives that address regional rather than local agendas. Given the wide range of community issues that local governments must respond to, there will have to be clear benefits if they are to take an active role in bus planning in the future. Ways to bring about changes need to take a long-term view and it will be necessary to modify some initiatives to gain acceptance of change.

With the greying of the population and increased environmental awareness, citizens are advocating improved travel alternatives. Their local authority is their first point of contact.

In recent research carried out by the DPI, 80 per cent of the public wanted public transport investment at the expense of road investment.

Their proposed spending priorities were in this order:

1. Buses
2. Trains
3. Existing roads
4. Footpaths
5. Traffic-calming
6. New roads.

This information provides opportunities for local authorities to increase their profile as advocates for sustainable urban transport planning policies and strategies.

2.4 Public Transport Planning Partnership

State and local authorities working together on urban development and transport infrastructure planning is a more effective process than individual entities developing plans in isolation for each other's consideration. With road and public transport planning agencies having different goals on different projects, one outcome has been conflicting guidance to local authorities on road matters. For example, bus embayments are recommended by an agency wanting to maximise free-flowing traffic, while the transit operation prefers buses to stop in the travel lane to reduce delay and improve passenger comfort. Also, with responsibilities for various planning areas within separate agencies, often their plans have been prepared in isolation. With the creation of the Department for Planning and Infrastructure, this situation should be improved.

As noted in the *Integrated Transport Planning Partnering Agreement*, close coordination during the development process, including structure planning and subdivision review will result in better overall urban form and performance of the transport system. Good structure planning reduces the need for punitive retrofit strategies.

Section 7 provides guidance to local and state governments on programs and processes that can improve the public transport environment. These *Design and Planning Guidelines for Public Transport Infrastructure* are based on triple-bottom line evaluation that considers economic, environmental and social issues in all decision-making processes.

The planning context includes financial considerations (capital and recurrent), policy considerations (discretionary patron or transit-dependent social service mode-share targets) and the environment.

3. Bus Service and Road Networks

In metropolitan Perth the choice of which streets bus services operate on, is related more to the historical timeframe of road network and urban development patterns than any street's role in regional road hierarchies.

Bus service levels are not a specific feature of either of the two existing road network hierarchy systems used in the Perth Metropolitan area – *The Metropolitan Functional Road Hierarchy (MFRH)* and *Liveable Neighbourhoods.* These two hierarchies are addressed in Sections 3.4 and 3.5.

The theory behind coordinating bus service levels with the road network hierarchy is to provide consistency in expectations of public transport performance and road environments. Hierarchies also provide guidance for setting priorities with limited resources.

3.1 History of Perth Urban Development

Suburbs developed prior to World War II generally have grid street networks with limited hierarchy, with commercial and residential properties having access directly on to major streets. Examples of bus streets of this generation include Stirling Highway, Charles Street, Beaufort Street and Canning Highway.

The 60s and 70s was a time of limited demand for public transport and high availability of cars. Urban places, specifically residential subdivisions, were developed with road networks that discouraged through movement, segregated land uses and limited residential access adjacent to major roads. Major roads of this generation include Leach Highway and South Street.

In recent years, street design has begun to include features that were used in the first half of the 1900s, but with remnant features from the recent past, such as discontinuous through-roads and segregated land uses. The evolution of streets such as Marmion Avenue has been influenced by changing road development and urban form philosophies.

- District Distributor 'B' roads (as designated in the MFRH) are roads that more closely reflect the design standards of Local Distributors (as designated in the MFRH), but historically serve as District Distributors. District Distributor 'B' is a classification created to reconcile inconsistencies between modern design standards and historical function.

3.2 Bus Service Streets

Transperth looks to locate services on roads that penetrate residential areas, have a customer service orientation, and are reasonably accessible by pedestrians.

The net result of Perth's land development history is that, depending on the suburbs age, Transperth services operate primarily on Local Distributors and/or District Distributor 'B' roads so as to best penetrate residential catchments and achieve optimum coverage.

- A typical CBD-oriented service operates on Local Distributors or District Distributor 'B' roads at the suburban end – picking up patrons and then moving on to District and Primary Distributors as it makes the regional part of its trip.
- Services oriented to local centres and public transport interchanges run primarily on Local Distributors. They terminate at centres that are generally on District or Primary Distributors.

Consequently, local distributors and District Distributor 'B' roads need to be considered as potential bus service streets.

3.3 Transperth Service Levels

Transperth's service planning strategy is outlined in *Better Public Transport: Ten-Year Plan for Transperth 1998-2007*. This is the strategic planning document for the agency and is built on two major initiatives:

1. The growth in the size of the bus fleet; and
2. The implementation of the South West Metropolitan Railway.

The new rail line will see increased frequencies and local services that connect the rail system to designated metropolitan centres.

Transperth currently operates a three-level hierarchy of services: High Frequency, Inter-Suburban and Local/Feeders. These service categories are differentiated by their frequency and service hours.

- **High Frequency** – High frequency, seven days a week. Included in this category are the Circle Route, 900 Series services and other trunk routes. The Circle Route and 900 Series provide a minimum 10-15 minute frequency on weekdays, increasing to five to seven-and-a-half minutes during peak periods; and 30 minutes on evenings and weekends.
- **Inter-Suburban** – High frequency on weekdays and Saturdays. These routes operate at 30-45 minute frequency during the day, with a 15 minute service during weekday peak periods. These routes have limited or no evening and Sunday services.
- **Local/Feeders** – Low frequency (30-90 minute frequencies) on weekdays only. These routes act as feeders to higher order routes and centres (including transit interchanges). A basic service sometimes incorporating modified routes is provided during evenings and weekends at low frequency.

3.4 Metropolitan Functional Road Hierarchy (1997 MRWA, LGAs)

There are over 11,000 kilometres of roads in metropolitan Perth, 10,500 of which are managed by local authorities. These roads have numerous functions. The MFRH was developed to make roads easier to use, manage and plan. It was created by Main Roads and metropolitan area local authorities, and designates the functions that roads are intended to perform. It also provides criteria to describe each road functional type and delineates a road system comprising Primary Distributors, District Distributors, Local Distributors and Access Roads.

The only reference to public transport in the MFRH is a criterion that identifies whether the road type "allows" buses – which all categories do.

3.5 *Liveable Neighbourhoods (Ed. 2, June 2000)*

The *Liveable Neighbourhoods* code is a development control tool and transport network management guideline intended to support delivery of the State Planning Strategy. It is provided as an alternative set of guidelines against which private development can be measured, rather than those in the established WAPC Development Control Policy Manual.

Liveable Neighbourhoods addresses Perth's model of low-density suburban development, high car dependence, and limited access to public transport. The code has been created as a guide to sustainable development in Western Australia through to 2029.

As part of *Liveable Neighbourhoods* a road hierarchy was developed as a basis for proposed design treatments and traffic management strategies. *Liveable Neighbourhoods* promotes several major differences to conventional suburban street systems including:

- Highly interconnected street systems;
- Integrator arterials that form the core or spine of neighbourhoods and towns – rather than the edges;
- The use of traffic signals and/or roundabouts on major roads to assist public transport and pedestrians; and
- A network that distributes traffic more evenly through a flatter hierarchy of streets.

