Western Australian Planning Commission

Department for Planning and Infrastructure

January 2009 Update 02

Liveable Neighbourhoods

a Western Australian Government sustainable cities initiative

Liveable Neighbourhoods is an operational policy for the design and assessment of structure plans (regional, district and local) and subdivision for new urban (predominantly residential) areas in the metropolitan area and country centres, on greenfield and large urban infill sites.

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How this policy applies

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Western Australian Planning Commission

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October 2007

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Copies of this document are available in alternative formats on application to the Disability Services Coordinator.

Updates

The WAPC will update Liveable Neighbourhoods as required.

Each update will consist of replacement pages and this update page (and possibly a new contents page).

It is important that the new pages be inserted as soon as possible after being received, and that the old pages be discarded.

Before inserting the update, please check that the previous update has been inserted. Refer to this update page where all updates are listed.

The current contents and update pages and Liveable Neighbourhoods are available on the WAPC website www.wapc.wa.gov.au/LiveableNeighbourhoods. Please register on the website to receive notification of future updates.

Date	Updates	Contents and purpose	Pages
Oct 2007	Update 0	Issuing 3rd edition of Liveable Neighbourhoods.	All
Sept 2008	Update 01	Introduction of subdivision orientation policy. Element 1: amend R13, delete figure 8. Element 3: amend R17-19, delete figures 41 and 42.	 Element 1, p 9 Element 3, p 9-10
Jan 2009	Update 02	Correction of figures in table. Element 2: table 5. Insert correct figure. Element 2: figure 32.	Element 2, p 24 Element 2, p 34

Foreword

Liveable Neighbourhoods has been on trial since 1998. In commencing a review some years ago the WAPC had the generous help of an expert advisory committee and many submissions from individuals and organisations. While all of this advice will continue to be taken into account in future revisions of Liveable Neighbourhoods, and while it is recognised that there remain many opportunities for improvement, it is important to publish the revisions already agreed on.

This updated edition of Liveable Neighbourhoods also marks several significant milestones in the evolution of the WAPC's policies for the creation of new urban places.

Liveable Neighbourhoods in the form published here has been adopted by the WAPC as operational policy, and is to be followed in the design and approval of urban development.

Liveable Neighbourhoods applies to structure planning and subdivision for greenfield sites and for the redevelopment of large brownfield and urban infill sites.

In general, Liveable Neighbourhoods replaces the current WAPC development control policies. Where there is conflict with existing policies, Liveable Neighbourhoods will prevail unless an applicant can demonstrate why the relevant Liveable Neighbourhoods policies cannot or should not apply.

Overlaps between development control policies and Liveable Neighbourhoods will be progressively removed through a mixture of incorporation into Liveable Neighbourhoods and rescission of redundant policies. Development control policies will of course be retained for those matters not covered by Liveable Neighbourhoods.

The first development control policies to be reviewed are likely to be DC 2.3 Public open space and DC 2.4 School sites. Policies on road standards and on urban water management are likely to be reviewed next.

At the same time, Liveable Neighbourhoods will itself be progressively revised, element by element. To make these policies simpler and more explicit each element will have succinct objectives, policy statements and advisory design guidelines.

The publication of Liveable Neighbourhoods in loose-leaf form indicates our intention, firstly, to progressively improve the format and, secondly, to continue to update the WAPC's policies generally. For instance, new policies on the orientation of streets and lots, to facilitate the reduction of greenhouse gas emissions by dwellings, are likely to make the current orientation provisions in Liveable Neighbourhoods redundant in the near future.

Circumstances permitting, it is also the intention to include case studies and examples of best practice in Liveable Neighbourhoods. Suggestions in this regard, and comments on any aspect of Liveable Neighbourhoods and neighbourhood design generally are very welcome. Please send them to Liveable Neighbourhoods, Department for Planning and Infrastructure, 469 Wellington Street, Perth WA 6000.

In future, to keep this version of Liveable Neighbourhoods up-to-date, please register for the update service, insert new pages including the new update page, and discard any superseded pages. You will also be able to check the currency of any version of Liveable Neighbourhoods on the WAPC website (www.wapc.wa.gov.au/LiveableNeighbourbourhoods).

Jeremy Dawkins
Chairman
Western Australian Planning Commission

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Purpose

The Western Australian Planning Commission (the WAPC) plays a central coordination role in the State planning process. It undertakes regional, strategic and statutory planning and administers subdivision powers under the *Planning and Development Act 2005*.

Liveable Neighbourhoods has been prepared to implement the objectives of the State Planning Strategy which aims to guide the sustainable development of Western Australia to 2029. Liveable Neighbourhoods operates as a development control policy, or code, to facilitate the development of sustainable communities.

The State Sustainability Strategy is a coordinated government approach to delivering a sustainability framework in which implementation actions, such as Liveable Neighbourhoods, can be delivered. Liveable Neighbourhoods has been reviewed on the basis of promoting a more sustainable approach to guide structure planning and subdivision, in accordance with the requirements of the State Sustainability Strategy.

Delivery of Liveable Neighbourhoods is an integral element of delivering the priority strategies and actions of Network City Framework.

Liveable Neighbourhoods addresses both strategic and operational aspects of structure planning and subdivision development in a code framework.

Liveable Neighbourhoods replaces issues-based policies with an integrated planning and assessment policy for the preparation of structure plans and subdivision layouts to guide the further development of Perth and the regional cities and towns of Western Australia.

Liveable Neighbourhoods replaces editions 1 to 3 and incorporates many of the development control policies relating to structure planning and subdivision.

The refinements and updates are based on operational practice. Key changes include the following:

- Increased emphasis on supporting sustainable urban development through land efficiency across all elements.
- Increased support for walking, cycling and public transport.
- Increased emphasis on achieving density targets and lot diversity, particularly around activity centres and public transport nodes.
- Promoting increased integration of urban water management elements into the urban form.
- Revised public open space credits including acknowledgement of sustainability measures through applications of public open space credits for retention of environmental features and adoption of water-sensitive urban design principles.
- Requirement for landscaping of public open space to a minimum standard.
- Deemed to comply street cross-section standards applicable across all local governments in the State.
- Resolution of anomalies and up-dated cross-sections in Element 2 - movement network with increased emphasis on traffic speed control and land efficiency.
- Revised street reservation requirements to accommodate a standard minimum verge width including street trees.
- Introduction of two new elements: Element 7 - activity centres and employment and Element 8 - schools.
- Increased guidance provided on delivery and design of centres, strengthening main street development, achieving walkable centres and delivery of jobs and employment.
- Increased recognition and strengthening of local identity and relationships with public transport identity.
- Simplified context and site analysis and application requirements.

Where Liveable Neighbourhoods applies

Liveable Neighbourhoods is an operational policy for the design and assessment of structure plans (regional, district and local) and subdivision, for new urban (predominantly residential) areas in the metropolitan area and country centres, on greenfield and large urban infill sites. The WAPC will also take into consideration the specific design issues associated with retirement and lifestyle villages and accommodation in determining applications.

Interface between Liveable Neighbourhoods and conventional proposals

Liveable Neighbourhoods proposals may occur in an area that is predominantly structured and built in accordance with conventional policy. In this circumstance, concerns have been raised over the interface between the two development types; particularly over the need to avoid rat-running through the more interconnected street system of a Liveable Neighbourhoods proposal and which way lots face when a conventional proposal backs onto the same street.

Consequently, the WAPC will consider any requests to vary Liveable Neighbourhoods in this circumstance where the key principles and objectives of this document cannot otherwise be accommodated.

Status of policy

Liveable Neighbourhoods has been adopted by the WAPC to guide structure planning and subdivision of green fields and large infill sites throughout the State. Over time and with subsequent reviews of Liveable Neighbourhoods, the WAPC will supersede development control policies that also deal with structure planning and subdivision of green fields and large infill sites.

Liveable Neighbourhoods is a performance-based code. The objectives and the majority of requirements in Liveable Neighbourhoods may be satisfied in a number of ways. The WAPC encourages creativity in response to the environment and in creating a thoughtful sense of place.

Key differences from current policy approach

Liveable Neighbourhoods provides an innovative approach to planning and design in several respects by:

- acknowledging government commitment to the requirements of sustainability;
- seeking a more thorough analysis of the site and its context to inform structure planning and subdivision design and graphically explain the basis of the design;
- encouraging greater use of structure plans as a planning framework;
- outlining the preferred approach to the design of neighbourhoods and towns that aims to achieve compact, well-defined and more sustainable urban communities; and
- moving toward a performance approach to structure planning and subdivision to encourage innovation in response to market needs.

Principal aims

Liveable Neighbourhoods has the following aims.

1 To provide for an urban structure of walkable neighbourhoods clustering to form towns of compatible mixed uses in order to reduce car dependence for access to employment, retail and community facilities.

2 To ensure that walkable neighbourhoods and access to services and facilities are designed for all users, including those with disabilities.

3 To foster a sense of community and strong local identity and sense of place in neighbourhoods and towns.

4 To provide for access generally by way of an interconnected network of streets which facilitate safe, efficient and pleasant walking, cycling and driving.

5 To ensure active street-land use interfaces, with building frontages to streets to improve personal safety through increased surveillance and activity.

6 To facilitate new development which supports the efficiency of public transport systems where available, and provides safe, direct access to the system for residents.

7 To facilitate mixed-use urban development which provides for a wide range of living, employment and leisure opportunities, capable

of adapting over time as the community changes and which reflects appropriate community standards of health, safety and amenity.

8 To provide a variety of lot sizes and housing types to cater for the diverse housing needs of the community at a density that can ultimately support the provision of local services.

9 To ensure the avoidance of key environmental areas and the incorporation of significant cultural and environmental features of a site into the design of an area.

10 To provide for a more integrated approach to the design of open space and urban water management.

11 To ensure cost-effective and resource-efficient development to promote affordable housing.

12 To maximise land efficiency wherever possible.

Information

Further enquiries on Liveable Neighbourhoods may be directed to the regional office responsible for your area, or:

Project Manager
Liveable Neighbourhoods
Department for Planning and Infrastructure
08 9264 7777

Process for preparing Liveable Neighbourhoods

Liveable Neighbourhoods is based on the Australian Model Code for Residential Development 1995: A national reference document for residential developments, which drew from AMCORD Edition 2 (1990) and AMCORD Urban (1992), and the Victorian Code for Residential Development (1992), Department of Planning and Housing.

Liveable Neighbourhoods was developed by the Department for Planning and Infrastructure (DPI) through a process of rigorous testing and amending AMCORD propositions and standards to suit Western Australian conditions. It was released by the WAPC as an alternative design and assessment tool to the existing operational development control policies, originally called Liveable Neighbourhoods Community Design Code. Following an initial twelve-month trial period, the effectiveness of Liveable Neighbourhoods Community Design Code was assessed and a revised version, retitled Liveable Neighbourhoods (Liveable Neighbourhoods Edition 2) was released for further testing and review.

The WAPC initiated a formal review of Liveable Neighbourhoods and its related development control policies in 2003, with the intention of reformulating and elevating Liveable Neighbourhoods as the key policy in delivering the sustainability objectives for urban development set out in the State Government's overarching planning and sustainability strategies.

