POLICY NO. DC 2.6
RESIDENTIAL ROAD PLANNING

CONTENTS

WESTERN AUSTRALIAN
PLANNING COMMISSION

BACKGROUND NOTES

1. This policy sets out the Western Australian Planning Commission's requirements for the planning and design of roads in residential areas and provides guidelines for the design and layout of residential roads.

2. The Residential Road Planning Policy DC 2.6 was adopted by the Commission in 1988 and reviewed by consultants engaged by the Commission in 1992. The consultants' report and recommended changes to the policy were released to local government, planning and engineering consultants and developers for comment in 1993. This policy now incorporates many of the recommendations from the consultants' study and takes into account the submissions made on the study.

3. The policy operates within the functional road classification framework contained in Policy DC 1.4, which provides for a hierarchy of four classifications of road: primary distributor, district distributor, local distributor and access road. As it is concerned with residential areas, the policy relates only to the two lower order classifications, these being the types of road encountered in residential neighbourhoods.

4. In principle, the policy reflects initiatives being pursued throughout Australia at both national and State levels. AMCORD 95, for example, offers a range of alternatives to the traditional approach to the planning and design of streets in residential areas in order to reduce housing costs and, at the same time, improve the amenity of the domestic environment.

5. The Commission has recently released the Liveable Neighbourhoods Community Design Code to help make the State's suburban areas more sustainable and offer a wider range of housing and employment to support changing community needs and preferences. The code has been released for an initial period of 12 months to test and refine aspects in practice. This policy will be modified where appropriate following the review and refinement of Liveable Neighbourhoods.

6. This policy was updated and reconsidered by the Commission in June 1998.

7. The policy should be read in conjunction with the following guidelines and policies included elsewhere in the manual:

   Policy No. DC 1.4 - Functional Road Classification for Planning

   Policy No. DC 1.5 - Bicycle Planning

   Policy No. DC 1.7 - General Road Planning

   Guidelines for the Preparation of Local Structure Plans for Urban Release Areas

   Guidelines for the Design and Geometric Layout of Residential Roads.

1. INTRODUCTION

1.1 Purpose of the Policy

The intention of this policy is to encourage the design of the road network within a residential neighbourhood to provide for the safe passage of motor vehicles, pedestrians and cyclists while at the same time providing for the creation of a high level of residential amenity.

The policy is not intended to be prescriptive. The standards and criteria it contains are broadly based and provide a range of options for the designer. Moreover, designers are advised to refer to the Public Utilities Committee in respect of the location of services in verges. Within the framework set by the principles of the policy, it should be possible to create from those options a road network which is suitable for any given set of circumstances and constraints.

The policy has been prepared with particular reference to the quality of the neighbourhood environment and the cost of housing. It offers a response to these issues in terms of road planning and design. The form and density of residential areas and in part the cost of housing are determined by standards of lot sizes, building controls, road design and servicing requirements that have in the past been too rigid and, in many cases, excessive.

As a positive approach to these problems the Commission seeks to modify standards in order to encourage more innovative and varied approaches to the design of residential areas which will result in closer settlement in new areas and increased densities in existing areas without adverse effects on residential amenity.

While this policy will have most direct relevance in developing areas, the principles also apply to established areas. In particular, the need to establish a road hierarchy, rationalise access to busy local distributors and provide treatments to cater to the needs of pedestrians and cyclists, are principles of general applicability to established residential areas.

1.2 The Neighbourhood Environment

Public awareness and concern about the impact of traffic upon the neighbourhood environment is acute. Residents are becoming less tolerant of the noise and general disturbance caused by traffic on their streets, and local traffic management schemes are more frequently being proposed. Traffic speed is the main cause of both nuisance and accidents, and the general loss of amenity.

Many residents see the road reserves outside their dwellings as an extension of their domestic environment, capable of other uses as well as the movement of traffic. Examples of such uses are children's play, cycling, meeting neighbours and even social events like street parties. As road reserves take up, on average, about 25 percent of the land contained within a neighbourhood, the multi-use of road reserves represents a more efficient use of residential land.

While the need to provide for the motor vehicle remains of fundamental importance, much greater priority must now be given to the creation of a safe, quiet and useable neighbourhood environment where the motor vehicle is less dominant than in many of our existing residential areas.

The way in which the street verge is treated can have a significant impact on the creation of a neighbourhood identity or sense of place as well as safety of all road users, including motor vehicle passengers and pedestrians/cyclists. This in turn affects how the street is used, particularly its multi-use by pedestrians and cyclists. Important components of the street verge include:

- footpaths/dual-use paths;
- tree planting; and
- street lighting.

Street trees, in particular, contribute to the creation of a sense of enclosure and human scale providing shade (to create a cooling effect), aesthetic attributes and the promotion of bird life. Canopies over hanging streets create a sense of enclosure which can influence driver behaviour by promoting a slow vehicle speed environment.

1.3 The Road Hierarchy

Policy DC 1.4 establishes a uniform road classification system based on function for use in the planning of urban areas illustrated in Figure 1.

This policy (DC 2.6) follows Policy DC 1.4 focusing on the planning and design of roads within residential areas, the two lowest categories of the hierarchy - local distributors and access roads - and has regard to the interface with district and primary distributors.