Liveable Neighbourhoods defines roads as either arterial routes or local streets, with a range of types within each classification. The arterial route classification is consistent with the Primary Distributor and District Distributor classifications identified in the MFRH.

The primary strategic difference is that the MFRH District Distributors are identified as Integrator Arterials in *Liveable Neighbourhoods*. They are intended to be the spine of neighbourhoods rather than the boundaries – as is the principle behind arterials in the MFRH. This strategy is supportive of public transport.

Within the local street category, Neighbourhood Connectors are similar in classification to Local Distributors in the MFRH. The proposed urban design guidance for these streets in terms of parking and frontage development strategies, is also supportive of public transport.

3.6 Transit Street Hierarchies

While 'bus service streets' in Perth are not particularly related to a road hierarchy in current practice, many communities have adopted transit street hierarchies. They give instruction on physical features that affect bus operations and provide for a designated level of service. These features are required for new roads and are the subject of retrofit programs on existing facilities. Where possible they are generally adopted into local and regional road hierarchies.

An example of a transit street hierarchy in a city with a similar road network age and form to Perth is provided in Appendix A. The City of Portland, Oregon has developed a road hierarchy of traffic and transit streets, bikeways, walkways and travel routes which establishes features for each and resolves conflict between categories**.**

Transit street hierarchy is used to identify appropriate bus priority treatments. Bike and pedestrian facilities are incorporated into transit street parameters.

It is proposed that the most effective approach will be for Perth to relate to the currently accepted road hierarchy systems and adapt public transport functions/performance into the existing criteria of the *MFRH* and *Liveable Neighbourhoods*.

There is, however, an opportunity to develop transport system plans/integrated transport plans at the local level as part of town planning schemes that would include designation of transit streets, design standards and evaluation criteria.

3.7 Traffic Management

Many of the road features that are best suited for buses are the same as those that allow free-flowing car use. Local authorities are under pressure from local residents and businesses to keep traffic flowing while keeping speeds safe, primarily on the Local Distributor network.

Roundabouts, chicanes, road narrowing, speed bumps and cul-de-sacs are used to slow down and/or decrease traffic (which is usually a peak-hour-only phenomenon). These traffic management devices have implications for bus patrons, including increasing their trip time and reducing the comfort of their bus ride.

Traffic management is addressed in Section 5.1 of this guide but further details are contained in the "Traffic Management and Control Devices" module.

4. Bus Operating Characteristics

As noted in Section 2.2.1, Transperth's strategic goal is to achieve the MTS target for doubling the share of trips by public transport. To achieve this, Transperth will need to provide alternatives for trips other than commuter trips to and from the Perth CBD. If bus services are to be a viable alternative to car use for some trips, the service must compete for convenience. The most effective ways to achieve the MTS targets are to improve passenger comfort, connectivity, directness, travel time; reliability, frequency, service hours, service coverage, and accessibility. Many of these are features that can be significantly improved through road network planning, street treatments and land development decisions.

4.1 Passenger Comfort

A car driver or passenger generally has a much more comfortable ride than a bus passenger. The design features of a car (sculptured seating, seat belts and a steering wheel to hold on to) are intended to maximise passenger stability and comfort. This is more difficult to achieve in buses with their large design and operating features. Although bus suspension systems and acceleration and deceleration features have improved greatly in recent years, traffic-calming devices that require vehicles to go around or over them are more likely to create discomfort for bus passengers than for car passengers.

Local Distributors, on which the majority of bus services operate, are also the streets with the most traffic management devices. While cars can move on to regional roads (District Distributors) to complete journeys, buses operate on the Local Distributor to service the residential catchment, before joining the higher order roads to complete journeys with all pick-ups completed.

The effect of a small number of roundabouts or bumps is not significant, but because the bus travels for longer on the Local Distributor than the car, the cumulative effect on passengers of these many road treatments is significant. Safety is also an issue when passengers stand up to get off, and a significant percentage of patrons are seniors and/or people with disabilities and less able to maintain stability.

4.2 Directness and Travel Time

Travel time by public transport is generally longer than by car due to the number of stops and the time spent at them. As noted earlier, Local Distributor networks are strategically laid out to discourage continuous direct travel. Discontinuous street networks in residential areas make it difficult to connect residential catchments with destinations directly, or in a time frame competitive with the car.

Improving the ease of transfers can also reduce travel time. According to Transperth research, 50 per cent of all public transport journeys in Perth currently involve a transfer. High frequency public transport services with transfers in high-quality, safe and efficient environments are expected features of public transport systems in a city of almost two million people. This is an argument for increased investment in stop and interchange facilities, which is discussed in detail in Section 5.3 and 5.4.

Streets that are to have transit-oriented features should be chosen with future bus frequency and patronage goals in mind. Buses operating at three-minute headways (20 buses per hour) can carry up to 1,000 passengers. This is equal to the number of people that can be moved by cars in a single lane in one hour. At these patronage levels bus priority is a viable strategy. This is discussed further in the Bus Priority module.

4.3 Service Coverage, Access to Public Transport

- The Transperth Ten-Year Plan service coverage goal is that there will be a bus stop within 500 metres of where 95 per cent of Perth's population lives. The more accessible bus stops are, the more efficient is the service coverage. Transperth encourages local authorities through their development review process and the WAPC, to ensure that the pedestrian network is both efficient and permeable. One measure is the 'walkable catchment' or 'Pedshed'. This is the actual area within a 400m (5 minute) walking distance expressed as a percentage of the theoretical area within a 400m (5 minute) walking distance *(Liveable Neighbourhoods, Appendix 2)*. A good target for walkable catchment is to have 60% on the area with a 5 minute walking distance.
- Although Transperth achieves its service coverage standard of 95 per cent in built out urban areas, this coverage level is difficult to achieve in new suburbs because of the limited or discontinuous road network layout.

There are six options for accessing public transport at either a single bus stop or interchanges: walking, bicycle, car, train, ferry and bus. Features of these modes are discussed in detail in Section 5.2.

4.4 Stop Spacing

There is a trade-off between walking time to a bus stop and in-bus travel time. The closer bus stops are to each other, the less the distances to be walked, but the slower the overall bus speed.

Planning for spacing of stops must consider land use and service type. Increasing the potential number of passengers is more important than sticking to stop spacing standards. Also, how stops are spaced should depend on the route origin and destination, and what level of service is being provided – High Frequency, Inter-Suburban and/or Local/Feeders. If there is a significant clustering of boardings/alightings, additional stops give a perception of convenience.

- For patrons the critical feature of low-frequency services is ease of access, rather than trip time. This is because low-frequency services are used primarily for short trips either to local destinations or to a public transport interchange to access a higher-frequency, higher-speed service to a regional destination.

Specific bus stop locations are addressed in Section 5.3.1.

5. Street Environment / Infrastructure

Bus route and street planning should be considered in terms of an overall bus network plan that includes circumferential regional services (the Circle Route), Perth CBD-oriented radial services, local services, cross regional services and rail feeders.