Liveable Neighbourhoods Edition 3 was developed with the DPI by consultants Taylor Burrell Barnett, in association with Ecologically Sustainable Design, RPS Bowman Bishaw Gorham, ERM, Shrapnel Urban Planning and Parsons Brinckerhoff through a process of rigourous testing and review of the existing development control policies.

Formulation of this policy was overseen by a steering committee of key industry stakeholders comprising:

- Western Australian Planning Commission
- Urban Development Institute of Australia
- Housing Industry Association
- WA Local Government Association
- Australian Association of Planning Consultants
- Planning Institute of Australia
- Institute of Public Works Engineering Australia
- Statutory Planning Committee of WAPC
- Main Roads WA
- Department of Environment and Conservation
- Property Council of WA
- Sustainable Energy Development Office
- Development Industry representative

An extensive consultation program was completed as part of the Liveable Neighbourhoods policy review process. Stakeholders participating in the consultation process included relevant state and local government agencies, various representatives of the development industry, DPI officers, special interest groups and other relevant organisations. Consultation included individual interviews, workshops with Development and Industry Representatives, Housing Industry Association, Utility service providers committees, with specialist workshops held in relation to movement network and urban water management issues.

Liveable Neighbourhoods represents an amalgamation of updated versions of various development control policies and Liveable Neighbourhoods Editions 2 and 3.

Edition 3 was advertised for public comment between October 2004 and February 2005. During this period 46 submissions were received many of which recommended improvements to the wording or clarification of specific issues. The WAPC resolved to adopt Liveable Neighbourhoods largely unchanged, recognising the community's desire to see the formal adoption of the policy and recognising that significant and on-going work would be required to maintain and update the document.

The WAPC envisages that policy will be reviewed on a regular basis so that it remains as a contemporary tool in guiding the creation of liveable and sustainable communities.

Background - towards sustainable communities

Responding to changing needs

The Western Australian community is changing. The majority of households now consist of one and two persons yet most new houses still have three and four bedrooms with two car garages. The lack of fit between housing stock and households may not serve our community well.

Perth, in particular, faces serious issues in the twenty-first century. These include the high cost of providing services and facilities to cater for continued rapid expansion, the need for greater housing affordability, concerns about safety and security, a desire for greater social, economic and environmental sustainability, the need for more locally-based jobs and the ability to provide public transport more efficiently.

In regional WA, other issues are significant, including the maintenance of the economic base, access to education and community services and the retention of environmental quality. There has been considerable community discussion on the need for planning to respond to these issues and, at the same time, improve the design of suburban development.

The design and layout of a subdivision are fundamental determinants of the urban form which:

- set the urban character and design of an area;
- allow or inhibit social interaction and therefore influences the likelihood of community formation;
- forces car dependence or reduces it by encouraging the non-car modes of walking, cycling and public transport;
- gives or denies access to facilities for all users of the urban environment; and
- provides or prevents opportunities for locally based business and employment.

Subdivision design will therefore crucially affect the performance of Perth and the regional centres in achieving the objectives of the State Planning Strategy.

Trends in neighbourhood design approaches

Neighbourhood design has changed. During the 1970s and 1980s, neighbourhoods typically comprised low-density housing on large lots in a curvilinear street layout with a strong street hierarchy and low levels of connectivity with cul-de-sacs off local collector streets. Neighbourhoods were usually planned in cells bounded by arterial roads and were often walled. Most areas were almost exclusively residential.

Today there is greater emphasis on social, economic and environmental aspects, with the resulting urban forms in transition. Recent neighbourhood design concepts have been given titles such as transit oriented design, traditional neighbourhood design, greenhouse neighbourhoods and urban villages. In each case the underlying objective is to create Liveable Neighbourhoods that reduce dependency on private vehicles and are more energy and land efficient.

In response to this, the emerging planning agenda focuses on the idea of an urban structure based on walkable mixed-use neighbourhoods with interconnected street patterns to facilitate movement and to disperse traffic. Daily needs may be in walking distance of most residents. With good design, more people will actively use local streets, enhancing safety. Local employment opportunities are facilitated in the town structure, providing the community with a firmer economic base and enhancing self-containment of neighbourhoods and towns.

Safe, sustainable and attractive neighbourhoods are sought with a strong site-responsive identity supportive of local community. This model promotes better community, employment and environmental sustainability than conventional planning practice.

Proposals

Element structure

Liveable Neighbourhoods reviews and draws together currently separate policy aspects such as lot size, movement systems, activity centres, public open space, school sites, urban water management and development adjacent to transit stations. The following elements are included:

Element 1 - Community design

Element 2 - Movement network

Element 3 - Lot layout

Element 4 - Public parkland

Element 5 - Urban water management

Element 6 - Utilities

Element 7 - Activity centres and employment

Element 8 - Schools

Objectives and requirements

Each element has two components:

- **objectives** which describe the principal aims of each element; and
- **requirements** which present a range of qualitative and quantitative responses to meeting the objectives.

The requirements are phrased in two ways:

- matters that **should**[1] be considered, where there are a range of design solutions; and
- matters that **must**[2] be satisfied, where a particular response is required, unless the requirement states that in particular circumstances, variations or exemptions are allowed.

The objectives of each element are as important as any one set of requirements through which urban development may be carried out. At times, objectives and requirements may be difficult to achieve together. In these cases the WAPC will assess the merits of a proposal against the objectives and circumstances presented by the particular site.

Tables in the elements set out standards referred to in the requirements. Figures are provided to explain requirements by way of example and to illustrate standards and tables.

A performance approach

Liveable Neighbourhoods is a performance-based code. The objectives and the majority of requirements may be satisfied in a number of ways ie responses may demonstrate how they perform to achieve the desired objective.

Liveable Neighbourhoods aims to balance the maintenance of acceptable standards and meeting a strategic vision with encouraging greater innovation in response to market needs. This performance-oriented approach will give greater flexibility to developers and designers, but at the same time provide a level of certainty through deemed to comply provisions on some aspects where it has, in recent times, become more difficult to negotiate an acceptable outcome.

It is recommended that applicants meet with the relevant local government and the Department for Planning and Infrastructure staff for pre-application consultations for proposals using performance-based solutions.

Compliance with Liveable Neighbourhoods objectives

For structure plans and larger subdivisions, the primary measure of compliance is achieving the objectives and requirements of Element 1 - community design. Compliance with the balance of the element objectives and requirements should follow. Smaller scale subdivisions should comply with relevant element objectives and requirements.

Liveable Neighbourhoods includes a degree of flexibility to provide the opportunity to achieve the best design for individual circumstances. The WAPC will be mindful of the need for flexibility in transferring from existing or committed conventionally designed structure plans and subdivisions to proposals designed under Liveable Neighbourhoods.

[1] Interchangeable terms may be used (for example, may or similar).

[2] Interchangeable terms may be used (for example, will, can or similar).

Application and assessment

Location of urban subdivisions

The WAPC will generally only approve subdivision for urban purposes where a proper statutory planning context is available. The WAPC will be guided primarily by the zoning context and provisions of the relevant local government town planning scheme and statutory region scheme (where applicable). The WAPC will also have regard for any endorsed regional, district or local structure plan.

Applications for subdivision

Application for the subdivision of land is to be made on the Form 1A and accompanying supplement, and include, where necessary, such information as is required by the WAPC's application information requirements and any additional information required in Liveable Neighbourhoods (refer to Application Information Guide).

The WAPC will forward a copy of each application to any local government, public body, or government department (referral agency) whose powers or functions may be affected. In making a decision on the application, the WAPC will consider the objections and/or recommendations of the referral agency.

Structure plans

Structure plans are to be prepared based on the framework provided under Liveable Neighbourhoods. Where a structure plan is a requirement of a town planning scheme, it must be prepared in accordance with scheme provisions. In the absence of scheme provisions the submission of a structure plan under Liveable Neighbourhoods should be in accordance with the requirements of the Application Information Guide.

Structure plans should be developed in consultation with affected adjoining landowners, servicing authorities and the relevant local government. It is appropriate that a copy of the plan is lodged with both the WAPC and the local government prior to advertising. The local government should ensure that adequate community consultation occurs through a participatory design process or by advertisement of a structure plan for a minimum of 28 days. This process should include notification of adjoining landowners.

Prior to advertising, it may be appropriate for the Department for Planning and Infrastructure and the local government to agree that the structure plan is suitable for advertising.

Inconsistencies

The WAPC recognises that inconsistencies may arise between proposals processed under Liveable Neighbourhoods and existing strategic and statutory regional or local structure plans, the Metropolitan Region Scheme, and/or local government planning schemes. Potential conflicts should be discussed with the relevant local government and the Department for Planning and Infrastructure at the earliest possible stage. The WAPC will continue to review existing regional plans, policies, and practice requirements (eg conditions of subdivision) to ensure greater consistency with the objectives of Liveable Neighbourhoods.

In general, Liveable Neighbourhoods replaces the current WAPC development control policies. Where there is conflict with existing policies, Liveable Neighbourhoods will prevail unless an applicant can demonstrate why the relevant Liveable Neighbourhoods policies cannot or should not apply.

Structure planning may be reliant on regional structure plans and, where applicable, region schemes. Through the process of context analysis, preliminary design proposals for structure plans may suggest adjustments to existing structure planning, committed subdivision, or to a region scheme beyond the site itself. This should enable responsive urban forms to be developed through Liveable Neighbourhoods.

The WAPC encourages early discussion with the relevant local government, the Department for Planning and Infrastructure and adjoining landowners to seek mutually beneficial solutions.

Relationship to Residential Design Codes

The Residential Design Codes of Western Australia control residential development in terms of built form and housing density. Due to its nature, this has only served to specify a maximum density and often what is delivered is much less. In addition, should a development actually endeavour to deliver the residential design code density, the result is usually a very limited range of housing as there is minimal flexibility to vary the lot size and siting controls for that density.

Liveable Neighbourhoods focuses on achieving higher densities of development to achieve more sustainable urban outcomes and support for planned facilities in selected area(s) through the application of density targets. These targets should be achieved by providing a wide range of lot sizes and dwelling types resulting in a greater range of housing and lifestyle choices.

Where inconsistencies arise between Liveable Neighbourhoods and the mandatory provisions of the residential design codes, detailed area plans may be used to override the residential design codes. This applies only for new urban (predominantly residential) areas in the metropolitan area and country centres, where two or more lots are created on green fields sites at the urban edge, or on large urban infill sites in developed areas.

Relationship to other WAPC policies

Liveable Neighbourhoods was developed pursuant to the State Planning Strategy and is included in the State Planning Policy Framework (State Planning Policy 1). State Planning Policy 3: Urban Growth and Settlement is also relevant.

Liveable Neighbourhoods is the preferred policy to guide the structure planning and subdivision of land. The WAPC will supersede specific development control policies over time with subsequent reviews of this document.

Regional variations

There are circumstances where particular requirements may be varied to accommodate the climatic and/or settlement conditions of areas of remote Western Australia, particularly for the temperate and tropical areas identified in Element 3. Requests for variation should be substantiated with regard to the Liveable Neighbourhoods Application Information Guide.