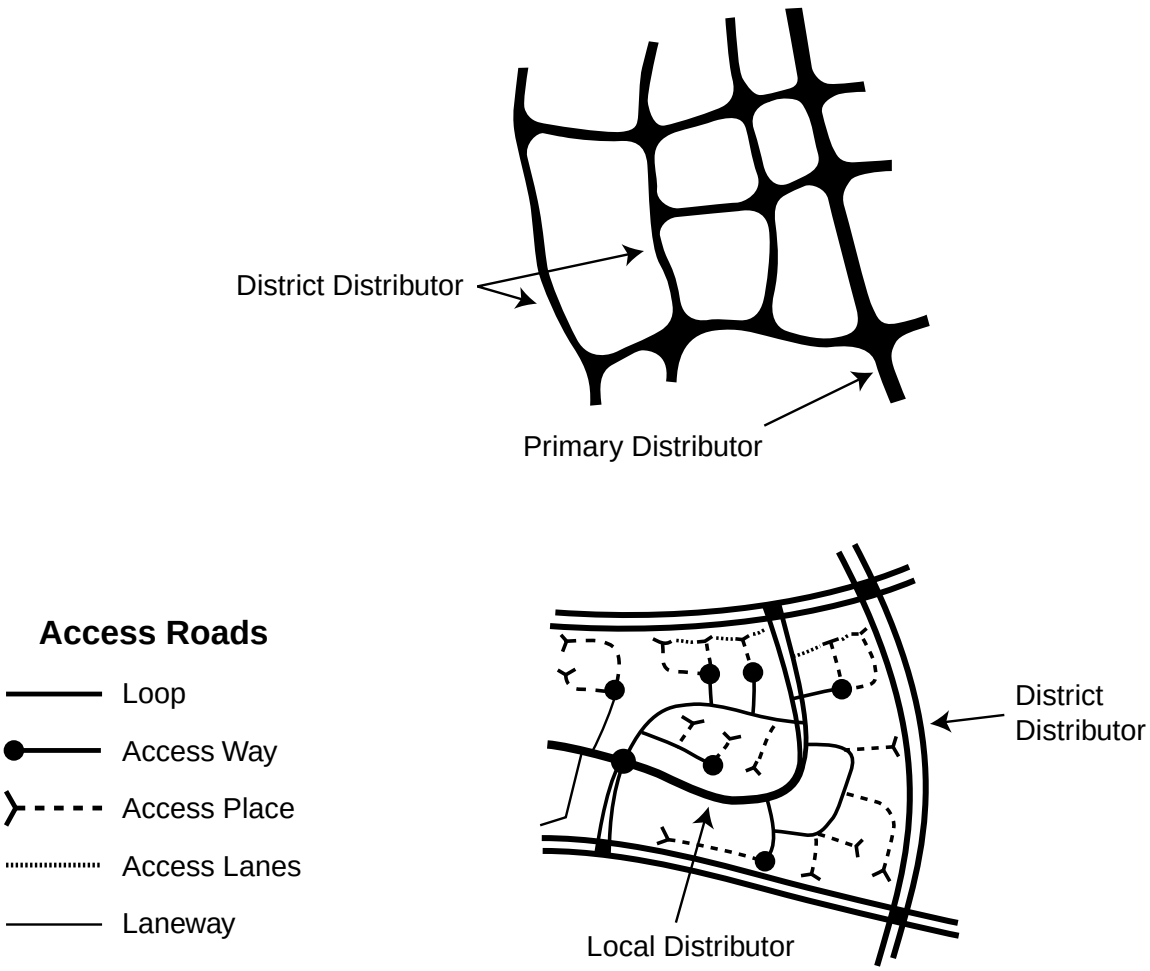


Figure 1. **Illustrative layout of Roads in Hierarchy**

A road network designed in accordance with the principles advocated by this policy should serve to minimise traffic speeds and volumes throughout the residential neighbourhood. The network should, however, be complemented by defined systems of pedestrian and cyclist movement which can further reduce traffic numbers by offering a practical alternative to the motor car for transport and recreation journeys to and through the neighbourhood (i.e. schools, shops, open space, public transport stations and employment centres).

1.3.1 **Local Distributors**

Local distributors form the link between the district distributor and the access road. They should carry only traffic generated within the neighbourhood and be planned and designed to discourage use by through traffic from outside the neighbourhood. They may also be required to carry bus routes through the neighbourhood, and special bus-only links should be provided as necessary.

Potentially, local distributors will have two, often conflicting, functions. By definition they are required to carry a certain volume of locally generated traffic, while the fact that they are within a residential neighbourhood suggests that they are also suitable to give access to individual residential properties.

Foreshore access roads (FARs) are a special category of local distributors intended to give access to linear open spaces such as beach, lake and river foreshores and Parks and Recreation reserves.

FARs are different from local distributors in that they carry recreational traffic from outside the neighbourhood to the foreshore strip and also carry some through traffic of the "scenic drive variety". They act as a local distributor for neighbourhood traffic and may serve as bus routes. They are used, where necessary to separate urban development from foreshore reserves in order to provide public and emergency access.

1.3.2 **Access Roads**

Access roads serve only to provide access to individual dwellings and are the link between these dwellings and the local distributor. It is on roads in this category that the domestic environment should predominate over the needs of the motor vehicle. To further develop this concept, this policy subdivides access roads into access ways, access places, access lanes and rear laneways.

Access ways are traditional albeit narrow, low-speed roads (designed as loops or portions of culs-de-sac) which function within the domestic environment. Access ways should be planned and designed in such a way that traffic speeds and volumes are low and do not prejudice the amenity of abutting dwellings in terms of noise, safety and disturbance.

Access places are short culs-de-sac in either a linear or court configuration with shared pedestrian and vehicular spaces. Pedestrians are given clear priority and traffic speeds kept to a minimum through the use of design techniques and features. They are in effect an extension of the domestic environment of the abutting dwellings.

Access lanes are used as a design technique to overcome the inefficient use of land associated with traditional culs-de-sac heads by providing for more regular lot shapes and improving lot yield. They are short extensions to access places and sometimes access ways and provide a pedestrian/cycle and/or vehicle link between access places. Like access places they are shared pedestrian and vehicular spaces and are in effect an extension of the domestic environment of the abutting dwellings.

Rear laneways provide vehicular access to the rear of lots. They can be used where there are parking and/or access difficulties along frontage roads such as where the lots are narrow or along busy local distributors. They may also be used to improve both the streetscape and pedestrian/cyclist safety, and to relate the domestic environment more closely to the frontage street by avoiding:

- the creation of carport and/or garage dominated house elevations (also enabling the reduction of front building setbacks); and
- verges broken with driveway cross-overs.

Rear laneways also provide flexibility and robustness in subdivision design allowing opportunities for redevelopment or additions.

1.3.3 **Pedestrian and Cyclist Systems**

Pedestrians and cyclists clearly belong within the domestic environment. They do not create the problems of safety, noise, pollution and disturbance caused by motor vehicles, and are compatible with the functions of lower order roads in the hierarchy - access ways, access places, access lanes and rear laneways. These categories of road can form the basis of a safe and attractive pedestrian and cyclist system.

The potential hazards for pedestrians and cyclists from motor vehicles is much greater on local distributors where greater emphasis is given to vehicle movement. Pedestrian and cyclist systems normally use local distributors, (e.g. to provide access to shops, schools, etc.), so separate footpaths or dual-use paths are necessary in the interests of safety.