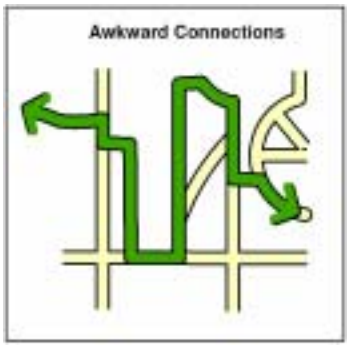
The sub-sections in this Section are guidelines for those involved in road network planning and street design or modifications. The aim is to ensure that traffic management measures do not have a negative impact on bus operations. These guidelines also suggest criteria for streets to be designated as transit streets and cater for high-quality bus services. The guidelines are based on best practice examples of public transport-oriented street design from relevant urban places around the world.

5.1 Public Transport and Traffic Management Strategies

Planning of local area traffic management should consider the safety, comfort, travel time and maintenance impacts of strategies on bus operations and patrons. Features of the bus route (s) operating on the street should be considered – including frequency, location of bus stops, patronage and the type of bus.

5.1.1 Street Network Configurations

- In developing or modifying street networks:
- Bus route streets should be provided at one-kilometre spacing from parallel bus routes through a suburban area to achieve the Transperth service coverage standard of service within 500 metres of residents. This is generally the spacing on District Distributors. If there were Local Distributors spaced evenly between District Distributors, the same spacing could be achieved.
- A grid street network is the most efficient street layout for bus operations. *Liveable Neighbourhoods* (WAPC, 2000) recommends highly interconnected street networks with frequent junctions with arterial streets wherever possible. Maximum permeability is provided with grid road systems because they are effective in spreading traffic loads throughout networks and decreasing concentrations of congestion. In the absence of a grid network there should be a relatively direct road, ideally through the middle of a development cell and connecting to higher order roads (see Figure 5.1). Street network A in Figure 5.1 below is an example of subdivision design that limits the quality of bus service in terms of directness, travel time and ride comfort as a result of the numerous turns. Network B allows good connections between development cells and permeability through a community.



Network A

Network B

■ **Figure 5-1 Alternative street network configurations**

5.1.2 Traffic Calming

Traffic calming has become a common practice by local authorities to address traffic volume and speed issues. Although traffic management and providing public transport are both pursued in an effort to improve quality of life (in terms of the transport environment), the different strategies being pursued can sometimes conflict.

Strategies for traffic management are evolving in recent urban planning approaches. However, there is an operational conflict between efforts to manage vehicle movements through channelisation and street treatments, and creating an environment in which public transport can operate most effectively. The existence of buses and their stopping patterns can be an effective traffic calming strategy, because their occasional stopping slows traffic. This in turn makes a street a less attractive option for drivers looking for a route that will by-pass congestion.

- When planning traffic calming schemes:
- It is desirable that traffic-calming devices be used no more than twice per kilometre on a bus service street.
- One-lane pinch points should not be used on bus service streets. Two lane pinch points should have a minimum carriageway width of 7.0 metres.
- Where road humps/speed cushions are used, they should be limited in width to allow buses to straddle them and not be affected. Speed tables with a flat top, affect buses less than rounded road humps. Sections 5.7 and 5.8 of the Traffic Management and Control Devices module provides design detail guidance on this issue.
- Rumble strips should not be used on bus routes as the vibrations result in passenger discomfort.

Traffic calming is addressed in further detail in the Traffic Management Guidelines module.

5.1.3 Intersections/Driveways

The treatment of intersections along transit streets can have a major impact on bus services.

The following recommendations relate to intersection planning:

- There should be relatively short spacing between cross-streets. This makes it easier for patrons to access the bus directly while also spreading out the volume of vehicles seeking access to the major street from any one cross street.
- Intersections with signals can benefit buses through passive or active priority systems. Active systems recognise buses and initiate appropriate signal changes, while passive systems provide extended "green time" in the directions of expected bus flow.
- In addition, recent revisions to the *Western Australian Road Traffic Code 2000* allow bus stops to be located closer to intersections. It is therefore recommended that:
- On transit streets, the location of driveways need to be carefully planned such that they permit a bus stop to be located within 25m of an intersection. This should be a design feature of greenfield development and be considered in redevelopment projects.
- Further detailed guidance on this issue is provided in Austroads *Guide to Traffic Engineering Practice, Part 5 – Intersections at Grade* (Section 6.4).

5.1.4 Horizontal Displacement, (Roundabouts, Chicanes)

In addition to traffic-calming, local authorities install roundabouts and chicanes for a number of reasons, including improving the flow of access from minor streets to major streets. A single roundabout or chicane, correctly designed, does not create adverse operating conditions. However, the sideways movement caused by a series of roundabouts along a bus

service street can affect the comfort of passengers and the quality of the ride.
Horizontal movement can be reduced by designs that are sympathetic to the dynamics of bus movement.

In relation to roundabout and chicane planning:

- Roundabout placement on bus service streets should consider passenger loads. At the origin end of most trips, there are fewer patrons, but there can be quite an impact on a full bus from inappropriately designed roundabouts further along routes on their way to the Perth CBD or regional centres.
- While roundabouts and chicanes are used to reduce speed, where possible they should be designed to limit the extent of horizontal deflection for a through-running bus. Detailed design guidance for roundabouts on bus streets is provided in Section 6.2.1 of the Traffic Management and Control Devices module.
- When bus routes move through a number of local authority areas, the councils should have a common approach to traffic management, and specifically to the use, location and spacing of roundabouts.

5.1.5 Turning Movements

- The impact on bus operations of turning movements can be significant. The following issues should be considered when street networks are being planned and bus service streets are being identified:
- In the design of residential cells, bus route streets should feature left turns on to major roads whenever possible.
- Roundabouts should be considered where buses are turning right.
- The number of direct private driveways with access on to District Distributors should be limited by creating shared driveways, thereby reducing access points on major roads. This also applies to reducing the number of access points to commercial parking lots.
- Street network layouts should not have right and then left turn combinations along bus service streets, as they are difficult to negotiate and increase bus travel time.
- On bus service streets where congestion is created by cars turning right, right turn pockets should be considered to reduce the effect on through-bus movements. Guidelines for provision of these areas are contained in Austroads *Guide to Traffic Engineering Practice, Part 5, Intersections at Grade*.
- "Except Bus" signage should be considered where general traffic is restricted from making right turns. Signal technology can also be used for pre-release of the bus in conjunction with this signage (see Figure 5.2).

5.1.6 Bus Embayments, Kerb Extensions

There are two extremes in the approach to the treatment of the interface of bus stop and street. At one end of the spectrum is providing a bus embayment. At the other is providing kerb extensions that allow the bus to stop in its lane (without pulling in or out). This issue is a major decision when there is a single through traffic lane. These features are discussed in more detail in Section 5.3.2.

5.1.7 Medians

Right turns from minor streets to major streets can create significant delays for buses. Having a 'storage' area in the median makes it easier for a bus to make a right turn from a minor street, across traffic, with safety, and with limited impact on passenger comfort. Approaches to this issue are:

- To provide a 'storage' area parallel to the traffic lanes; an acceleration lane can be added in some circumstances.
- To provide a median of sufficient width (11.5 metres) to store the bus at an angle. This width allows a bus to sit at a

minimum of a 70^0 angle to the through road and ensures adequate sight lines. If buses are not allowed to sit at an angle in this area, the median width to store a bus at a 90^0 angle would be 13 to 18 metres (depending on bus size).