Conditions on approvals

The WAPC will continue to review the standard conditions of subdivision approval, having regard for the intent of this policy. In determining subdivision applications under Liveable Neighbourhoods, the WAPC may impose conditions on approvals to secure the principal aims of this policy and the objectives of the elements.

Applications for Review

Part 14 of the *Planning and Development Act 2005* and provisions of the *Strata Titles Act 1985* create a right of review against a decision by the WAPC. Applications for review can be made to the State Administrative Tribunal.

Applications

Introduction

This part sets out the three scales of design proposals under Liveable Neighbourhoods and information requirements to be submitted with applications for structure plans and subdivisions.

Design proposals

The three scales of proposals envisaged under Liveable Neighbourhoods are:

1 district and larger-sized structure plans;

2 local structure plans; and

3 subdivisions.

District and larger-sized structure plans

District and larger-sized structure plans should show:

- neighbourhoods as represented by approximate circles of 400-450 m radius, together with town and neighbourhoods centres;
- density targets expressed as dwellings per urban hectare;
- existing and proposed neighbourhood centres;
- arterial routes and neighbourhood connector streets;
- natural features such as water courses and vegetation;
- major open spaces and parkland;
- major public transport routes and facilities;
- proposed land use distribution; and
- proposed schools and community facilities.

The plans should be supported by text that addresses the relevant elements of Liveable Neighbourhoods. An application information guide follows (page12) to guide the preparation of the supporting text. Other information may be required by local government or the WAPC.

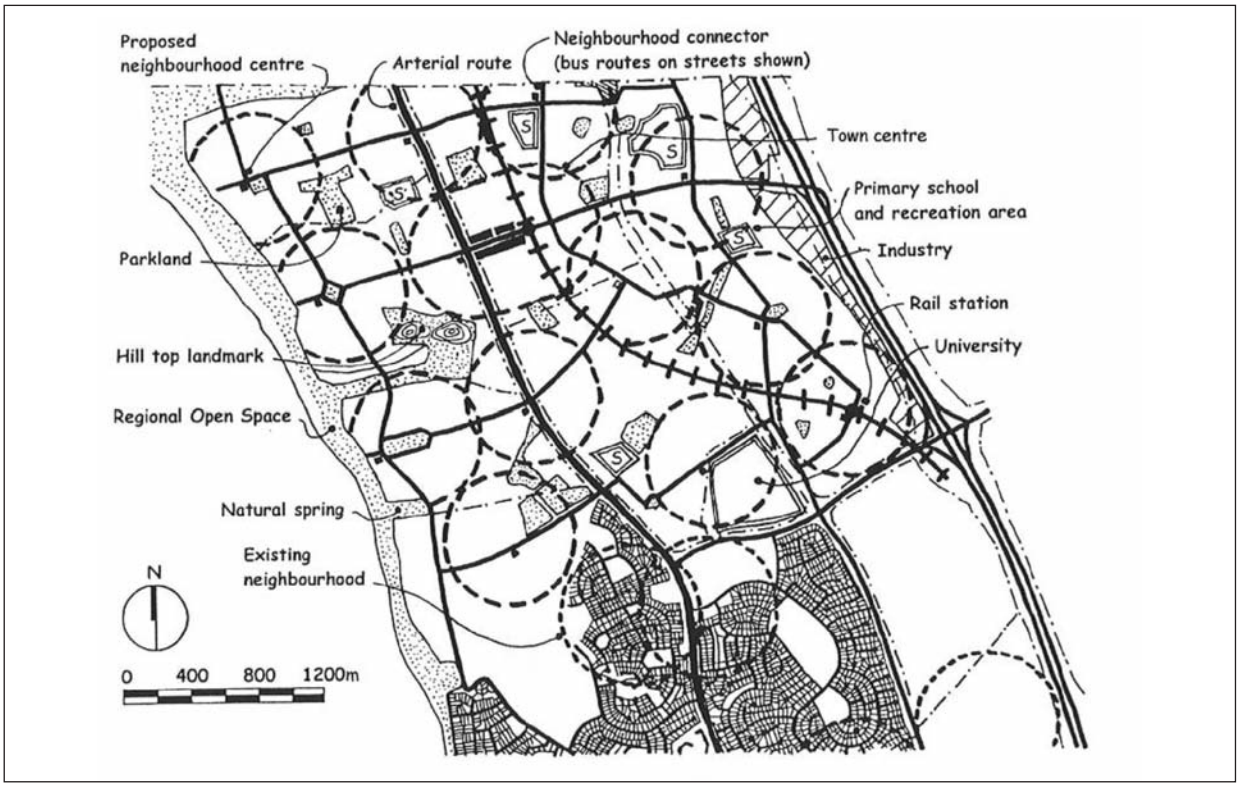


Figure 1: Example of a distrct structure plan

A design process for a district structure plan and subsequent subdivision is included in appendix 1.

Local structure plans

Local structure plans should show:

- walkable neighbourhoods, represented by approximate circles of 400-450 m radius around proposed neighbourhood and town centres, superimposed over the structure plan;
- density targets expressed as dwellings per site hectare;
- existing and proposed commercial centres;
- proposed natural features to be retained;
- proposed street block layout;
- proposed street network, including street types and path networks;
- proposed transportation corridors, public transport network and cycle and pedestrian networks;
- proposed land uses, including distribution of higher, medium and lower-density residential;
- proposed schools and community facilities;
- public parkland; and
- proposed urban water management measures.

The plans should be supported by text that addresses the relevant elements of Liveable Neighbourhoods. An application information guide follows (page12) to guide the preparation of supporting text. The local government or the WAPC may require other information.

Subdivisions

An application for subdivision should show:

- proposed street network, including street types as set out in Element 2 - movement network, and cross-sections for any special streets;
- location of proposed footpaths and shared paths;
- proposed lot pattern and sizes;
- the location of any proposed detailed area plans;
- location and size of proposed public open space; and
- location of proposed urban water management measures.

The plans should be supported by text that addresses the relevant elements of Liveable Neighbourhoods. An application information guide follows (page 12)

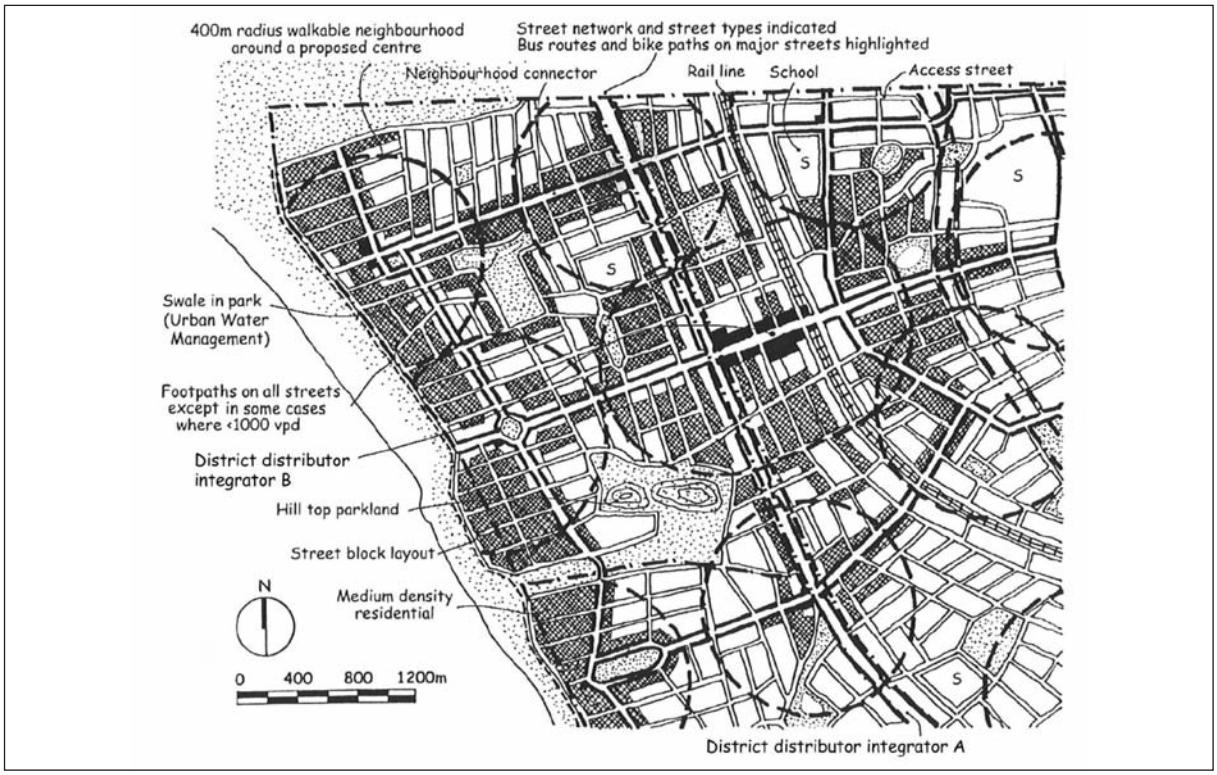


Figure 2: Example of a local structure plan

to guide the preparation of supporting text. Local government or the WAPC may require other information.

Where information has been provided for an approved local structure plan, it is not necessary for it to be repeated for an application for subdivision. Where the application for subdivision is not consistent with an approved local structure plan, it will be necessary for proper planning justification to be provided, including the need for and manner that the local structure plan is to be amended.

Application information guide

Table 1 details the information to be included in structure plans or submitted with subdivision applications to enable assessment under Liveable Neighbourhoods. The information should be provided on plans and in a single document either as a structure plan report or attached to a Form 1A in an appropriate format. In general, most of the relevant planning information will be provided through the preparation of a regional and/or district or local structure plan. Subdivision applications will need to be accompanied by sufficient information to demonstrate how proposals satisfy the structure plan and/or objectives, targets and requirements set out in **table 1**. The WAPC will continue to update this checklist.

As part of subdivision approval, ongoing implementation plans and reporting may be required. These will be application specific, but may include the requirements listed in **table 2**.