Pedestrian and cyclist systems should be carefully integrated into neighbourhood design to provide a linkage between residences, open space, community facilities and schools and, through carefully designed crossings of district distributors and primary roads, to adjacent neighbourhoods.

1.4 Road Planning and Neighbourhood Design

Road planning forms an integral part of the neighbourhood design affecting the cost of housing and the quality or amenity of the domestic environment, including not only safety and personal security but also the contemporary concepts of permeability, variety, legibility and accessibility within the neighbourhood. These concepts are discussed below and contribute to an "environment of care" to create neighbourhoods with a sense of enclosure and a human scale with a low vehicle speed regime.

- **Permeability**

  "Permeability" relates to the ability of people and vehicles to move through the area. This allows and encourages direct movement through subdivisions, especially by pedestrians, cyclists and public transport. This can be facilitated by an interconnecting network of streets and lanes, a system of public access ways and open culs-de-sac heads which allow movement in a direct manner and without encountering "dead ends".

- **Variety**

  "Variety" refers to the mix of land uses and their locations. This can include retention of historic buildings, recycling of older buildings, retaining existing vegetation or other natural features, choice of housing types and mixed use commercial areas. Variety is particularly important for pedestrians and cyclists as they have more time in their trip to appreciate the various forms in their neighbourhood.

- **Legibility**

  "Legibility" is defined by the ease with which people can identify with an area and understand what opportunities the environment offers. The street pattern should be simple, memorable and direct, avoiding circuitous routes. The key elements used to express legibility are streets, paths, districts, edges, facades, nodes and landmarks. It relates to designing the massing of buildings and the enclosure of the public space with clarity and the use of direction.

- **Accessibility**

  "Accessibility" refers to the link between the efficiency of transport and of land use. In a new suburb, grouping of commercial, retailing and community facilities can give a focus for activity within the suburb and assist in creating a sense of community so as to improve transport efficiency. Higher density residential development near commercial, retailing and community facilities increases the level of accessibility to such facilities and is encouraged.

  A neighbourhood can occur at a number of levels from the traditional primary school level (a convenient planning precinct) to the corner store and street levels (refer to Figure 2). Neighbourhoods can also take various forms. There are four variations or extremes in neighbourhood planning for which there are many professional advocates. These can be described as the Radburn Cell, the Centralised Cell, the Milton Keynes Cell and the Modified Grid Cell (refer to Figure 3). The use and development of these variations (including different levels and combinations) provide the opportunity for design innovation and the creation of interesting and varied residential environments which incorporate the above-mentioned concepts within a clearly defined road hierarchy.

2. POLICY OBJECTIVES

- ❏ To incorporate road planning as an integral part of neighbourhood design with the location of land uses appropriate to the road function.
- ❏ To encourage innovative approaches to the design of roads, services and dwellings which are consistent with the most efficient and sustainable use of residential land and other resources, at densities appropriate to meet State housing objectives.
- ❏ To provide road networks, within a clear road hierarchy, which are permeable and which offer all road users safe, convenient and legible access to all residential dwellings and destinations inside and outside the neighbourhood.
- ❏ To create a domestic environment that is visually attractive and at a human scale.
- ❏ To provide for bus routes (and bus stops) which are both accessible from all dwellings and activity centres and appropriate to the road function.
- ❏ To provide for a high-quality pedestrian/cycle network to facilitate the safe, convenient, legible and direct movement of pedestrian and cyclists both inside and outside the neighbourhood.

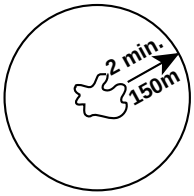
3. POLICY MEASURES

3.1 Residential Neighbourhoods

3.1.1 Residential neighbourhoods should be defined by the grid of primary or district distributors (external roads). They should be served by an internal road network comprising local distributors and access roads designed so that ideally no dwelling is more than 400m from public open space, 800m from the primary school and the local shopping centre and at least 60 percent of households are within 400m walking distance of a bus stop (See Figure 4).

Street Neighbourhood

- 80 to 100 dwellings
- Streets for people
- Safety for children
- Traffic calm zones

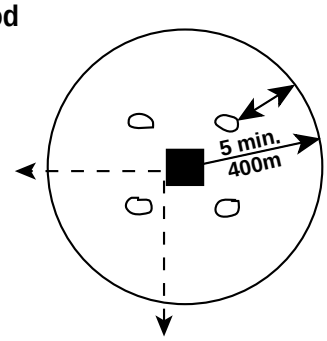


2 Minute Walk

Child playground
- Street neighbourhood
- Streets for play

Corner Store Neighbourhood

- 400 to 600 dwellings
- Daily convenience store
- Public transport within 400m
- Local traffic only

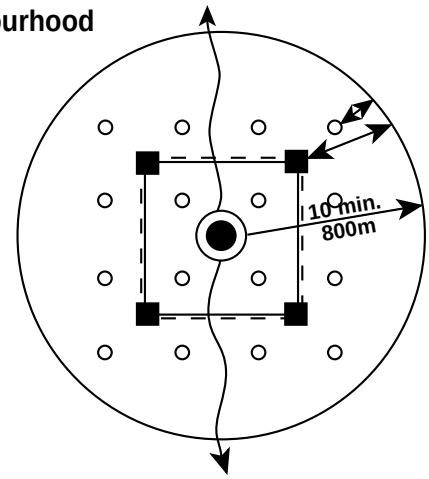


5 Minute Walk

Small neighbourhood square
- Deli - 7/11 store
- Bus stop
- Local playground
- Local hall

Primary School Neighbourhood

- Up to 1800 dwellings
- Mixed business activity
- Primary school
- Community and recreation
- Easy access by foot, bike or bus
- Public transport link
- Town centre as community focus