- At these types of intersections "Keep Clear" signage is also an effective tool to assist buses accessing the major street from a right turn.

Figure 5-2 Turn exemptions for buses – Wellington Street into William Street

5.1.8 Bus Priority

Increased congestion is a significant indicator of the need for bus priority. The Bus Priority module addresses specific design features of infrastructure, signing and lining, and technology initiatives.

5.2 Access to Public Transport

As noted in Section 4.3 there are six options for accessing public transport at either a single bus stop or at interchanges: walking, bicycle, car, train, ferry and bus.

5.2.1 Pedestrian Facilities

As a bus journey requires walking to and from a bus stop, all return journey bus patrons are pedestrians twice during their trip. One difficulty of planning for the entire bus journey is that the footpath access network and the service/stop network are the responsibility of two different entities. Many potential patrons cannot or will not walk any significant distance without a formal footpath system. Pedestrian network planners should note the following principles:

- Pedestrian networks should be designed to ensure that 60 per cent of all residents living within 400 metres of a bus stop have only a maximum 400 metre walk to the bus stop.
- Cul-de-sac design should include pedestrian access-ways that reduce distances to bus services on the adjacent higher order bus streets. Guidance on this area is provided in *Liveable Neighbourhoods.*
- Continuous and direct footpath networks that permeate neighbourhoods increase the catchment for public transport because it takes less time to walk from home to bus. Street lighting also enhances the perception of security.
- Pedestrian networks should be most developed where they are adjacent to commercial or mixed-use sites as well as schools, aged care facilities and hospitals.
- Pedestrian networks should be provided along District Distributors and Local Distributors that have bus services.
- Street crossings (with universal access including kerb ramps) should be provided for pedestrians and bicycles on District Distributors.
- Safe, convenient and/or controlled road crossing points should be provided to stops with high passenger usage.

5.2.2 Disabled Access

Australian Standards (AS) 1428 provides guidance for universal access standards including 1428.4 that addresses bus stops.

5.2.3 Bicycle

A designated cycle network increases the catchment of the public transport system. The Transperth bus system currently provides cycle parking at most Bus Stations.

5.2.4 Car

Parking and/or pick–up/ drop-off facilities should be considered for bus interchanges (see Section 5.4).

5.2.5 Bus

Feeder bus operations create two planning issues: a) the ability of feeder buses to penetrate residential neighbourhoods is affected by traffic management features; and b) the arrangement for transfers from a local route to a regional route is a road space and pedestrian network issue.

5.3 Bus Stop Facilities

There are over 12,000 bus stops in the Transperth system. They are the shopfront of the Transperth product and are critical to creating favourable impressions on potential patrons and their decisions on whether to use the system.

5.3.1 Placement and Stop Spacing

Placement

It is vital that bus stops be provided close to major trip generators. Section 2.2.1 refers to DC 1.6 – the WAPC policy which aims to ensure that land development planning takes into account opportunities created by providing public transport. Section 6 provides guidance on transit-oriented land development strategies.

In the past, some local authorities have opposed preferred bus stop locations, citing their interference with car traffic. As a result bus stops have been located inconveniently away from major demand centres rather than at centralised locations. The following guidance points would ensure the best possible stop placements:

- Local authorities and Transperth should cooperatively review the bus stop network along streets to ascertain whether stop relocation, consolidation, and/or removal would improve bus operations and/or patron access.
- Stops should be safely located to provide direct access to adjacent centres and attractors.
- Bus stops should be located adjacent to or before traffic-calming devices (if possible) to reduce the number of acceleration/deceleration movements.
- Planning for bus stop locations should consider that stops operate in pairs on opposite sides of a street for the departure and return trips. Stops are sometimes staggered to improve safety.
- Bus stops should be located within 25 metres of intersections to reduce walking distance from surrounding neighbourhoods as well as to make transfers from/to routes on the cross-street more efficient and convenient (see Figure 5.3). Stops may be located as close as eight metres from an intersection, subject to local site conditions and the route of the bus service..
- The location of bus stops in terms of approach-side versus departure-side of intersections is an important consideration when planning bus priority features (eg signal pre-emption, queue jumps). It is more effective to have departure-side stops on a bus priority lane. This topic is addressed in more detail in the Bus Priority module and in AUSTROADS Part 11, 7.2.

Stop Spacing

Transperth has the following stop spacing parameters:

Service type / road type	Stop Spacing	Notes
Inter-district or regional services	800 – 1000 m	A more frequent stopping pattern is appropriate in major central business districts or town centres that are major trip generators.
Primary Distributor or District Distributor A or B	400m	Local services
	800m	High frequency services. These stops would be a priority for stop and access facilities. (See section 5.3.6).
Local / Feeder services	400m	

5.3.2 Embayments and Kerb Extensions

Currently bus stop treatments range from a signpost in the ground to a shelter with extensive system information. As noted in Section 5.1.7, there are two approaches to the street/bus stop interface.

Embayments

Embayments remove a bus from the traffic lane – which can delay its journey. "Give Way" legislation has been ineffective and failure to give way was exacerbated by the recent "Keep Left" rule. Although the Keep Left legislation has been rescinded for less than 80 kph environments, the behaviour continues.

■ **Figure 5-3 Good Example of a bus stop close to intersection – Roberts Road and Centro Avenue, Subiaco**

- Bus Embayments should be used only on routes with high dwell time at stops (ie a timed stop, a major passenger stop etc). Experience has shown that whereas bus embayments improve traffic flow on a major road, buses have difficulty rejoining the traffic flow. Motorists generally do not give way to buses leaving an embayment, even though they are required to by law.
- Bus embayments should be considered only along high-speed roads, where it is imperative to use one and there is no other alternative to improve traffic flow.

The standard design for bus embayments is covered by Main Roads standard drawings and design guideline, which can be obtained from the Main Roads web site. To avoid splashing waiting passengers with water from the gutter, the cross fall of the embayment should be towards the road (typically two per cent) and drainage gullies should not be placed within embayments.

The desirable minimum width of a bus embayment is 3.0m. This provides sufficient room for a bus to pull off the roadway entirely and not have side mirrors hanging out into an adjacent traffic lane.

A narrow 2.5m embayment must not be used. Side mirrors will overhang the adjacent traffic lane and may pose a hazard to traffic if that lane is narrow, as illustrated in Figure 5.4. It is suggested that the adjacent lane width be at least 3.5m (to allow the traffic space to avoid any overhanging side mirrors) and that the bus embayment be at least 3.0m wide. However, individual cases can be put forward to Transperth for special consideration.

Figure 5-4 Narrow Bus Embayment (note width of adjacent truck), Huntriss Road.