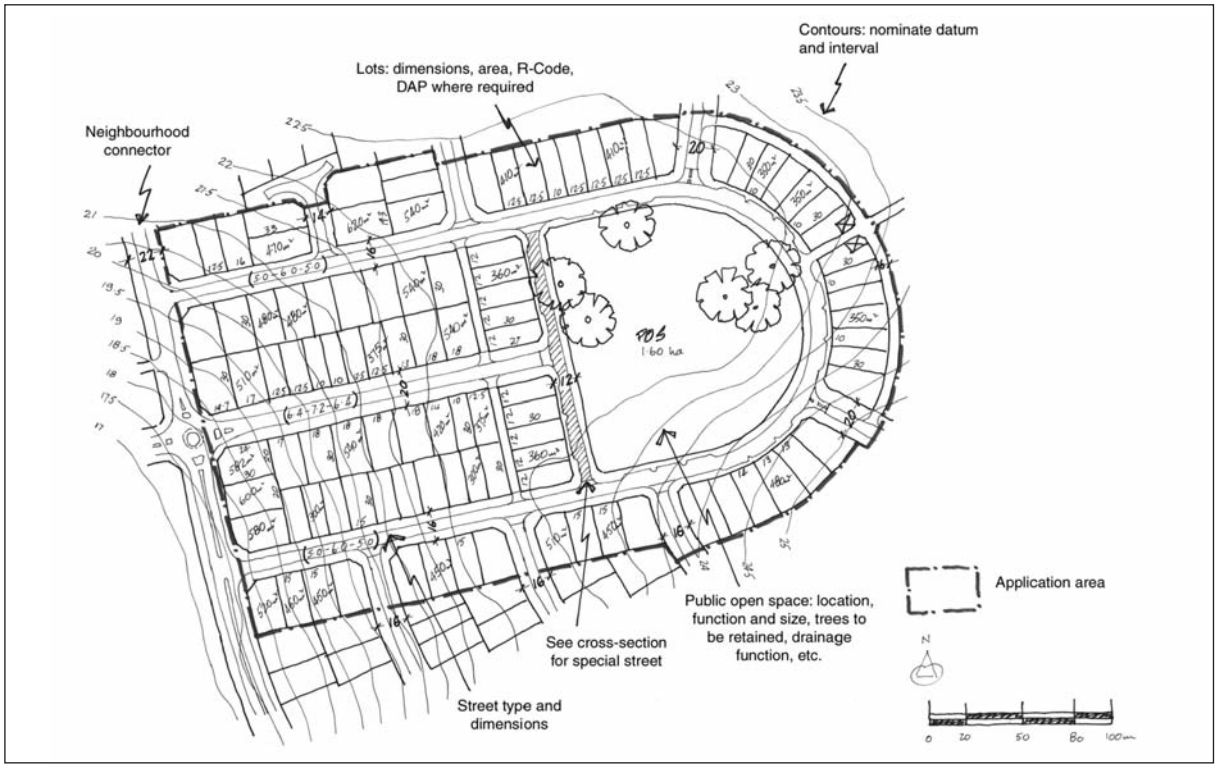


Figure 3: Example of an application for subdivision

Table 1: Application requirements checklist

Legend:

- ● Indicates the information and/or detail required.
- ▲ Indicates relevant information and/or detail which may be desirable in circumstances where this aspect is a consideration.
- ◆ Mandatory if not completed as part of the local structure plan stage.

Information/detail required	Regional/ district structure plan (generally >300 ha) 1:5000 - 1:10 000	Local structure plan (generally <300 ha) 1:2000 -1:5000	Large scale subdivision (generally >20 ha) 1:1000	Small-medium scale subdivision (less than 20 ha) 1:1000
Existing site and context analysis	●	●	▲◆	▲
• site analysis				
• specific topographic features				
• view corridors				
• biodiversity assets				
• acid sulfate soils				
• features of cultural/heritage significance (eg heritage areas, sites or buildings)				
• context analysis				
Planning context provide	●	●	▲◆	▲
• Region schemes				
• Regional planning strategies/structure plans				
• Town planning schemes				
• Other local structure plans and planning decisions				
Proposed design and implementation				
Community design				
• define sense of place and/or identity of village	●	●	▲◆	▲
• design response to site and context analysis	●	●	▲◆	▲
• land use distribution and rationale	●	●	▲◆	▲
• design objectives	●	●	●	●
• density targets.	●	●	●	●
Movement network				
• traffic volumes and street hierarchy	●	●	●	▲◆
• connectivity of proposed street system	●	●	●	▲◆
• connectivity of street system with activity nodes	●	●	●	▲◆
• street cross-sections	●	●	●	●
• traffic management	●	●	●	●
• clear network based on function, traffic volumes, vehicle speed, type, public safety and amenity	●	●	●	●
• public transport	●	●	●	●
• pedestrians, cyclists and disabled	●	●	●	●
• provision for safe/convenient pedestrian, cyclist and vehicular access	●	●	●	●
• accessibility to public open spaces, shops, bus stops, primary schools, transit station	●	●	●	●
Activity centres and employment				
• type of centre	●	●	▲	▲
• identify employment rates and opportunities (provision, extent, type, location, sources and/or localities other than structure plan area of employment for the future population)	●	●	▲◆	▲
• identify land use distribution ie retail, mixed use, commercial, educational institutions, government, civic entertainment, home-based business, business.	●	●	●	▲

Table 1: Application requirements checklist (continued)

Legend:

- ● Indicates the information and/or detail required.
- ▲ Indicates relevant information and/or detail which may be desirable in circumstances where this aspect is a consideration.
- ◆ Mandatory if not completed as part of the local structure plan stage.

Information/detail required	Regional/ district structure plan (generally >300 ha) 1:5000 - 1:10 000	Local structure plan (generally <300 ha) 1:2000 -1:5000	Large scale subdivision (generally >20 ha) 1:1000	Small-medium scale subdivision (less than 20 ha) 1:1000
Lot layout				
• lot size and variety	●	●	●	●
• land use description	●	●	●	●
• retention of existing vegetation;	●	●	●	●
• minimise effects on local and/or nearby amenity;	●	●	●	●
• provision of and/or proximity to school site(s) in the area	●	●	●	●
• climate-responsive design	●	●	●	●
• density target.	●	●	●	●
Public parkland				
• size and distribution of public open space	●	●	●	●
• public open space schedule (size and distribution of active and passive public open space to satisfy expected demographics of the development, integration with activity nodes)	●	●	●	●
• ongoing management arrangements and responsibilities	●	●	●	●
Schools				
• catchment requirements	●	●	●	▲ ◆
• size and distribution of school sites	●	●	●	▲ ◆
• site analysis and design	●	●	●	▲ ◆
• school site detailed area plan		▲ ◆	●	●
• movement network including public transport, walking and cycling	●	●	●	●
Urban water management				
• urban water management strategy (control of stormwater quality and/or quantity at source)	●	●	▲ ◆	▲ ◆
• define best planning practices (use of natural stormwater systems)	●	●	●	▲ ◆
• ongoing management arrangements and responsibilities	●	●	●	▲ ◆
Utilities	●	●	●	●
• servicing report				
• power, gas pipelines and/or easement(s)				
• telecommunications infrastructure				
Impacting land uses/activities and buffer requirements				
• aircraft				
• quarries				
• UXO				
• kennels				
• midge/mosquitoes				
• market gardens				
• poultry farms				
• industrial activities				
• fire hazards				
• flooding and/or inundation				

Table 2: Information requirements

Legend:

- ● Indicates the information and/or detail required.
- ▲ Indicates relevant information and/or detail which may be desirable in circumstances where this aspect is a consideration.
- ◆ Mandatory if not completed as part of the local structure plan stage.

Information/detail required	Regional/ district structure plan (generally >300 ha) 1:5000 - 1:10 000	Local structure plan (generally <300 ha) 1:2000 -1:5000	Large scale subdivision (generally >20 ha) 1:1000	Small-medium scale subdivision (less than 20 ha) 1:1000
Community design/lot layout				
Detailed area plans				
• density targets and/or detailed area plan			●	●
• detailed area plan to vary building site planning			●	●
• environmental management plans - various eg wetland management plan, acid sulphate soils management plan, pipeline management plan	●	●	●	●
Movement network				
• transport and traffic management report	●	●	●	●
Activity centres and employment				
• employment strategy	●	●		
• centre plan		●	●	●
Public parkland				
• parkland management and maintenance strategy	▲◆	▲◆	▲◆	▲◆
• landscape master plan	▲	●	▲◆	▲◆
Schools				
• school site detailed area plan		●	●	●
Urban water management				
• urban water management strategy	●	●	▲◆	▲◆
• drainage and nutrient management plans		●	●	●
Utilities				
• wastewater re-use management plan		●	●	●

Liveable Neighbourhoods

a Western Australian Government sustainable cities initiative

Element 1

Community design

Introduction

The need to design for sustainable communities

Approaches to urban development in the past have typically had an emphasis on land use segregation and hierarchical street systems, and designs focused on engineering, surveying and lot yield efficiency. The primary objective today in planning any new part of a city or town is to design a framework for a community that is sustainable, safe, vibrant and efficient. A broader and more integrated perspective is needed, with many design issues best addressed at the town and neighbourhood structure planning level.

This element sets out the intent of Liveable Neighbourhoods with respect to how towns and neighbourhoods should be structured, the layout of street networks and block structures, the mixing of uses and facilitation of employment opportunities, the range of residential densities and other urban design issues.

It seeks to provide safe, convenient and attractive neighbourhoods that meet the diverse needs of the community, are adaptable to future change, and fit into the existing and planned urban context.

A key focus in this element is to ensure that an urban framework is provided that facilitates a much more sustainable urban and environmental outcome in all new developments. Coupled with this is a need to provide improved social sustainability (social capital and community development) and better equity and choice.

Key differences from conventional practice

The Liveable Neighbourhoods approach calls for an urban structure based on walkable, mixed-use towns and neighbourhoods. The neighbourhood and town centres are located at junctions of arterial routes or important local streets, rather than having such roads define the edge of development. The town centre acts as a district level community focus with a compatible mix of uses providing a range of weekly shopping needs, community facilities and significant non-retail employment; the neighbourhood centre should aim to cater for the daily convenience needs of a community.

There is greater emphasis on site-responsive design, enhancing local identity, providing an interconnected network of streets with development frontage to streets and open spaces, a wider choice of housing, together with increased residential density.

There is recognition of the need for structure planning at all levels in order to achieve more sustainable urban outcomes and to appropriately consider all the complex issues associated with urban development. Structure plans must provide a reliable framework to coordinate the more detailed planning processes that follow.

Another difference is the focus on designing complete integrated communities, not just housing estates. In particular, this requires design of an urban structure that has an appropriate distribution of mixed-use centres, an appropriate level and type of public transport, provides sites for larger industrial areas and that adequate and appropriate provision is made for a wide range of employment opportunities.

It also requires much greater consideration of, and integration with, existing communities and with proposals on surrounding land. Sites cannot be planned in isolation.

Another key difference is the increased emphasis on planning for natural resource conservation and management. Protection of waterways, significant vegetation and habitat, more sustainable urban water management and incorporation of items of cultural significance are all required.

In the introduction to each of the elements, a detailed list of key differences to conventional practice is included (ie practice generally prior to the first edition of Liveable Neighbourhoods in 1997). These lists should also be read before preparing designs in response to this element.

General principles and background to objectives and requirements

Balancing urban and environmental sustainability outcomes

Achieving a balance between the extensive spatial requirements of some environmental outcomes and achieving efficient walkable mixed-use urbanism is a key challenge in structure planning. This may require difficult trade-offs to ensure that overall a sustainable urban environment will result.

In some cases, the green spaces may need to be narrowed, or vegetation cleared or floodplains or streams adjusted, to ensure efficient neighbourhoods, town centres or rail station urban catchments result. In

other areas, the unique or special nature of the environmental attribute may mean that urban development would be highly fractured and reliant on private car journeys or public transport as the only viable means of transport for day-to-day services. In such areas, urban development may be precluded.

In most cases, good urban structuring can design the towns and neighbourhoods so that the green network is placed at the urban edges, rather than cutting through or dividing neighbourhoods or centres. Where urban structure seeks to capitalise on streams or water features, a more urban approach to setbacks and buffers may need to be taken, and in return, higher development densities should take advantage of the amenity. Integration is a fundamental outcome in most instances.