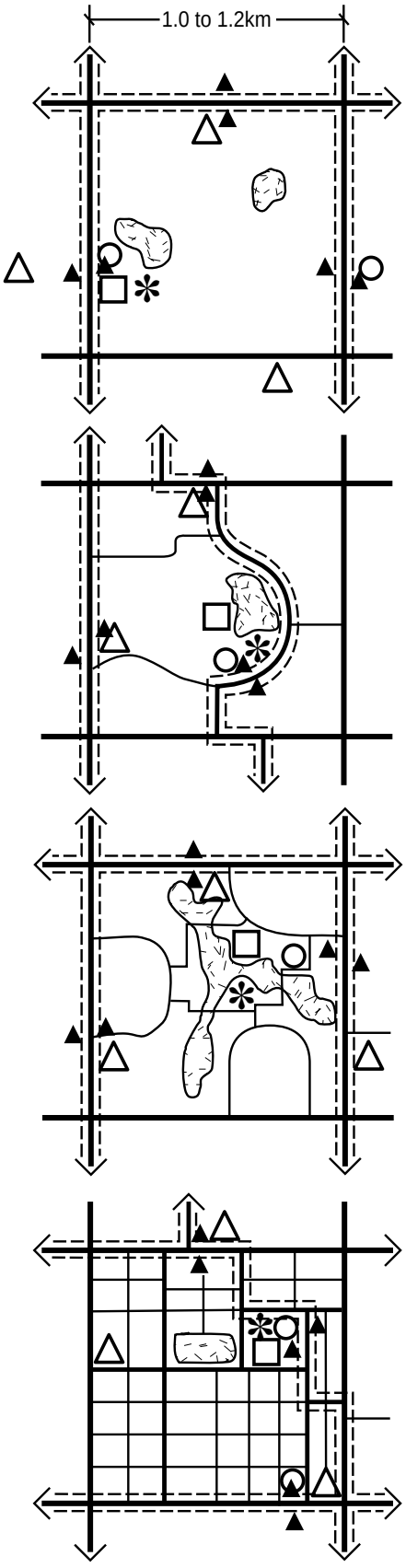
10 Minute Walk

Town Centre
- Mixed Uses - Commercial
  - Community
  - Recreation
  - Primary school
  - Medical
- Bus stop

– – Local bus route may not apply at low density

- Centralised design for people and pedestrian movement
- These theoretical models should be read in conjunction with neighbourhood forms, Figure 3
- Note the dimensions and numbers of dwellings will vary with density and land use parameters

Figure 2. **Three Levels of Residential Neighbourhood**



Milton Keynes Cell

- Neighbourhood Based on High School catchment
- Sharing of facilities located close to the edge of Primary School neighbourhood
- Both bus routes located on district distributors

Centralised Cell

- Neighbourhood based on Primary School Catchment
- Centralised facilities located on local distributors
- Long-haul bus routes located on district distributors
- Local bus routes located on local distributors

Radburn Cell

- Linear Open Space dominates neighborhood
- Minor local distributors only within cell
- Indirect links between local distributors
- Both bus routes on district distributors

Modified Grid Cell

- Permeable road network which is legible and robust
- Centralised or shared facilities
- Bus has choice of routes

Shops **Service Centre/Store**
Community **Bus Stops**
Primary School

Figure 3. **Four Types of Residential Neighbourhood**

3.1.2 The interface between the internal and external road networks should be carefully considered to avoid the creation of external roads which have continuous fence lines along their length (creating "fenced road canyons" or "slots"). A range of frontage treatments, including internal loop roads, culs-de-sac heads, service roads and public open space should be used for openings along the external roads to provide visual relief, personal security (for pedestrian access to bus stops and underpasses) and pedestrian/cycle access for permeability between neighbourhood cells.

3.2 Local Distributors

3.2.1 Local distributors should not be designed to carry traffic volumes in excess of 7,000vpd unless there are special circumstances such as proximity to major traffic generators (e.g. shopping centres). Where volumes are expected to be in excess of 7,000vpd direct residential lot access will not be permitted.

3.2.2 Where volumes are expected to be less than 7,000vpd the design of local distributors should avoid the creation of "fenced road canyons" which are fenced along their length with no direct lot access or frontage. In particular, single and grouped housing lots will not be permitted to back onto local distributors while gaining access from other internal subdivision roads as this results in a detrimental impact on legibility, safety and aesthetics as well as the creation of verge management problems.

3.2.3 Where volumes are expected to be between 3,000 - 7,000vpd the Commission will require the inclusion of design techniques which recognise the local distributor as a residential street. The design techniques should emphasise an "environment of care" by promoting a human scale (that is enclosed by buildings and trees at a ratio of 1:6 height to width or as close thereto as possible) and safe speed environment psychology. Appendix 1 includes a range of frontage treatment techniques which may be applied to local distributors to improve safety and amenity appropriate for the particular circumstances. The techniques described are not exhaustive. Other innovative techniques may be agreed to where demonstrated to achieve an "environment of care".

3.2.4 Local distributors may be designed as loops. This is a feature which avoids the need for excessively long culs-de-sac systems. The range of available carriageway widths for local distributors will enable appropriately narrow carriageways and reserve widths on looped local distributors with low traffic volumes. Care should be taken to ensure efficient public transport can be provided.

3.2.5 Vehicle operating speeds on local distributors should be 50kmh when the local distributor provides access to houses, shops, schools, open spaces, etc, achieved through speed restraint measures incorporated into the road design.

3.2.6 The reserve width should be between 14.4 and 23m with wider reserves accepted to accommodate frontage treatment techniques. The carriageway width should be in the range of 6-10m which should reflect both the environmental and traffic-carrying functions of the road. No specific standards are prescribed, but the widths selected in the design should achieve amenity and safety in the most economical and convenient way.

3.2.7 Verges should be the minimum necessary for the required services, for parking bays (where demand is expected such as at schools and other community facilities) and tree planting space. Each verge should be designed specifically for the services it has to carry and to accommodate mature large canopied trees on both verges and the median (where provided) of a species specified by the local government.

3.2.8 Foreshore access roads (FARs) may carry up to 10,000vpd near the district distributor network and up to 5,000 adjacent to the foreshore. These figures are calculated on the basis of either annual average weekday travel or the average of the busiest 12 summer weekend days, whichever is the greater. The design techniques for local distributors between 3,000 - 7,000vpd also apply to FARs (refer to Appendix 1). Where traffic volumes are expected to exceed 7,000vpd direct residential lot access will not be permitted.

3.2.9 Where a recreational destination, such as a marina or significant regional attraction, is likely to attract traffic to the FAR that would result in volumes exceeding the limit of 5,000vpd adjacent to the foreshore, a road of district distributor status is warranted for access.

3.2.10 FARs have a performance criterion of a measured 85 percentile vehicle speed of 50kmh or less during operation. For guidance on the design and spacing of traffic management measures to achieve this, the designer is referred to Guidelines for Local Traffic Management produced by Main Roads Western Australia.