Kerb Extensions

- The use of kerb extensions ("bus boarders") can reduce the linear length required for a bus stop and allow for additional on-street parking. They also improve passenger ride comfort. Whereas 20-30 metres is required for bus pull-in and pull-out, a bus boarder need only be approximately nine metres long to accommodate boarding passengers. Bus stops arranged in this fashion are also an effective traffic calming strategy, particularly for town centre areas, as they create gaps in traffic for pedestrian movements across streets.

Universal Access

- All stops should be accessible by patrons with mobility restrictions. In 1995, Western Australia's Department of Transport produced *Tactile Ground Surface Indicator (TGSI) and Mobility Design Policy Report for Bus Stops in the Metropolitan Area*. This has been superseded by AS 1428.4 Appendix E (2002) *Design for Access and Mobility Part 4: Tactile Indicators.*

Bicycle Lanes Adjacent to Bus Embayments and Kerb Extensions

- The design and provision of bicycle lanes adjacent to bus embayments or kerb extensions must conform to standards found in Austroads Part 14, 4.4.2.

5.3.3 Capacity

- When allocating space for a bus top facility, the following should be considered:
- To minimise the loss of on-street parking bus stop capacity should reflect the level of service at the stop. The number of spaces provided at a bus stop should generally comply with that set out in Table 5.3. This is based on a 20 to 30 second dwell time.

Buses Passing Stop in Busiest Hour	Number of Bus Spaces in Stop
15	1
30	1-2
45	2
60	2-3
75	3
90	3-4
105	3-4
120	3-5
150	4-5
180	5-6

■ **Table 5-1 Minimum Bus Stop Requirements**

- A length of 12m for each rigid bus, plus one metre separation, should be provided between each bus on the straight section of the embayment. This excludes any tapers. For an articulated bus a length of 18m should be provided with a 1m separation between buses. However, the 12m length should be used only where it is certain that longer buses will not be used.
- The patron capacity of the waiting area at a stop (including the shelter) should be commensurate with the existing or planned service level and possible maximum per-trip boardings.

5.3.4 Support facilities

Convenient adjacent locations for safe pick-up and drop-off should be a consideration in bus stop location selection.

5.3.5 Information

Currently, bus stop information ranges from a signpost in the ground identifying the stop to a shelter with extensive system information, including real-time video and audio arrival information. In relation to information:

- It is important to select bus stop locations that have enough space to allow for future enhanced stop facilities.
- High Frequency service stops should have bus stop-specific timing information.

5.3.6 Furniture

Transperth administers a partnership program whereby local authorities can receive grants on a matching basis to fund bus shelters. A bus stop with more than 20 boardings a day is considered a candidate for a shelter. Direction on the selection of appropriate furniture includes:

- High Frequency service stops should have safe and convenient covered waiting areas in residential areas in the peak travel trip direction and in both directions at centres.
- The extent of supportive infrastructure at bus stops should reflect service level (frequency and service hours) and demand from patrons.

Features that enhance the amenity of a bus stop include information, lighting, space for pick off/drop off, shade trees, seats, telephones and rubbish bins.

5.4 Interchange Facilities

Transperth interchange facilities serve car-to-bus, bus-to-bus or bus-to-rail movements. Given that 50 per cent of all trips in the Transperth system require a transfer, the ease and convenience of interchange is critical.

5.4.1 Location

- Bus stops that work in combination with a stop on a crossing street should be located within 25 metres of intersections to make transfers more efficient and convenient.

5.4.2 Layout

- In the vicinity of public transport interchange facilities the interface between large vehicles (buses) and small vehicles (cars) should be planned for and managed.
- There should be safe and convenient covered waiting areas and paths between the two modes for passengers.
- Where park-and-ride facilities are provided, access should be from the higher order street (if possible) to reduce impact on the local street network and to make access easier.
- Ways of making use of park-and-ride facilities during non-peak periods should be considered. This would increase passive surveillance by creating "public eyes" and could generate extra revenue.

5.4.3 Support facilities

- The extent of support facilities at a bus, rail and/or ferry interchange relates to the adjoining land uses and the volume of patronage. Off-line facilities can include park-and-ride and kiss-and-ride facilities, bus lay-over facilities, taxi ranks and additional amenities.

5.4.4 Information

- Public transport interchange sites should provide extensive system information.
- Major interchanges should include Transperth customer service staff.

5.4.5 Furniture

- All interchange locations that include High Frequency services should include:
- Shelter and shade;
- Seats;
- Lighting;
- Pick off/drop off site;
- Telephones; and
- Rubbish bins.

6. Land Use/Development

In addition to transport network features addressed in Section 5, land development patterns (urban form) are a key feature in determining the quality of the public transport environment. The bullet points in the following sub-section include issues to be considered during the development process. These guidelines also suggest criteria to be met to "earn" transit street status and qualify for a high-level bus service. The individual guidelines have been developed from the themes of various planning practices in other relevant urban places.

The location of urban development determines whether it can be served well by public transport. The layout of development determines how easy it is to use.

6.1 Location

- The minimum urban density necessary for Transperth to introduce service is an average of 300 dwelling units per linear kilometre (500 metres wide). The criteria to receive higher levels of service include patronage potential and significant community attractors. An area undergoing residential growth (dwelling units and/or density) or the creation or growth of centres/attractors, is a candidate for increased levels of service.

6.2 Layout

- The two features of development layout that affect public transport provision are whether the layout makes public transport easy and convenient for patrons to use and whether the layout makes it economic and efficient for Transperth to provide the service. When developing concepts for urban development, the following should be considered:
- Where physically possible, access points to the public transport system should be closer to major destinations, rather than car parking. Commercial facilities should provide similar access facilities (including cover) from bus stops as those provided from parking facilities.
- Transport planning for developments should include access from public transport facilities across any site boundary street.
- Bus routes through developments should be as direct as possible, with access and egress points compatible with the surrounding road/pedestrian network.

6.3 Transit Oriented Development

Transit Oriented Development (TOD) has been defined as *"mixed use communities within an average of 600 metres walking distance of a transit stop and core commercial areas. TODs mix residential, retail, office, open space and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot or car." (Calthorpe, 1993)*

Western Australian Planning Commission (WAPC) Development Control Policy 1.6 aims to ensure that land development planning takes into account the opportunities created by providing public transport services. The policy is applied by the WAPC in determining subdivision and development applications, in advising on town planning scheme amendments, and in the preparing structure plans and amendments to the Metropolitan Region Scheme. The following public transport-oriented features are included as a guide and focus on the non-Perth CBD areas of the metropolitan area:

- The policy states that maximum residential development potential should be achieved on appropriate land (approximately 200 hectares) within reasonable walking distance

(approximately 800 metres) of public transport interchange stations/hubs and to promote the best possible integration of land use with the public transport system.

- It is recommended that the following land uses not be allowed: low-intensity commercial uses, warehousing, general industry, low-density residential and undeveloped public open space.
- The clustering of ancillary commercial, retail and service uses in the core area around public transport interchanges provides public transport patrons with easy access to a wide range of urban activities.
- Mixed-use (commercial and residential) development is most effective in a sustainability sense because it removes the need for trips on the road or public transport network.
- Development density should peak at the transit interchanges and decrease proportionately based on distance from the station.
- *WAPC DC 1.6* supports reduced car-parking provision in town planning schemes in these public transport precincts.