Another aspect of urban development requiring critical review under Liveable Neighbourhoods is the amount of land set aside for various agency requirements, based on the conventional view that more is better.

This applies, for example, to land allocation for environmental buffers, easements, foreshores, setbacks, acoustic barriers, street reserves and community facilities (eg schools). This excessive approach to land use decreases urban efficiency, wastes land, decreases density, increases overall cost of urban development and contributes to urban sprawl. Many of the issues or concerns can be dealt with by using appropriate urban design or built form solutions.

When producing a structure plan, these various land requirement matters should be critically reviewed, to ensure that land is being used efficiently.

Assessment of proposals

This element is the starting point for assessing district and local structure plans and for large scale plans of subdivision, particularly where no structure plan has been prepared. The objectives and requirements of this element are intended to guide the initial structure planning of new urban areas before refining the plan by applying the more detailed provisions of the remaining elements.

The scale of proposals will vary. Some will comprise whole new suburbs with all of the components of a complex urban area. Others will comprise one or more neighbourhoods, while others will be smaller still, forming just part of a neighbourhood.

Amongst other requirements, a proposal may need context and site analysis, walkable catchment area diagrams, transport and traffic management strategies, and urban water management strategies. A written rationale may also be required, explaining how the design responds to the context and site analysis, and to the requirements of Liveable Neighbourhoods. (Applications information guide (page 12) provides more details).

Development abutting existing residential development

In many areas, new development will be abutting areas that have developed under conventional WAPC policies. Many of these areas will comprise residential estates with hierarchical street systems and no mixed use.

This policy requires integration of new areas, as far as practicable, with abutting existing areas. Relatively frequent local street connections should be provided, in order to gain the benefits of integrated urbanism.

Designs need to balance the benefits of integration against any significant adverse effects (eg likelihood of heavy through traffic) that may occur in areas that were built under a different philosophy. Interfaces and edge treatments of new areas should generally transition into the existing urban character.

Design for mixed use

Liveable Neighbourhoods promotes but does not cover all aspects of mixed land use planning and design. Reference to the use of key design texts is recommended for more information on particular non-residential aspects. For example, for designing town centres, home–based businesses and industrial interfaces see Mixed Use Developments: New designs for new livelihoods, (DTSBI, Qld, 1996), and the range of other references included under further reading. The WAPC will examine this issue in more detail in future editions of Liveable Neighbourhoods.

The aim of Liveable Neighbourhoods is to design a robust urban and neighbourhood structure that can accommodate a range of uses, and which is flexible enough to change over time.

Residential density

Achievement of more sustainable urban outcomes will require higher residential densities in many urban areas. This increased density will usually be associated with centres, and with areas well served by public transport routes. The target density will need to be achieved to support planned facilities.

In Western Australia, the usual way of designating proposed residential density on structure plans has been by specifying an R-Code (eg R20) across a defined area. This has only served to specify a maximum density and often what is built is much less than coding permits.

In addition, should a development actually endeavour to deliver the lot sizes specified in the Residential Design Codes, the result is usually a limited range of housing or lifestyle choices.

For the purposes of local structure planning and subdivision, the WAPC defines residential density as dwellings per site hectare, representing the number of dwellings per hectare of a development site or an aggregation of sites. This residential density is calculated as the density per hectare of land to be developed for residential purposes and excludes non-residential uses including streets, laneways, open space and centres.

For local structure plans, the residential density must be specified on street blocks or aggregated sites to indicate the target dwellings per site hectare. The detail of lot diversity and housing choice is delivered through subdivision conditions and detailed area plans. Element 3 - lot layout provides a more detailed description of how to annotate plans to show both the target residential density and the circumstances that will necessitate detailed area plans.

In typical walkable neighbourhoods, a residential density of around 20 dwellings per site hectare will result in 750-900 dwellings in a 400-450 m radius. This will usually be the minimum yield needed to support a neighbourhood centre corner store and reasonable levels of bus service.

In strategic areas close to higher order centres and railway stations, significantly higher residential densities will usually be expected, with 30-40 dwellings per site hectare in 400 m, and sometimes 800 m, of major nodes being appropriate. Lower residential densities may be appropriate in areas on the edge of neighbourhoods or in physically constrained areas, and in smaller country towns.

Residential densities and diversity of dwelling types should be achieved by providing a wide range of lot sizes and building forms. This provides for greater housing and lifestyle choice.

For regional and district level structure planning, determination of overall urban densities is necessary to assist in traffic modelling and in determining regional and sub-regional infrastructure requirements. In the Metropolitan region these would, for example, be based on MRS urban and urban-deferred zones.

The WAPC defines urban densities as the number of dwellings per hectare of gross urban land. Gross urban land includes land required for infrastructure and for open space purposes. In most new urban areas, urban densities of at least 15 dwellings per urban hectare, and an average of 22 dwellings per site hectare, should be provided. (Note that R20 (ie 500 m^2 average lot size) is equivalent to an urban density of approximately 13 dwellings per hectare of gross urban land given that 25 per cent of gross urban land is dedicated to streets and 10 per cent to public open space).

Urban structure for improved public transport

This element requires attention to be given to providing an urban structure that will support public transport. New urban areas should facilitate significantly improved transit usage relative to conventional urban development. Other elements (Elements 2, 3 and 7 in particular) provide more detail.

Key considerations for structure plans relate to the following:

- Whether a rail-based service is possible and if so the timing of the service relative to the urban development. If the timing for the establishment of the service is uncertain, how can the desired density and mixed use be provided in the short or long term?
- Is a heavy rail (train) or a light rail (tram) mode more appropriate and is compatibility with existing systems an issue?
- If a bus-based service is provided, where are the proposed routes and key destinations? Do key routes justify a dedicated bus-transit way or other priority bus route?
- What density, centres distribution and range of other activities are required along the transit route, and specifically around stops, to support adequate frequencies of service? Both origin and destination custom will need to be considered.
- How can the street network and adjoining development achieve a safe, efficient and attractive pedestrian environment in the walkable catchment of all transit stops?

Detailed consultation with DPI and transport providers should occur at an early stage. Reference should also be made to Development Control Policy 1.6 Planning to support transit use and transit oriented development for more information.

Activity centres and employment

Element 7 outlines in some detail the types of mixed-use walkable activity centres envisaged under Liveable Neighbourhoods. The main centre types are town centres and neighbourhood centres (**table 12** in Element 7 for centre types).

The size, location, layout and quality of town centres are critical to successfully generating a wide range of businesses and employment in new growth areas. Sufficient and appropriate land needs to be identified for the wide range of non-residential uses needed to produce a relatively self-sufficient urban extension, where car travel and related congestion, greenhouse gas emissions and air pollution can be constrained.

Planning for adequate employment is now a key outcome sought by Liveable Neighbourhoods. It is recognised that there are challenges relating to the different time frames usually associated with residential development and the later demand for business development. Liveable Neighbourhoods will require that this issue be fully addressed in structure plans.

At present, in Perth's growth areas, approximately 1.3 jobs are required per household (or 0.46 jobs per person). If 60 per cent of these jobs are to be provided in growth areas, this equates to around 0.8 jobs per household. Therefore, for each 100 dwellings, capacity for around 80 jobs is likely to be required in new urban areas.

The provision of well-distributed neighbourhood centres is vital to supporting local walking and cycling, public transport use and catalysing physical activity as a part of daily routine, vital for good health. These centres will also ensure that it is possible to provide people with the option to live in most new areas without the need for a car.

Schools

Element 8 provides detail on public and private, primary and secondary schools. In this element, it is important to ensure that provision is made for sufficient schools and that they are appropriately located relative to both their core walkable catchment and, for secondary and private schools, to public transport and arterial roads.

Public primary school sites should be located conveniently to the catchment area they are intended to serve and be provided with a well-connected street network focused towards the school, so as to maximise the walkable catchment area. Primary schools should generally be located between neighbourhoods to enable sharing between approximately three neighbourhoods.

Public secondary schools and private schools should generally be located on arterial roads, with good public transport access. They should be located about 400 m or a little more from railway stations, but not closer, as they take up large amounts of space in the core walkable catchment.

Urban water management

Liveable Neighbourhoods requires comprehensive incorporation of state-of-the-art urban water management processes. At the level of urban structuring, these will require establishment of parks that can accommodate urban water management measures and may include linear parks that act as integrated public open space corridors. These corridors will need to be designed to balance urban structure objectives, the provision of usable and accessible active and passive open space with larger scale urban water management requirements.

Usually these corridors will follow valley lines, and will incorporate; streams, floodplains and wetlands (both natural and constructed), storm detention measures including basins, stormwater infiltration and other water quality treatment devices.

These corridors need to be planned interactively with the town and neighbourhood structure to ensure that corridors do not compromise efficient and safe urban structure. In some places, particularly in neighbourhood, district or higher order centres, the corridors will narrow down to enable urbanism to be integrated across them.

Vegetation, habitat and cultural heritage preservation

A comprehensive site analysis will be required in conjunction with structure planning. Part of this analysis will identify areas of natural and cultural significance. Where practical, those items that are of adequate significance, or can contribute to establishment of a sense of place or identity should be retained.

For items recommended for retention, a mechanism for appropriate ownership and management of the asset will be required and consideration must be given to the impact of its retention on the urban structure.

Social, health and community safety outcomes

Important aspects to consider in the design of new urban areas include how to establish an urban environment that can deliver improved social and community outcomes relative to conventional development. This aspect underlies the overall thrust of Liveable Neighbourhoods, with its focus on walkable mixed-use communities that are well served by services, facilities and public transport and designed to create a special sense of place for each community.

There are additional measures to address as structure plans and subdivisions are refined. In particular, this includes provision for appropriately located and designed community buildings, opportunities for people in communities to interact socially and to build social capital and opportunities to facilitate physical activity as a contributor to physical and mental health.

Design to provide a high level of actual and perceived community safety is also vital, and requirements for establishing a safe urban structure and public realm are included throughout Liveable Neighbourhoods.

Objectives

O1 To facilitate a sustainable approach to urban development by minimising non-renewable energy use and car dependence, encouraging greater local self-containment of neighbourhoods and towns, and protecting key natural and cultural assets.

O2 To provide safe, convenient and attractive neighbourhoods and towns that meet the diverse and changing needs of the community and offer a wide choice of housing, leisure, local employment opportunity and associated community and commercial facilities.

O3 To develop a coherent urban system of compact walkable neighbourhoods which cluster to form towns with relatively intense, mixed-use town centres that are capable of catalysing a broad range of employment and social opportunities.

O4 To ensure a site-responsive approach to urban development that supports and enhances the context in which it is located, strengthens local character and identity, integrates with its context and promotes a sense of community.

O5 To provide a movement network which has a highly-interconnected street network that clearly distinguishes between arterial routes and local streets, establishes good internal and external access for residents, maximises safety, encourages walking and cycling, supports public transport and minimises the impact of through traffic.

O6 To provide a network of well-distributed parks and recreation areas that offer a variety of safe, appropriate and attractive public open spaces.