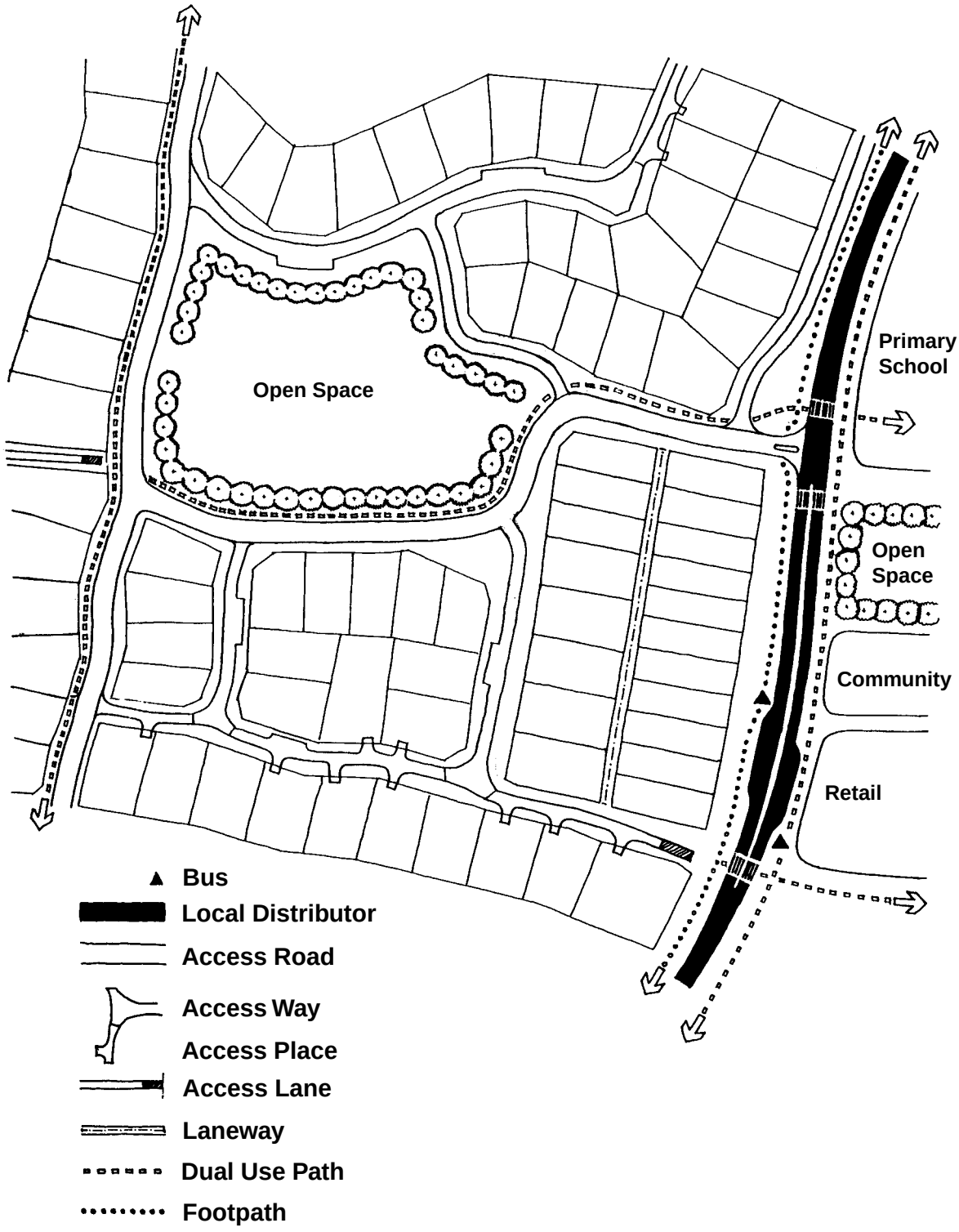


Figure 4. **Road Hierarchy Within Neighbourhoods**

3.2.11 Horizontal and vertical alignments on local distributors should provide curves in the road designed to encourage low vehicle speeds, although for safety reasons sight lines on horizontal and vertical curves commensurate with a design speed of 60kmh are required.

3.2.12 Crossings of local distributors should be provided, where demand exists, for pedestrians and cyclists at locations such as schools, shops and open space. Refuge treatments are desirable.

3.3 Access Ways

3.3.1 Access ways may be designed as either a loop road or culs-de-sac and traffic flows should not exceed 800vpd at any one point. The use of loop roads is encouraged to spread more evenly the distribution of traffic on the access way system, to improve permeability and to avoid an unnecessarily circuitous road network. Extended culs-de-sac systems will be considered only in difficult terrain or special circumstances such as where they are unavoidable in canal estates.

3.3.2 Vehicle operating speeds on access ways should be in the order of 30-40kmh or less.

3.3.3 Reserve widths should be in the range of 11.5-15m comprising:

- a carriageway of 5.5-6m in order to encourage low vehicle speeds in keeping with the character of the street;
- verges being the minimum necessary to accommodate services, parking bays and in both verges mature large canopied trees of a species specified by the local government.

3.3.4 Horizontal alignment should incorporate sharp curves to keep vehicular speeds low. Horizontal and vertical sight lines commensurate with the required design speeds of 30-40kmh should be provided.

3.3.5 The distance from the most distant lot on an access place or access lane (as the case may be) to the point at which the access way joins the local distributor should not exceed 350m.

3.4 Access Places

3.4.1 Traffic flows on access places should not exceed 200vpd at any one point.

3.4.2 Vehicle operating speeds should be 20kmh or less.

3.4.3 Reserve widths should be in the range of 10-14.5m and should comprise:

- a carriageway of 4-5.5m, although where four dwellings or less are served, widths as low as 3m may be acceptable;
- verges of the minimum necessary to accommodate services, parking bays and in both verges large canopied mature trees of a species specified by the local government.

3.4.4 Horizontal and vertical alignment should incorporate curves to encourage low vehicle speeds, with horizontal and vertical sight lines designed for operating speeds of 40kmh, although actual speeds will be lower.

3.4.5 Access ways, access places and access lanes should together have a maximum length of 350m between the furthest lot and the local distributor. Access places together with access lanes should not exceed 200m to avoid an unnecessarily circuitous road network and to promote low vehicle speeds.