Future urban form decisions by Councils that reduce the number of trips and trip length per household are the most effective method of achieving MTS targets. If urban development does not evolve to a more sustainable form it will be an uphill battle to capture bus patronage from low-density, long trip environments. A larger increase in public transport patronage can result from transit-oriented urban development than from improving public transport service to areas which do not inherently create potential for trips.

Modifying land use policies to encourage growth that is concentrated around transit nodes and corridors will help to maintain and increase numbers of patrons in the future. An environment that is pedestrian friendly is transit friendly. The principles of Transit Oriented Design (TOD) recommend that mixed use, high density activities are located close to public transport stops and interchange stations.

Residents of TOD communities tend to drive about 20 per cent less than those living in conventional neighbourhoods. *(Source TDM Encyclopaedia, Victoria Transport Policy Institute.)*

6.4 Redevelopment, Inner Suburbs

Inner suburb areas are the most likely to have traffic management issues resulting from pass-through traffic.

It is vital to pursue transit-oriented redevelopment in these areas, because the level of public transport service is higher than in outer suburbs, thus increasing potential public transport patronage. Travel patterns are well established and transit streets are generally set and unlikely to change in these areas.

Consideration should be given in these inner-suburban areas to transit-oriented parking management strategies, which are discussed further in Section 6.6.

Kerb-side bus priority facilities (as in the case of Beaufort Street in Inglewood) should be considered in these environments as part of traffic management strategies. Guidance for the bus priority facilities is provided in the Bus Priority Measures module.

6.5 New Development, Outer Suburbs

New development road planning should minimise the impact of its street treatments on any externally generated pass-through traffic.

Liveable Neighbourhoods provides statutory guidance on best practice urban development in these areas.

The following urban transport planning principles apply to new urban development:

- As noted in *Liveable Neighbourhoods*, integrator arterials (District Distributors) should be located through the middle of developments to maximise their catchment, which is approximately 500 metres to each side of the route.
- Routes should be spaced approximately one kilometre apart to maximise the efficiency of the service coverage.
- Development adjacent to High Frequency services should be planned and designed to support transit-oriented development and provide a high level of multi-modal access from up to one kilometre away.
- As supported by the Metropolitan Development Plan process, the development front should be contiguous to improve the efficiency of bus services and other utilities.
- In planning town centres, consideration should be given to the orientation of bus routes along the streets that mirror the major travel direction.
- A common new residential road layout strategy is to reduce traffic loads by not having direct through streets. An impact of this strategy is to require buses to make numerous left and right moves to pass through a community. To minimise this impact on bus operations, off-set intersections should be arranged so that buses are making left then right combinations rather than right then left moves.

6.6 Parking Management

A critical feature of urban development is its traffic generation. A parking management plan should consider the following:

- As noted in the *WAPC DC 1.6* section, significant urban places with a high-level public transport service should have off-street parking maximums in conjunction with development density minimums. These strategies can be implemented though control of parking supply and cost.
- In transit-oriented locations such as town centres the car should share access priority with public transport and pedestrians. Anecdotally, more patrons will use a bus stop than drivers will use the same space allocated for parking.

Although removal of parking can provide a lane for priority over traffic or congestion relief for buses, on-street parking is an effective traffic management tool. Narrow roads have lower average traffic speeds than wider ones. On-street parking is a feature of a "main street" – generally with a single lane in each direction and kerbside parking.

7. Coordination and Implementation

There are numerous opportunities for the various partners to pursue initiatives identified in Sections 5 and 6 separately or together to enhance the environment for public transport and support the achievement of MTS targets for public transport. This section discusses strategies that can be used by the various partners to enhance the performance of public transport and increase patronage. Best practice examples of public transport-oriented street design from relevant urban places around the world have been considered in preparing the individual guidelines proposed below.

Overseas examples of coordination include memorandums of understanding between public transport agencies and local authorities outlining how the parties will coordinate public transport and land use planning. See Appendix A for an example from San Diego, California).

7.1 Infrastructure

- To coordinate infrastructure provision, local authorities and Transperth should require the following:
- Transport system plans (TSP) (as part of town planning schemes) that identify a transit street network and bus stop locations. These public transport network features should be identified in structure plans and retained in the subdivision process. This street network should also be documented in the Transperth Service Plan. As part of the preparation of a TSP for local authorities, the catchment areas should be identified and quantified. These evaluations can be used in considering and setting priorities for future works.
- Bus service street traffic management plans, including bus stop locations and footpath strategies. This allows a long-term strategy to modify and implement features. Funding programs should be developed to reflect the chosen strategy.
- Multi-modal transport impact assessments (TIAs) by developers as part of the development process. As part of a TIA an developers should demonstrate how accessible individual homes are to public transport. In particular, developers should demonstrate the number and percentage of homes that are within 5 minute walking distance and 10 minute walking distance to the designated bus stops.
- As new suburbs expand, bus service streets that will be extended in the future should have temporary turnaround facilities at the terminus.

7.2 Land Use

- To maximise the sustainability of land development, the approving authorities (Local Government, Main Roads and DPI) should require the following:
- Updating of local town planning schemes by local authorities to reflect *WAPC DC 1.6* principles in terms of land development density and mix, and parking supply management.
- The introduction of bus services with development in keeping with the *Metropolitan Development Plan* direction on critical services.
- The siting of significant attractors, including educational facilities (high schools, TAFEs and universities) on High Frequency bus route streets to take advantage of the high-level of service and to reduce traffic and bus impacts on lower order streets. This also dilutes the overall quality of bus services.

7.3 Funding

This section describes the current roles and responsibilities for development and modification of the road network.

- Main Roads are responsible for Freeways and Highways designated as Regional Roads under the Metropolitan Region Scheme. Funds for maintenance and improvements for these roads are made available from the State and Commonwealth.
- Local authorities are responsible for the maintenance and redevelopment of existing roads that are not under the control of Main Roads. Funds are available from both the Commonwealth and the State. Specifically Main Roads controls a number of funding programs which local authorities can access. In addition, DPI/Transperth currently provides funding for local authorities for bus shelters and can also be approached for funding assistance for specific projects which enhance bus operations.
- DPI has participated with local authorities in the development of integrated transport plans which serve as a basis for setting priorities for funding and confirming that proposed expenditures are planned efficiently.
- Streets in new areas are the responsibility of land developers. In addition to construction of streets to meet bus requirements, developers can also contribute to the early introduction of services to meet community needs.

8. Disability Considerations

8.1 Principles

In August 2002, the Federal Government enacted the *Disability Standards for Accessible Public Transport 2002* under the *Federal Disability Discrimination Act 1992*. This document sets out stringent standards that all authorities must strive to achieve with full implementation on all public transport by 2032.

The guiding principle of an equitable transport infrastructure for people with disabilities is providing a clear and continuous accessible path of travel. This allows people with disabilities to find their way to their desired destination.

Way-finding is a two-stage process by which people must solve a wide variety of problems in architectural and urban spaces. It involves both decision making and decision executing.