O7 To ensure that the design of neighbourhoods takes into account environmental constraints including soil erosion, flooding and bushfire risk, and protects areas of natural or cultural significance.

O8 To ensure that new urban areas incorporate best-practice urban water management techniques relating to stormwater quality and quantity, water conservation and re-use, ecosystem health, economic management, and public health.

O9 To balance provision of a sustainable and efficient urban structure with protection and enhancement of environmental attributes.

O10 To structure urban areas to enable public transport systems to provide a viable alternative to private cars.

O11 To equitably provide public utilities in a timely, cost-efficient and effective manner.

Requirements

Application requirements

R1 Structure plans and subdivision applications must be accompanied by the relevant information listed in the applications section (page12).

Neighbourhood and town structure

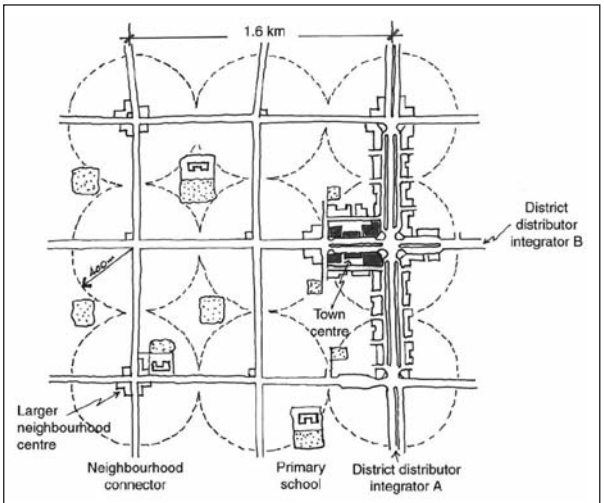
R2 The layout of any structure plan or plan of subdivision should contribute to an urban structure of highly interconnected neighbourhoods and towns.

R3 Neighbourhood structure should have the following characteristics (**figures 4 and 5**):

- size and shape generally defined by a five-minute walk from the neighbourhood centre to its perimeter, typically 400 m (average residential density 22 dwellings per site hectare) to 450 m (average residential density 20 dwellings per site hectare);
- the centre acts as a community focus with a compatible mix of uses, including retail, which provide for a variety of daily needs and may include community facilities and urban open spaces such as a small square;
- to assist retail exposure and accessibility, the centre is located on or at the intersection of relatively busy local streets and is served by public transport;
- an interconnected street network focused on the centre, and with strong links between the neighbourhood centre and its related town centre, providing good accessibility, route choice and detailing to make walking and cycling pleasant, efficient and safe; and
- a range of residential densities and variety of housing types that increase toward the neighbourhood centre.

R4 Town structure should have the following characteristics (**figures 6 and 7**):

- be formed by the clustering of neighbourhoods, typically with six to nine neighbourhoods needed for adequate population to sustain a sufficiently-sized town centre with public transport and a wide range of goods and services;
- the town centre is central to the cluster of neighbourhoods, well-linked and in



Liveable Neighbourhoods seeks to integrate land uses in a network of interconnected streets designed for all users. Neighbourhood centres are located at the intersection of major streets to provide for retail exposure and better bus routes. Large parks and standard-sized schools are located between neighbourhoods so that walking access to the centre is not compromised. Note that rarely, in reality, at typical urban fringe densities, will neighbourhood centres be this closely spaced. Element 7 provides more detail on parameters for successful neighbourhood centres.

Figure 4: Comparison between conventional and Liveable Neighbourhoods approach to neighbourhood design.

Figure 5: Diagram of the neighbourhood unit which is based on a 400-450 m radius, five-minute walk to centre.

reasonable walking distance of most residents;

- major new transport routes are based on desired town and neighbourhood structure;
- for commercial viability and accessibility the town centre is located adjacent to the intersection of arterial routes and has one or more major public transport stops, wherever possible;
- sites are identified and facilitated by design, for a wide range of business and employment opportunities; and
- a range of housing types with residential densities that increase toward the centre is provided, so that the town can, over time, support sufficient population to foster good local self-containment.

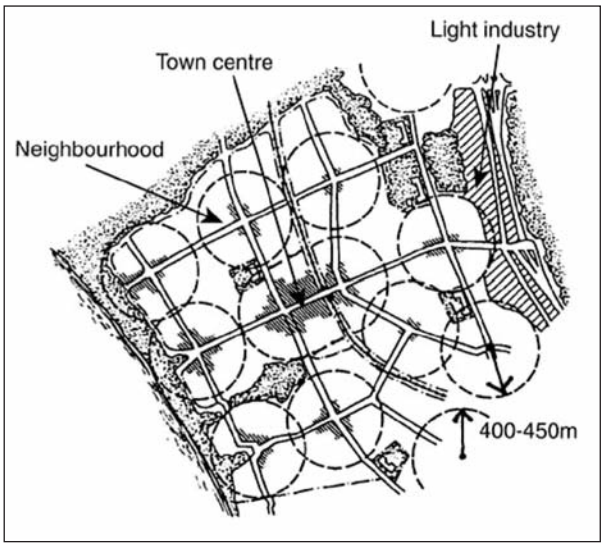


Figure 6: Diagram of neighbourhoods clustered to form and support a town centre.

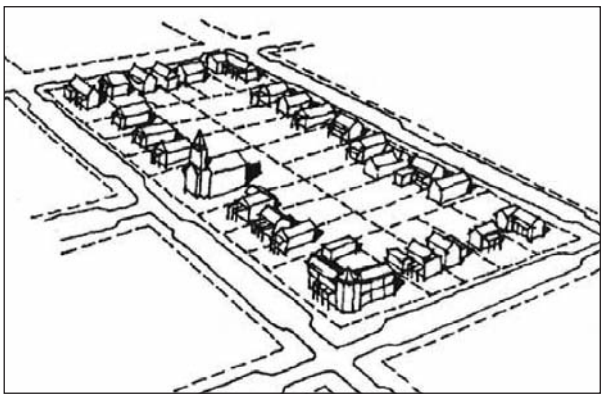


Figure 7: Example of perimeter blocks with buildings arranged to front streets, and generating private rear yards (or, in centres, space for off-street parking) at rear.

Integrating with adjoining development

R5 The layout should connect well to existing, committed, or proposed development on adjacent sites. The urban structure of new areas should take into account the existing urban structure of adjoining areas and should endeavour to enhance its contribution to a more sustainable urban structure, wherever practical.

Local identity

R6 The layout should enhance local identity by responding to the site context, site characteristics, setting, landmarks and views and incorporate key elements of natural and cultural significance.

R7 The layout should create a strong sense of place through a range of design techniques and should establish legible street and open space networks.

Street network and lot layout

R8 The street network should provide a high level of internal connectivity and good external linkages for local vehicle, pedestrian and bike movements. Traffic management design should aim to restrain vehicle speed, limit the negative impact of through traffic and create safe conditions for all street users.

R9 Streets should provide multi-purpose public spaces, and should be designed to balance traffic management with other roles such as community spaces, pedestrian environments, for parking, and as settings for residential and commercial uses.

R10 The layout of streets and lots should generally provide for perimeter blocks of buildings fronting streets and create a relatively continuous street frontage for safe, attractive and efficient circulation of pedestrians, cyclists and drivers (**figure 7**).

R11 The layout of streets should enable development to front all streets, urban parks and natural areas. Where rear lanes are used they should be laid out and detailed to ensure adequate passive surveillance.

R12 The street network should have no more than 15 per cent of lots fronting culs-de-sac.

R13 The orientation of subdivisions (principally the orientation of streets and lots) is addressed in element 3 Lot layout, R17-R19.

Figure 8: deleted

Mix of uses and employment

R14 District structure plans should provide for jobs by allocating land for around 60 per cent of the jobs needed by a new population, (ie provide 0.8 jobs per person, based on a total requirement of 1.3 jobs per household). Local structure plans should provide sufficient land to accommodate job target set by any district structure plan.

R15 Sufficient and appropriately located non-residential land should be identified and have an appropriate street and lot layout for a wide variety of business and home-based business development opportunities. Transitions between uses should be designed to minimise land use conflict, while delivering an efficient urban form.

Density and mix of housing types

R16 New areas should have regional and district structure plans that set a desirable urban density that will support self-contained mixed-use centres that will facilitate an increase in the use of either public or non-motorised transport.

R17 Local structure plans detailing street blocks and land uses must specify the residential density in dwellings per site hectare. The plan should also identify those areas for which a detailed area plan is required, to deliver a variety of lot sizes or dwelling types. As a guide, the following minimum residential densities are suggested:

- 12 to 20 dwellings per site hectare for standard lot layouts, distributed to achieve any required urban density or dwelling yield set in a district structure plan;
- 20 to 30 dwellings per site hectare for areas in 400 m of neighbourhood centres and in 250 m of main bus routes; and
- 30 to 40 dwellings per site hectare for areas in 400 m of town centres and metropolitan railway stations.

R18 The lot layout should provide a mix of housing types, lot sizes and densities, with smaller residential lots and higher density housing in areas close to town and neighbourhood centres, near public transport stops, and in areas with high amenity such as next to parks.

R19 Residential developments should not be provided in gated street formats. Where lifestyle, retirement or other special-interest developments are proposed, these should aim to maximise development on public streets, with good linkages to surrounding urban areas. Potentially suitable sites for such developments may be identified on structure plans, together with provisions to specifically ensure that these developments do not disrupt the overall walkable urban structure.

R20 Retirement complexes should be located close to town and neighbourhood centres, and to incorporate multi-storey denser components to achieve sufficient yield on relatively small sites. In some cases, they may be designed so that their facilities can be shared by the broader community and be located to form the core of the neighbourhood centre.

Schools

R21 The layout should provide for State education facilities in accordance with Education Department of Western Australia standards. Adequate and appropriate sites for private schools should also be identified.

R22 Primary schools should generally be located between neighbourhoods to enable sharing amongst two or three neighbourhoods. Secondary schools and major private schools should generally be located on integrator arterial routes near public transport. The location of primary schools at or near the centre of a neighbourhood may be appropriate in limited circumstances (**figure 9**).

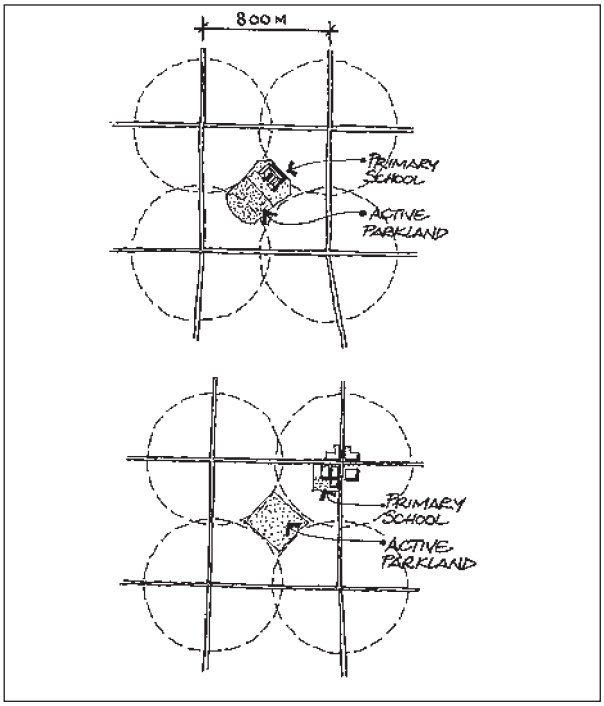


Figure 9: Diagrams of a primary school located near a neighbourhood edge, or near a centre if proposed as an interim school.