3.5 Access Lanes and Rear Laneways

3.5.1 Traffic flows on access lanes and rear laneways should not exceed 100vpd at any one point.

3.5.2 Vehicle operating speeds should be 20kmh or less.

3.5.3 Reserve widths should not exceed 13.5m for access lanes. This may be reduced to 6m for rear laneways. The reserve should comprise:

- a carriageway width of 4-5.5m for access lanes which may be reduced to 3m where four dwellings or less are served;
- a minimum carriageway width of 6m for rear laneways;
- verges for access lanes to be the minimum necessary to accommodate services, parking bays and on both sides mature large canopied trees of a species specified by the local government. This may be reduced to 1.5m where there is no frontage or to zero where bollard protection is used (e.g. in rear laneways).

3.5.4 Horizontal and vertical alignment should incorporate curves to encourage low vehicle speeds, with horizontal and vertical sight lines designed for operating speeds of 20kmh.

3.5.5 The combined length of access places and access lanes should not exceed 200m to avoid an unnecessarily circuitous road network and to promote low vehicle speeds. The connection of access lanes between access

places, to provide a loop road, is encouraged to improve accessibility (particularly for service vehicles such as garbage collection trucks) and permeability.

3.6 Pedestrian and Cyclist Systems

3.6.1 The Commission will expect subdividers to plan for pedestrian and cycle movements by providing for a network of footpaths and dual-use paths in residential subdivisions.

3.6.2 In many instances provision may also be made for cyclists within the road carriageway through careful design.

3.6.3 The Commission will require that the subdivider provide for the construction of footpaths:

- along one side of local distributor roads;
- along both sides of portions of local distributor roads where there is heavy demand (such as opposite schools where there is a demonstrated need);
- along one side of access ways where there is potential for traffic/pedestrian conflict.

3.6.4 The local government may request the Commission to impose a condition to require a subdivider to provide for the construction of dual-use paths:

- along one side of district distributor roads;
- along one side of local distributor roads where such a system is an integral part of the subdivision design, where it accords with the proposals within an overall structure plan or to provide adequate cycle access to local attractors such as schools, neighbourhood shopping centres and other community facilities.

3.6.5 The local government may request the Commission to impose a condition to require the subdivider to provide direct routes by footpath or dual-use path to major activity centres, through public access ways and public open spaces, and in other instances where pedestrian linkages are desirable in the interest of public safety and amenity or accord with the proposals within an overall structure plan. Links via well-designed public access ways are particularly desirable where they facilitate direct pedestrian and cycle movement.

3.6.6 Footpaths will generally not be required in access places, access lanes or rear laneways (except where access lanes are not constructed for vehicle through traffic).

3.6.7 Design details for the various component sections of the systems should accord with the design guidelines of Bikewest.

3.6.8 In the past, narrow pedestrian access ways (3m) have been introduced between lot boundaries linking nearby roads. This arrangement has been particularly popular in linking adjoining culs-de-sac type of residential layout. Local governments, however, have increasingly sought the closure of these kinds of pedestrian access ways following complaints from adjacent landowners experiencing anti-social behaviour, damage to property, loss of privacy and general disturbance.

3.6.9 The design of new subdivisions should, therefore, avoid narrow pedestrian access ways between property boundaries. Alternative design solutions should be sought using the road network and public open space linkages to provide direct, pedestrian-friendly connections between residential areas and public facilities such as shops, schools and bus routes.

Where pedestrian links between property boundaries are unavoidable, the design of the pedestrian access way should limit the opportunities for anti-social behaviour. For this reason, the width of the pedestrian accessway should not be less than eight metres and the design should be straight and open to view from other residences, street or public open space.

3.7 Public Transport

3.7.1 The neighbourhood should be designed so that at least 60 percent of households are within 400m walking distance of a bus stop and the neighbourhood community facilities (including public open space, primary schools and neighbourhood centres) can be served by a bus route. The location of bus routes is dependent upon the form of the neighbourhood and may be either restricted to external roads (primary/district distributors which define the neighbourhood cells) or a combination of both internal (local distributors) and external roads. Bus routes should be designated at the district structure planning stage in consultation with the Department of Transport. Both bus routes and bus stops should be shown on the local

structure plan and subdivision application plan.

3.7.2 Where local distributors incorporate bus routes, road design should take account of the following:

- the need for local distributor cell-to-cell crossings using offset T-junctions based on left out and right turn into the adjacent cell;
- the need to accommodate wider carriageways.

3.7.3 Bus stops, bus routes and exclusive bus lanes should form part of the subdivision application plan. An average spacing of 400m should be provided between stops depending upon patrons' accessibility and residential densities. Wherever possible bus stops should be located adjacent to pedestrian/cycle paths, underpasses, major activity centres and linear open space and take into account personal security (adjacent to places of activity which would be well-lit at night).

3.7.4 The subdivisional plan should also incorporate the location of any bus stops on adjacent district and primary distributors and provide for safe and convenient access to these stops. Where these roads are walled there should be sufficient breaks which have overlooking houses to allow for pedestrian access to bus stops which have a reasonable level of personal security (refer to Figure 5).

3.8 Transport Management Studies

3.8.1 The design of the road network within a residential neighbourhood should be supported by a transport management study which should provide the technical basis for the road design (including traffic management techniques used) and land use framework. This should normally be prepared by the developer as part of the local structure plan and be based on transport studies prepared at the district level.

3.8.2 Transport management studies should be based upon an average trip generation rate for residential dwellings of 10 vehicles per lot per day as a general guide. This figure may be reduced where it can be demonstrated that the neighbourhood would be expected to have a lower trip generation rate. This may result from various factors, including the projected household type/car dependency, public transport availability and accessibility to essential services.