In providing facilities for pedestrians to access bus infrastructure, and in the context of bus stops, there is a range of considerations in design that also cover the range of disabilities:

- Physical Disabilities;
- Blind (Total or close to Total Vision Loss);
- Vision Impairment (Partial Vision Loss);
- Hardness of Hearing; and
- Cognitive Impairments.

These areas are discussed in more detail below.

Physical Disabilities
Way-finding considerations are:

- Space to manoeuvre;
- Level access for lifts, ramps and steps so people do not become unstable;
- Wide surfaces of paths to allow for wheelchairs;
- Circulation spaces to allow two wheelchairs to pass;
- Minimal length of travelling distances – with seats to reduce stress;
- Minimal cross fall on verges;
- No surface drainage across footpaths;
- Signage location that can be read without difficulty; and
- Heights and design controls that are within easy reach.

Blind
Way-finding considerations are:

- Auditory signs and warnings;
- Warning Tactile Ground Surface Indicators (TGSIs) – imperative at hazards;
- Directional navigation by inherent design features such as handrails, walls, fences and landscaping with no barriers;
- Directional TGSIs only when other features are not present; and
- Over-use or inappropriate use of TGSIs that confuse in a dangerous situation.

Vision Impaired
Way-finding considerations are:

- Signage that is clear with large fonts and high colour contrast;
- Adequate lighting levels;
- Colour contrast of navigation paths and major structures; and
- Minimal use of reflective and see-through surfaces.

Deaf/Hard of Hearing
Way-finding considerations are:

- Clear plain English signage;
- Visual information and warnings; and
- Hearing augmentation.

Cognitive Impairments
Way-finding considerations are:

- Standardisation with logical pedestrian flows;
- Plain English; and

- Use of symbols and words in signage.

As discussed in Section 7, Main Roads WA has developed a series of standard ramp types that should be used on all its roads. These have been developed through extensive consultation with stakeholders and should be used for all road crossings by pedestrians. Readers should refer to the MRWA publication *Geometric Design of Pedestrian and Cyclist Facilities.* This ramp type should be used where appropriate on all road types.

Figure 8.1 illustrates a good example of a ramp that is wide, not steep and has appropriate TGSIs.

- **Figure 8-1 Good Disabled Access Designed Ramp designed to current MRWA standards, Curtin University.**

8.2 Legislation & Standards

The provision of equity for mobility for people with disabilities is governed at various levels of government. Some Acts are:

- United Nations Conventions and Charters;
- *Federal Disability Discrimination Act 1992*;
- *State Equal Opportunity Act 1984*; and,
- *State Disability Discrimination Act 1992*.

The relevant standard appropriate for the design for equitable access and mobility is AS1428 Design for Access and Mobility.

- AS1428.1 - Part 1: General Requirements for Access – Buildings;
- AS1428.2 - Part 2: Enhanced and Additional Requirements – Buildings and Facilities;
- AS1428.3 - Part 3: Requirements for children and adolescents with physical disabilities; and
- AS1428.4 - Part 4: Tactile Ground Surface Indicators for the Orientation of People with Vision Impairments.

The overriding standard guiding all disability access considerations is *Disability Standards for Accessible Public Transport 2002*.

9. Relationship to Other Public Transport Guideline Modules

This module is intended as a planning guidance tool providing principles for consideration by planners and designers of urban development and transport networks. In most cases the specific design standards related to principles discussed are found in the Traffic Management and Control Devices module.

The module discusses transit-oriented planning strategies for general street operations. There are locations where giving public transport priority would further enhance transit operations. These priority facilities are addressed in detail in the Bus Priority Measures: Principles and Design module.

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Appendix A City of Portland, Oregon – Classification Descriptions

Appendix A City of Portland, Oregon – Classification Descriptions

CLASSIFICATION DESCRIPTIONS

The street classification descriptions of the Transportation Element describe the types of automobile, transit, bicycle, pedestrian, and truck use that should be emphasized on each street and how future street improvements and public and private development relate to those uses. The street classification descriptions describe the functional purpose of the classification, how to treat intersections with other streets, the appropriate land use and development for the street, and design treatment and traffic operations for the street. Changes to the traffic classification descriptions have been made to address appropriate traffic operation on streets having a dual classification of Regional Trafficway and Major City Traffic Street. No changes have been made to the transit classification descriptions and only a minor change was made to the truck classification description. Major changes have been made to both the bicycle and pedestrian classification descriptions based on work in the Bicycle and Pedestrian Master Plans and the desire to make the descriptions for these two modes more parallel in construction with each other and with the descriptions for other modes.

Street classification descriptions are divided into the following categories:

TRAFFIC STREETS
Regional Trafficways
Major City Traffic Streets
District Collectors
Neighborhood Collectors
Local Service Streets

TRANSIT STREETS
Regional Transitways
Major City Transit Streets
Minor Transit Streets
Local Service Streets

BIKEWAYS
City Bikeways
Local Service Bikeways
Off-Street Paths

WALKWAYS
Pedestrian Districts
City Walkways
Local Service Walkways
Off-Street Paths

TRUCK ROUTES
Truck Districts
Regional Truck Routes
Major Truck Routes
Minor Truck Routes
Local Service Streets

Appendix A City of Portland, Oregon – Classification Descriptions

TRANSIT STREETS

Regional Transitway

Functional Purpose
Regional Transitways are intended to provide for interregional and interdistrict transit trips.

Regional Transitways are intended to provide for frequent high-speed, high-capacity, express and limited transit service.

Stations, Transfers and Stops
Stations and stops on Regional Transitways should be located in such a way as to provide direct service to regional and neighborhood commercial centers and major trip generators along the transitway.

Stations and stops on Regional Transitways should provide a safe and convenient covered waiting area and means of transfer to other transit services. Transit information and access for pedestrians and bicyclists should also be provided.

On Regional Transitways, minimum distance between stations and/or stops should be approximately one-half mile. In high-density areas in the Central City, closer station spacing may be appropriate.

On Regional Transitways, locate stations and stops to provide convenient access to neighborhoods and commercial centers. Stations located within 25 minutes travel time of downtown should primarily be served by feeder bus connections. Those beyond 25 minutes travel time, should be served by either park-and-ride or feeder bus service.

Land Use and Development
Regional Transitways should provide connectors between downtown and all regional activity centers.

Regional Transitways should not provide direct access to areas in which urban growth is to be discouraged, as defined by the Comprehensive Plan.

Private and public developments of regional significance (for example, shopping centers, stadiums, arenas, etc.) should be encouraged to locate adjacent to Regional Transitways to reduce traffic impact on adjoining areas and streets.

On Regional Transitways, land uses surrounding transit stations should be planned and designed to support transit-oriented development and provide a high level of multimodal access to the station site within one-half mile.

Density should peak at the station center and decrease proportionately based on distance from the station.

Design Treatment and Operating Characteristics
A Regional Transitway should be an exclusive transit facility where the level of service demands and the topography and adjoining development allow.

Where feasible, neighborhoods in a developed area should be buffered from the direct impact of Regional Transitways.

Design treatment of a Regional Transitway should consider auto, transit, bicycle and pedestrian circulation at the station area.

Major City Transit Street

Appendix A City of Portland, Oregon – Classification Descriptions

Functional Purpose

Major City Transit Streets are intended to provide transit service for all person trip ends having none, one or both of its trip ends within a Transportation District.