Community safety, social capital and health

R23 The layout should enhance personal safety and perceptions of safety and minimise potential for crime, vandalism and fear by providing for streets and urban open spaces to be fronted and overlooked by housing and actively used facilities, especially on routes to and from schools, public transport stops and other routes used at night.

R24 To enhance community well being the layout and detailed design of new urban areas should include appropriate community nodes and facilities a sense of ownership and an urban structure that encourages physical activity and interaction.

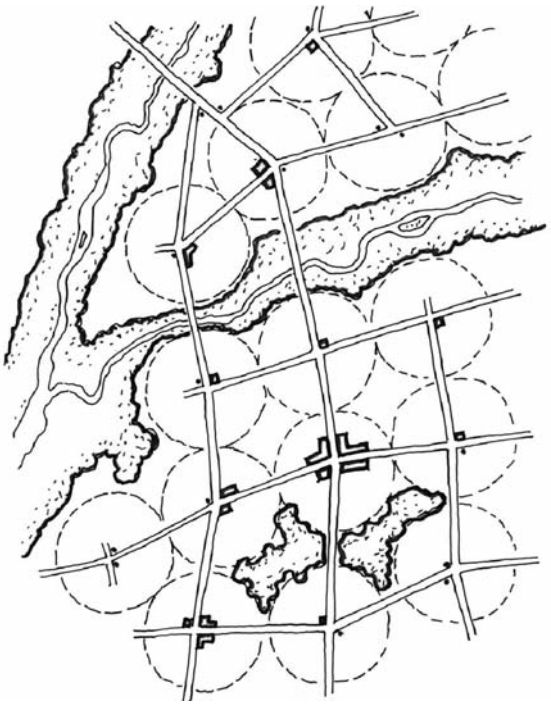
Bushfire hazard

R25 The layout of neighbourhoods abutting areas of high bushfire hazard should provide for streets that are designed, located and connected to allow safe and efficient movement of emergency vehicles and that lots facilitate the siting and design of houses incorporating bushfire protection measures in accordance with the WAPC Bushfire Hazard Guidelines.

Public parkland

R26 The layout should provide well-distributed parkland that contributes to the legibility and character of the development, provides for a range of uses and activities, is cost-effective to maintain and assists with urban water management.

R27 Major linear, district or regional open spaces and regional or arterial drainage should be located to define the boundaries of neighbourhoods rather than dissect them (**figure 10**). Linear corridors that are proposed to pass through urban centres or key connections between urban areas should be narrowed to provide for well integrated crossing points that are under appropriate levels of community surveillance.



Many of these open spaces will be used as a multiple-use corridor incorporating a range of urban water management features. Bushland, conservation areas or rural edges should be under passive surveillance by fronting development towards all the open spaces, and bounding these areas by streets wherever practical.

Figure 10: Urban structure showing how major open spaces are located to define the edge of neighbourhoods.

Flooding and urban water management

R28 Urban development should avoid land identified with significant flood risk. Where a floodplain has significant affect on urban structure (eg town centre or rail station catchments) adjustments to the stream or floodway may be considered, if practical, provided that an enhanced environmental and urban outcome can be demonstrated.

R29 An integrated approach to urban water management should be achieved by:

- creating areas of open space (including multiple-use linear parks along drainage lines, and some streets with median swales), that can be used for urban stormwater management, to enhance water quality without compromising efficient urban structure;
- retaining and enhancing natural watercourses, wetlands and riparian vegetation, while also recognising that limited alignment modifications may be appropriate to enhance urban structure;
- providing urban floodway and flood retention features in a range of forms to manage flood flows. The floodplain may incorporate sports-fields and other uses less sensitive to flooding; and
- considering the use of artificial lakes, ponds or other permanent water bodies as features in urban areas where these can lead to an increase in the intensity of urban uses while providing an effective urban water management function.

Utilities and easements

R30 The street and lot layout should enable efficient provision of utility services to new communities, and should ensure that anticipated enhancements such as grey water distribution systems and enhanced communication networks can be incorporated, either at the point of development or in the future.

R31 Structure planning should identify and protect all major service easements and incorporate any related constraints from nearby land uses. In some cases, relocation or removal of services and easements, or enabling certain development in easements, may need to be considered to ensure that an efficient urban structure can result.

Balancing urban and environmental sustainability

R32 The urban structure should achieve a balanced outcome to urban and environmental sustainability by making appropriate trade-offs to ensure that core urban areas and most public transport catchments are not compromised by extensive environmental areas, and that significant environmental attributes are not compromised by urban development.

Liveable Neighbourhoods

a Western Australian Government sustainable cities initiative

Element 2

Movement network

Introduction

This element sets out the Liveable Neighbourhoods approach to determining movement networks, street design and construction, and public transport. The emphasis is upon connectivity, amenity, and integration to achieve safe, efficient and attractive street networks. The priority is to develop a street network that not only works for vehicles and public transport but also specifically aims to attract a high level of use by pedestrians, cyclists and the disabled.

Streets have a significant role to play in relation to social interaction, public safety and amenity, but require contiguous development frontage to do this effectively. Development that provides direct frontage onto streets provides surveillance, activity and visual interest and, on busier streets, exposure which can assist commercial viability. Buildings that have direct frontage onto a street help build community focus and enables streets to act as an integrating element in neighbourhoods and towns, rather than as a divider.

Design of the street network can assist the potential for energy conservation through reduced vehicle travel, facilitating climate-responsive house siting, management of natural features, provision of business and commercial opportunities, and adaptability to changes in land use.

The introduction of section 169 of the *Planning and Development Act 2005* provides that the WAPC may fix the minimum standards of road construction. The road standards set out in this policy are intended as a guide until such time as any WAPC minimum road standard requirements may be gazetted.

This element sets out requirements and some design solutions for a standard set of street types, and some examples of traffic management treatments that satisfy the element objectives. Streets are classified as either arterial routes or local streets, with a range of types in each classification. The WAPC will consider variations for specific purpose streets where a case is provided consistent with the element objectives.

Liveable Neighbourhoods is not intended to be a traffic engineering manual. It provides a guide to principles for designing integrated networks and street design and construction.

Referral to Main Roads Western Australia (MRWA) will be required for all subdivisions abutting roads under its control and intersections requiring traffic signals.

Key differences from conventional practice

Liveable Neighbourhoods promotes several major differences from conventional suburban street systems, including the following characteristics:

- the street system is highly interconnected, and is aimed at reducing local travel distances and related emissions and energy use;
- integrator arterial routes generally form the core or spine of neighbourhoods and towns, rather than being located at the edges;
- use of service roads or other lot layout techniques to enable development, rather than back fencing, to front arterial routes;
- traffic is distributed more evenly through a flatter hierarchy of streets, reducing pressure at major intersections;
- culs-de-sac become less frequent and, if used, are connected through to another street by a wide reserve with path, enabling safe pedestrian and bicycle access;
- more streets per unit area of land, but lower cost per lot with greater lot diversity and smaller lots;
- use of rear laneways in higher density areas;
- increased on-street parking capacity to allow fewer overall parking spaces and to support changes in land use over time;
- substantially improved pedestrian access and amenity based on development fronting and overlooking wide footpaths along both sides of most streets, for personal safety through surveillance, rather than segregated linear trails;
- street layout designed using a walkability analysis (ie ped shed analysis) to ensure efficient walk routes to centres, schools, public transport stops and other key destinations;
- detailed footpath and street crossing design suited to disabled vehicle users;
- the street network design to accommodate and facilitate cyclists;
- parkland and open spaces fronted by streets;
- streets designed to provide an integral part of a more sustainable urban water management system;
- in centres, integrator arterial routes are supported by parallel routes that serve local traffic and reduce pressure on arterial intersections;

- pedestrian underpasses are discouraged because of personal security problems, land requirements and cost. These may be appropriate where topography and road levels are favourable and where passive surveillance is achievable;
- traffic signal control, rather than roundabouts is encouraged on major roads to improve pedestrian crossing opportunities, both at the lights and in breaks of flow mid-block, and to improve safe vehicle access into local streets. Roundabouts may be appropriate in specific circumstances such as where traffic speeds and volumes are low or the roundabout is so located and designed that it will not discourage pedestrian movement;
- bus routes and stop locations are designed to facilitate pedestrian access to stops, by both the layout of the street network and the design of the bus route to ensure ease of crossing of busy streets to access bus stops across the street; and
- increased use of four-way junctions to facilitate pedestrian and cycle movement, and to enhance legibility and efficient development yield; minor cross roads are detailed to control entry speeds and to minimise the need for roundabouts.

General principles and background to objectives and requirements

Sustainability and movement networks

In response to the State Sustainability Strategy the movement network provisions provide for more land-efficient street reserves, including narrower pavement and lane widths that concurrently promote reduced vehicle speeds, reduced kerb radii and increased requirements for footpaths and large street trees, to support pedestrians, together with other details to support a more balanced movement system.

This has led to some street requirements in this policy being different to those in Austroads.

Arterial routes classification

Table 3 outlines the function and characteristics of arterial routes in Liveable Neighbourhoods. These routes are intended to provide for efficient and safe regional and local traffic movement while integrating the community through development frontage and urban activity, wherever possible.

The location and design of freeways and most controlled access highways is beyond the scope of Liveable Neighbourhoods (except in so far as negotiations may occur with MRWA, the WAPC and local government in considering the neighbourhood and town structure of an area as a critical part of the design process).

Liveable Neighbourhoods introduces a suite of integrator arterials specifically designed for development, to front the street both in and between centres. They are intended to facilitate business development and resultant employment generation, as well as reducing travel demand in new communities by providing the opportunity for more services to be made available locally.

Integrator arterials are designed to facilitate pedestrian movement both along and across them, with the spacing and control mechanisms of intersections being focused towards increased priority for pedestrian crossing needs, including bus stop access.

Relationship between Functional Road Hierarchy and Liveable Neighbourhoods tables 3 and 4

Liveable Neighbourhoods differs from the MRWA's Functional Road Hierarchy in that route design considers character and land use integration as well as function.

The WAPC and MRWA are working towards the joint review of the Functional Road Hierarchy and **tables 3 and 4** to provide better policy integration.

The nature and classification of arterial routes and local streets may change along their length in response to the varying urban contexts they pass through, while still maintaining appropriate safety standards and efficiency for adjacent development, vehicles and other street users.

Primary distributors

Primary distributors, other than freeways, include the four and six-lane roads under MRWA control (ie highways) and play a fundamental role in catering for inter and intra-regional traffic and major truck routes. Typically, these have projected traffic volumes of more than 35 000 vehicles per day. Primary distributors should be designed to be fronted by service roads and development frontage, and be highly connective wherever possible.