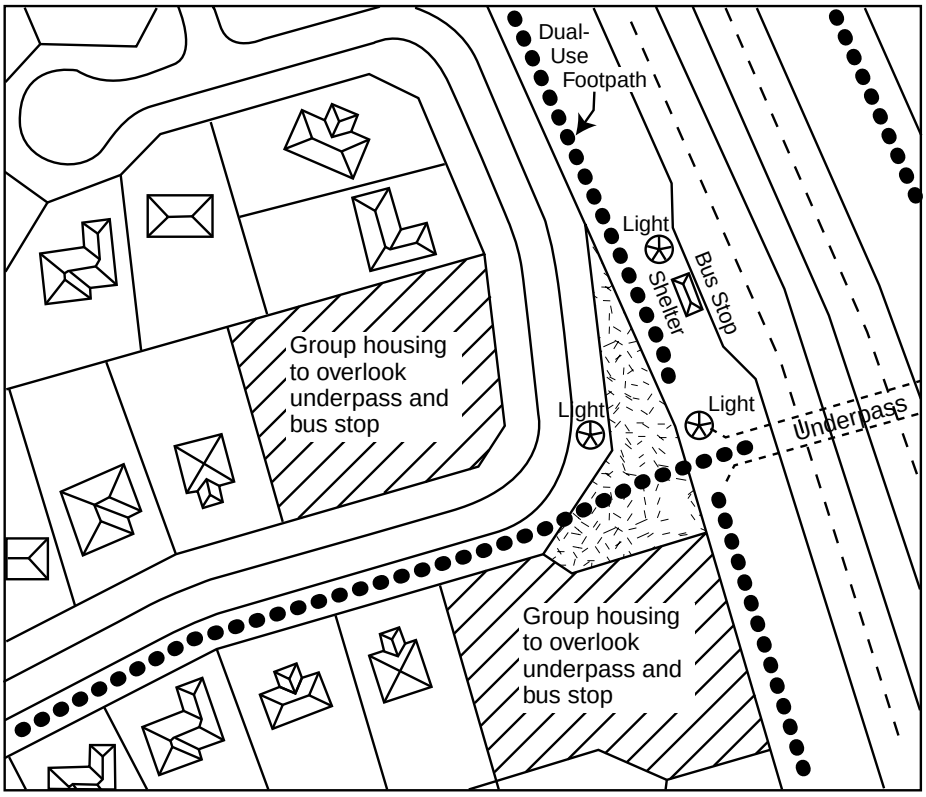


Figure 5. **Access to Bus Stops on Adjacent Primary and District Distributors**

3.8.3 Transport management studies should address the following matters:

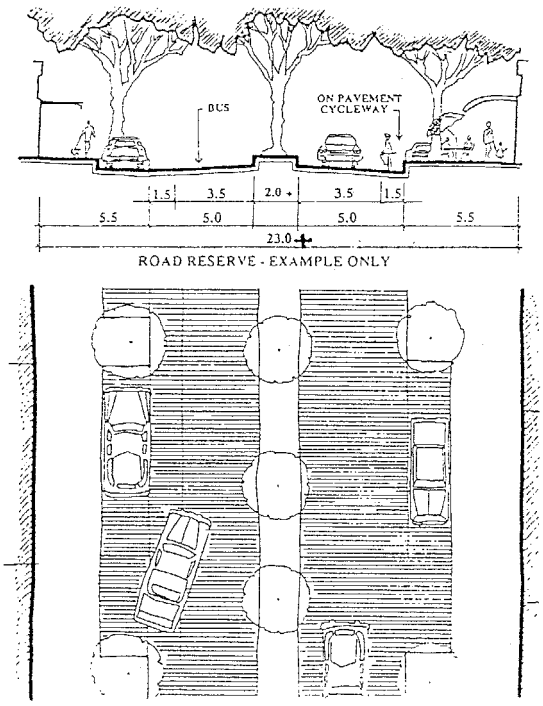
- the need to account for all internal and external movements and traffic generation features, including anticipated short cuts or "rat runs" through the design;
- a description of any proposed frontage management initiatives on local distributors (required where volumes are between 3,000-7,000vpd) and attempt to quantify their impacts on vehicle and resident safety;
- a description of methods/techniques to be applied to control (where appropriate) traffic numbers and vehicle speeds;
- a description of traffic management solutions/design initiatives for access roads;
- public transport routing and the associated impact on cell design and land use distribution (the location of bus routes and bus stops will require liaison with the Department of Transport);
- other transport modes - pedestrians, cyclists; and
- safety and amenity assessment.

APPENDIX ONE - Frontage Management Techniques for Local Distributors with Traffic Volumes Between 3,000 - 7,000vpd

(1) The Traditional Boulevard (up to 7,000vpd)

Typically this option consists of lane-separated carriageways with landscaping along the edges and within the median, usually in the form of three rows of large canopied trees, giving scale and a sense of enclosure. Parking can be allowed within the verge and marked on-pavement cycle lanes. This form of local distributor is characterised by the following:

- Allows lot frontage at higher traffic volume due to median divided flows.
- Reduces ingress/egress conflict with main traffic flow.
- Can include bus routes and thereby improve accessibility.
- Enhances amenity through landscape scale and sense of enclosure.
- Refuge median provides improved pedestrian safety and sufficient width to allow for mature large canopied trees.



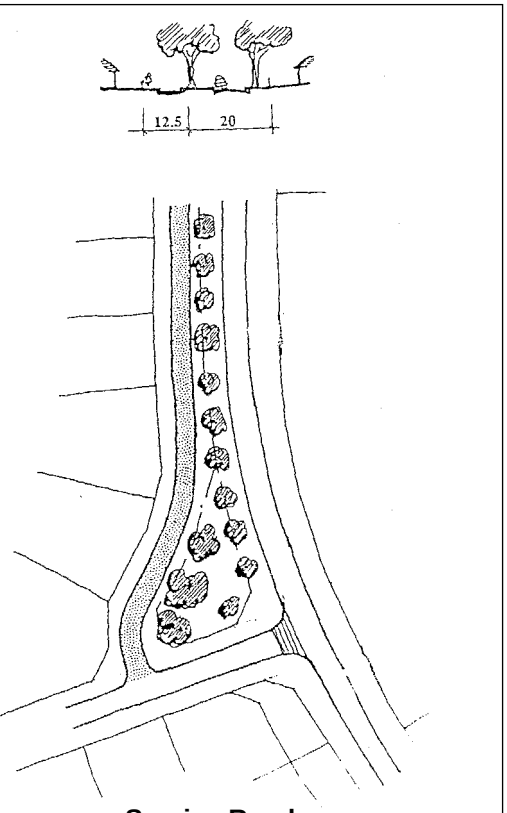
Traditional Boulevard

- Requires local government acceptance of a street tree planting policy to ensure selection of appropriate species (i.e. tall, large canopied and fast growing, such as Eucalyptus citriodora, E maculata Norfolk Island Pines, Plane trees etc).
- Where traffic volumes are expected to be between 5,000 - 7,000 vpd a solid median island with minimal breaks is required.

- Where traffic volumes are expected to be less than 5,000vpd more frequent breaks may be incorporated into the median island.