Major City Transit Streets are intended to provide concentrated transit services to connect and reinforce major activity centers and residential areas.

Major City Transit Streets are intended to provide for local, limited and express transit operations.

Stations, Transfers and Stops

Facilities at transfer points on Major City Transit Streets should provide a safe and convenient covered waiting area and a means of transfer between transit routes. Transit route information and access for pedestrians and bicyclists should be provided.

On Major City Transit Streets, locate stations and stops to provide convenient access to neighborhoods and commercial centers. Stations located within 25 minutes travel time of downtown should primarily be served by feeder bus connections. Those areas beyond 25 minutes travel time, should be served by either park-and-ride or feeder bus service.

On a Major City Transit Street, stops should be 400 to 750 feet apart in high- to medium-density areas and 600 to 1000 feet apart in low-density areas.

Limited transit service should stop at transfer points and activity centers along Major City Transit Streets.

Land Use and Development

Transit-oriented land uses should be encouraged to locate along Major City Transit Streets.

Auto-oriented land uses should be discouraged from locating along Major City Transit Streets, except where the street is also classified as Major City Traffic Street.

Encourage land use densities along Major City Transit Streets to vary directly with the planned capacity of transit service and in conformance with the Comprehensive Plan.

Design Treatment and Operating Characteristics

Major City Transit Streets are intended to provide service for living and doing business within the Transportation District.

Where neighborhood commercial uses occur along Major City Transit Streets, pedestrian and bicycle improvements and on-street parking should be encouraged.

On Major City Transit Streets, employ preferential transit service, including transit priority treatment (such as signal pre-emption or exclusive lanes), which may involve removing on-street parking or acquiring additional right-of-way.

Adequate pedestrian and bicycle crossings should be provided along a Major City Transit Street at or near transit stops.

Appendix A City of Portland, Oregon – Classification Descriptions

Minor Transit Street

Functional Purpose
Minor Transit Streets are intended to provide for district transit service.

Stations, Transfers and Stops
On Minor Transit Streets, stops should be located between 400 and 600 feet apart in medium-density commercial areas and between 500 to 1000 feet apart in other areas.

Facilities at transfer points on Minor Transit Streets should provide an adequate covered waiting area. Transit information and direct and convenient pedestrian and bicycle access should be provided between transfer points.

Land Use and Development
Encourage direct and convenient pedestrian and bicycle access between transit stops and land uses along Minor Transit Streets.

The density of development along Minor Transit Streets should be encouraged to vary directly with the planned capacity of transit service and in conformance with the Comprehensive Plan.

Design Treatment and Operating Characteristics
Transit movement is not the primary function of Minor Transit Streets.

Parking removal, or purchase of additional right-of-way for transit purposes on Minor Transit Streets should not be undertaken except at specific locations, in order to provide for transit stops and intersection improvements.

The size and type of vehicle used on Minor Transit Streets should be appropriate to the needs of the land uses being served along the entire route.

Local Service Street

Functional Purpose
Local Service Streets are intended to provide service to local residents and commercial areas and paratransit service. Where no alternatives are available, they may be used as route end loops for regularly-scheduled routes.

Stations, Transfers and Stops
On Local Service Streets, the location of stops should be based upon Tri-Met Service Standards.

Land Use and Development
The design of Local Service Streets should correspond directly to the land uses served.

Design Treatment and Operating Characteristics
Design treatment and transit operations on Local Service Streets should give preference for access to individual properties and to the specific needs of property owners and residents along the street.

Appendix B San Diego Memorandum of Understanding

Appendix B San Diego Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING BETWEEN THE CITY/COUNTY/AGENCY AND THE SAN DIEGO METROPOLITAN TRANSIT DEVELOPMENT BOARD (MTDB) FOR TRANSIT/LAND USE PLANNING COORDINATION

WHEREAS, land use planning is the responsibility of individual local government agencies, and MTDB has a stake in the shape of future development in the region and in the redevelopment of existing urban neighborhoods; and

WHEREAS, sprawled development patterns and auto-oriented site designs are difficult and costly to serve by transit. Conversely, neighborhoods designed to facilitate walking and bicycling will reduce auto dependence, make transit use easier, and lead to better communities; and

WHEREAS, the cooperation and assistance of the cities in the region, the County of San Diego, and other government agencies with land development authority are required to provide an efficient and effective transit system; and

WHEREAS, MTDB desires to work with the agencies in its area of jurisdiction in order to interrelate and coordinate land use and transit planning in all immediate-action, short-range, and long-range plans; NOW THEREFORE

In consideration of the foregoing, the parties agree as follows:

1. The City/County/Agency (hereinafter "City") will regard transit as an integral component of all major planning studies and programs.

2. The City will depict existing and proposed transit corridors and centers in long-range plans. Land use, development intensity, and transit-oriented design recommendations will be incorporated into the long-range plans to reinforce the use and effectiveness of these identified transit corridors.

3. The City will include MTDB in the project review process at an early stage, similar to review procedures established for other public agencies such as school and water districts. MTDB and the City will develop a "transit checklist," or other project review materials, to raise awareness of transit issues and outline the scope of MTDB's review.

4. MTDB will provide a response to the City on project review within the City established allotted time frame. The City shall include MTDB's comments into the formal record of the project and forward such comments to the municipal project decision-maker.

5. The City will identify a planning staff member who would include transit liaison as part of his or her job responsibilities. This staff person would oversee and monitor the MTDB review process.

6. The City will include transit- and pedestrian- and bicycle-oriented design standards in its zoning code and street design manual.

7. The City will locate public facilities and services such as schools, libraries, government offices, parks, and recreation centers in transit-oriented, mixed-use neighborhoods whenever possible to provide a transit travel option for patrons and to strengthen the sense of community.

Appendix B San Diego Memorandum of Understanding

8. MTDB and the City will work cooperatively in the planning of regional institutions and infrastructure, and on issues of regional importance.

9. To encourage higher productivity of its resources, MTDB shall consider transit-friendly community design as an important factor in evaluating the allocation of transit improvement funding.

10. The City will work with MTDB to secure and protect transit rights-of-way.

11. The City will recognize transit as an essential public service, similar to other elements of municipal infrastructure, and will strive to obtain transit operations and facilities funding from a variety of sources.

12. MTDB will work with the City to optimize and leverage any local funds with available discretionary transit funding.

13. MTDB and the City will conduct an ongoing public information program on the role of transit, and transit-oriented development. This program would include: annual staff briefings, communications with elected officials, newsletter articles, information materials, and presentations targeted to key professional, community, civic, and environmental groups; and publicity for exemplary plans and projects.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be signed this _____ day of _____ 2000.

Approved:

_____
General Manager
San Diego Metropolitan
Transit Development Board

Approved:

_____
Mayor
City/County/Agency

Approved as to form:

_____
General Counsel
San Diego Metropolitan
Transit Development Board

Approved as to form:

_____
City Attorney
City/County/Agency

DGunn/POLICY 40
MOU-TRN-LUPLNG-CORONADO.NBRAGA
7/10/00