(2) Service Road (5,000 - 7,000vpd)

This option may be used where traffic volumes are expected to be towards the upper end of that which is acceptable for local distributors or where the proximity of non-residential land uses may result in increased frictional effects of slower morning traffic such as at a local shopping/community centre.



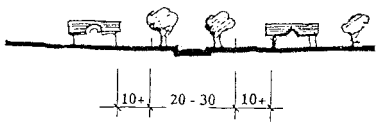
Service Road

(3) Increased Setbacks (3,000 - 5,000vpd)

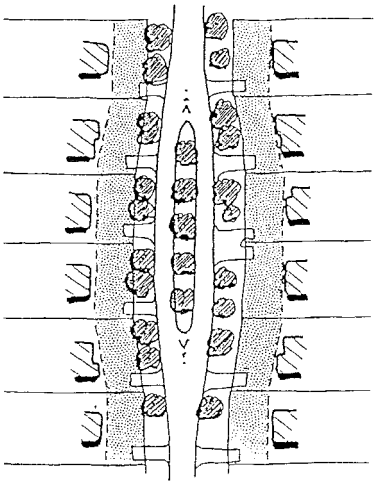
The provision of deeper lots with increased setbacks along the frontage to the local distributor have the following characteristics:

- Allows greater setback of dwellings from the carriageway.
- Reduces noise nuisance and improves safety and amenity.
- Provides vehicle manoeuvring space off the road.

This technique should be incorporated into structure plans and/or subdivision applications only where the local government has appropriate provisions in its town planning scheme and/or policies (or will have such provisions prior to subdivision approval) to ensure compliance with the required setbacks at the planning approval and/or building licence stages as appropriate.



Setbacks Increased and Variable



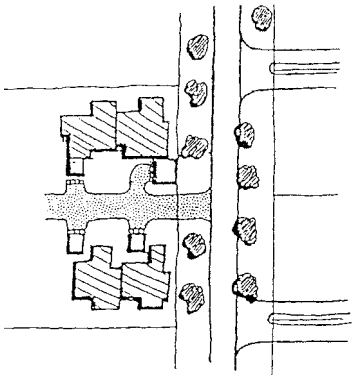
Increased Setbacks

(4) Shared Driveways (3,000 - 5,000vpd)

Common or shared driveways and crossovers typically found in group housing developments or project housing estates have the following characteristics:

- Improves safety by concentrating vehicle entry/exit at a single driveway.
- Allows vehicle parking and manoeuvring off the road.
- Improves sight distance.

This technique should be incorporated into structure plans and/or subdivision applications where the local government has appropriate provisions in its town planning scheme and/or policies (or will have such provisions prior to subdivision approval) to ensure crossovers are located in accordance with the approved subdivision plan and/or agreements are required between adjacent landowners (for reciprocal rights of access) at the planning approval and/or building licence stages as appropriate.

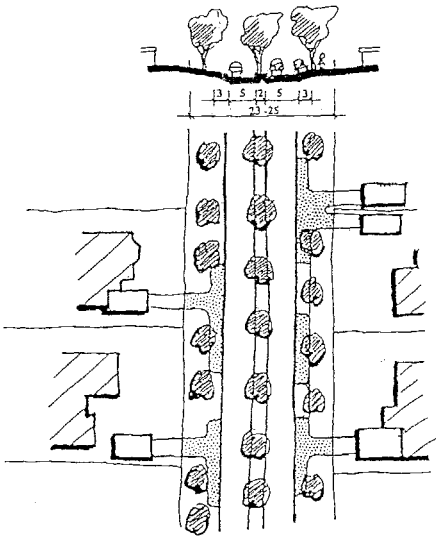


Shared Driveways

(5) Reversing and Parking Lanes (3,000 - 5,000vpd)

Additional paved areas within the verge space of local distributors can provide the following:

- Improved vehicle manoeuvring off the main carriageway with improved sight distances.
- Additional parking parallel to the kerb which can make room for on-pavement cycle lanes.
- Can be used in conjunction with other frontage management options.

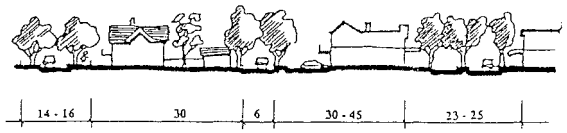


Reversing Lanes

Reversing and parking lanes
3,000 - 5,000vpd on two-lane undivided
5,000 - 7,000vpd on dual carriageway road

(6) Selected Land Uses/Rear Lane Access (3,000 - 5,000vpd)

This option encourages land uses adjacent to local distributors which have minimal impact on the local distributor road function (i.e. residential, mixed uses). Rear lane access should be provided to parking and garage areas to help alleviate access and parking problems in the local distributor.

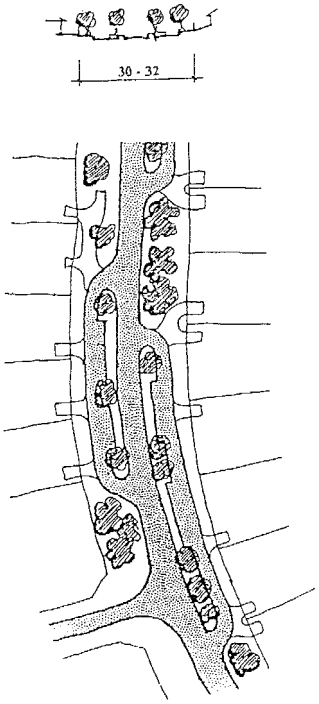


Rear Lane Access

(7) Controlled Access Places (CAPS) (3,000 - 5,000 vpd)

This option is a modified service road concept which provides a combined driveway and parking facility as well as a cycling surface. It has the following features:

- Increased road reserve width which improves noise abatement.
- Improved safety for ingress and egress points along the local distributor.
- Short lengths between entry and exit points, usually 200 metres or 10 lots maximum.



Controlled Access Place (CAP System)

(8) On-site Turnaround (3,000 - 5,000vpd)

This option may be used alone or in conjunction with options 1, 3 and 4. It requires development adjoining the local distributor to include properly designed on-site turnaround facilities to ensure that vehicles can exit the site in a forward gear.

This technique should be incorporated into structure plans and/or subdivision applications only where the local government has appropriate provisions in its town planning scheme and/or policies (or will have such provisions prior to subdivision approval) to ensure that adequate on-site turnaround facilities are required at the planning approval and/or building licence stages as appropriate.