Liveable Neighbourhoods does not specifically deal with the design of MRWA primary distributor roads. Proposed junctions and edge conditions should be negotiated with MRWA at an early stage, although the WAPC will encourage context sensitive solutions wherever possible.

Types of integrator arterials

These routes serve the multiple functions of carrying traffic efficiently, facilitating pedestrian activity and public transport usage, and providing development frontage for adjoining properties. They are classified as A or B according to projected traffic and design.

- **Integrator A** routes are for higher volume four-lane arterials and suit tertiary education, civic, larger-scale commercial and suitable residential and home-based business uses along service roads. In some circumstances service roads are not required as other access techniques serve development frontage. Service roads can be removed for short lengths in centres. In these circumstances on-street parking should be provided as the road treatment response to the centre.
- **Integrator B** routes are for lower volume and lower speed two-lane arterials and residential frontage onto service roads. These roads suit pedestrian-based retail streets, as they have sufficient traffic volumes to support the retail.

Development frontage should be provided in all but exceptional circumstances.

A location adjacent to a junction between integrators A and B may be an excellent place for a town centre, with the pedestrian-scale retail focused on the integrator B, rather than the integrator A, where high traffic flows are less compatible with heavy pedestrian crossing movements. The integrator A frontage will support complementary town centre commercial uses, including those requiring high car exposure.

Acceptable cross-sections for integrator A and B streets are shown in **figures 12 to 16**.

Arterial network spacings

A network of arterial routes and neighbourhood connectors should be provided. Arterial spacing at around 1.6 - 2 km is a guide, supported by sub-arterials (referred to as neighbourhood connectors) at 800 m - 1 km spacing. Arterial spacing needs to respond to site conditions, predominant movement directions, development intensity and land use.

Integrator B's and neighbourhood connectors (see local streets classification) form the central spines of towns and neighbourhoods. These streets are appropriate for mixed-use, shopping, schools, bus routes and community activities and help to integrate land uses. The movement network contributes to urban vitality and activity associated with business and community land uses.

Controlling vehicular access along arterial routes and neighbourhood connectors

Liveable Neighbourhoods encourages development to front arterial roads and neighbourhood connector streets, rather than back on to them.

Solutions that facilitate vehicles exiting forwards, and from limited points of access, will be required along integrators without service roads, and on higher volume neighbourhood connectors.

Vehicles reversing directly out of driveways into the moving traffic stream where ultimate traffic volume will be over 5000 vehicles per day should be avoided. From 5000 - 7000 vehicles per day reversing vehicles may be considered, provided they can back out into a protected part of a parking lane, or similar.

Element 3-lot layout gives a range of lot layout solutions to provide for alternative vehicle egress for single dwellings on busier neighbourhood connectors and integrator arterials. Rear lanes are preferred for alternative access. Visitor parking also needs to be addressed.

Table 3: Function and characteristics of arterial routes

Route type and function	Route characteristics	Route name	Max speed limit (km/hr)	Indicative volume range* (vehicles per day)	Indicative street reserve width (metres)**	Indicative road pavement width (metres)
Primary distributors Form the regional grid of MRWA traffic routes, including highways, and catering for inter- and intra-regional traffic. Major truck routes.	Should be designed to be fronted by development and connected with service roads wherever possible. Usually median divided.	Six lane **Primary distributor**	80	50 000	Determined by Main Roads WA	
	Intersections limited and often signal-controlled.	Four lane **Primary distributor**	80	35 000		
Integrator arterials Form a finer grain of routes than the primary distributors, with frequent connections to local streets. Low percentage of trucks. Usually bus routes. On-street bike lanes and separate dual-use paths are usually required.	Four lane and two lane arterial road types. Integrators outside centres typically have service roads and development frontage to support a mix of uses.	**Integrator A** (Four lanes, outside centres)	70 or 60	15 000-35 000	50.6 - 52.6	2 x 8.2 including bike lane and 2 x 5.5 service roads with parking.
	Direct vehicle access from adjoining property should be limited where no service roads are provided. On-street parking desirable.	**Integrator A - centres** (Four lanes, in centres)	60	<25 000	35.6	2 x 10.7 in centres including combined on-street parking and bike lane.
	Integrators through centres typically will have at least one clear travel lane in each direction, and a parking and/or manoeuvring lane. Volumes above 15 000 vehicles per day need detailed design to manage traffic at intersections, facilitate bus movement and deal with parking and access.	**Integrator B** (Two lanes, outside centres)	60	7000-15 000 15 000-20 000	29.2	2 x 7.5 including on-street parking and bike lane. 2 x 7.5 including bike lane. Parking requires special consideration, or service roads may be needed.
		Integrator B - centres (Two lanes)	40-50	15 000	25.2	2 x 7.5 including on-street parking.

Notes: Wider central medians are to be provided where a route is planned to be used for a future bus transit way or light rail route, or possibly for drainage swales to provide stormwater infiltration.

Where an arterial is constructed in an interim situation at a higher posted speed than that intended as the ultimate speed limit, the horizontal and vertical alignment should suit the higher speed, but the lane widths, planned intersection spacings and deceleration lanes etc should be designed to the ultimate speed standard (**tables 5, 5A and 5B**).

* All functions of streets need to be considered as well as traffic volume and through traffic needs.

** Refer to **figures 12 to 16** for indicative cross-sections. Adequate reserves need to be provided to accommodate space for trees, varied service requirements, or wider shared path requirements, particularly where densities are at 15 dwellings per hectare or greater, and/or mixed-use development is anticipated. Widening for intersections may also be required.

Table 4: Function and characteristics of local streets

Street type and function	Street characteristics	Street name	Max design speed/ target operating speed (km/hr)	Indicative volume range* (vehicles per day)	Indicative street reserve width (metres)+	Indicative road pavement width (metres)
Neighbourhood connectors Streets with mostly residential frontage that typically provide the lower order sub-arterial network. These streets service and link neighbourhoods and towns.	A two-lane divided street used for higher neighbourhood connector volumes, or for character, stormwater infiltration swales or safety. These are often special streets and their design needs to have particular regard to context, function and adjacent land uses.	**Neighbourhood connector A** (Median)	50/50	7000	24.4 **	2 x 7.1 including parking, on-street bike lane, median plus shared path on one verge.
	A two-lane undivided street for lower volume neighbourhood connectors. Typically can accommodate buses, will have at least one shared path and above 3000 vehicles per day separate on-street bike lane.	**Neighbourhood connector B** (Minor)	50/50	3000	19.4	11.2 including parking, plus shared path on one verge.
Access streets Access streets are to accommodate shared pedestrian, bike and vehicular movements. The requirements of adjacent land uses should be supported through street design.	Varied formats to suit a range of typical conditions in predominantly residential areas at different densities, and with different traffic volumes. An avenue access street (Access street A) with median is particularly suited to incorporation of a drainage swale. Access street B is a wider undivided street for situations with increased parking and/or traffic demand. The most typical and most common residential street will be Access street C – Yield street. Access street D is for short, low volume and low parking demand streets. In addition, a comprehensively designed variant with 3.5 m travel lane with indented parking, is also specified for very low volume short streets.	**Access street A** – avenue	50/40	3000	20-24	2 x 3.5 (or 2 x 3.6 under some conditions) plus indented parking.
		Access street B – wider street	50/40	3000	16.5-18	9.7
		Access street C – yield or give way street	50/40	3000	15.4-16	7.2 (7-7.5)
		Access street D – narrow yield or give way street	50/30	1000	14.2	5.5-6
			50/20	150	14.2	3.5 (plus parking indents)
Laneways Provide access to the side or rear of lots principally for access to garages.	Laneways may incorporate some services and can provide rubbish collection access. Laneways usually contain some studio units over garages for surveillance. Lane may be widened in parts to create mews courts.	**Laneway/rear lane**	15	300	6** - 6.4	6** typical 3-6.4 (range)

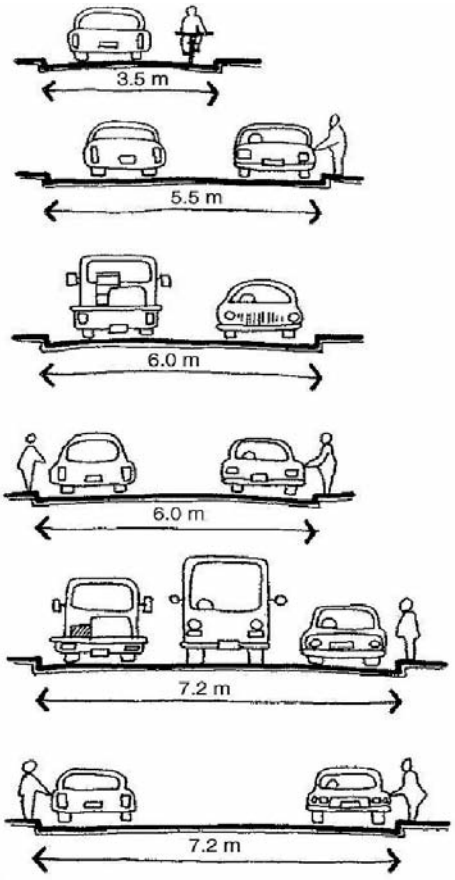
Table 4: Function and characteristics of local streets (continued)

Street type and function	Street characteristics	Street name	Max design speed/ target operating speed (km/hr)	Indicative volume range* (vehicles per day)	Indicative street reserve width (metres)+	Indicative road pavement width (metres)
Small town centre street Suited to small secondary streets in centres.	For use in predominantly pedestrian areas in centres, where the street is short and is specifically designed for pedestrian emphasis, and visual containment is required.	**Small town centre street**	50/20	300	10-12	5.5 m

Notes: * Refer to **figures 17 to 23** for cross-sections. In approving applications for subdivision under Liveable Neighbourhoods, the WAPC will specify both reserve and matching road pavement widths and require the construction of footpaths and the planting of shade trees in accordance with the provisions of the policy. Verge widths will often need to be increased if wider shared paths or trunk services are required. Verge widths on access streets abutting parks may usually be reduced from 4.1 m to 1 m on the park side.

* Function of streets needs to be considered as well as traffic volume and parking.

** Lesser reserves and road pavement widths may be applied over limited lengths where performance can be justified, such as at laneway entrances.



A 3.5 m pavement allows a car to pass a cyclist (or pedestrian), but is clearly too narrow for parking without blocking the street.

A 5.5 m pavement allows a car to pass a parked car or a moving car. It also allows a moving car to pass a truck, but is clearly too narrow for cars to park opposite each other without blocking the street. Staggered parking supports the function of the street.

A 6.0 m pavement is wider and also allows a car to pass a parked car or a moving car. Vehicles have to be parked appropriately.

A 7.2 m pavement is wide enough for two vehicles to pass each other while passing a parked car. It is wide enough for a moving car to pass between two parked cars, but is clearly not wide enough for two moving vehicles to pass at once. Pavements will need to be widened to 7.4 m to accommodate buses.

Figure 11: Diagram of physical determinants for the width of pavements in access streets (figures 19 to 22)

Local streets classification

The local street extends the domestic environment and should be safe for pedestrians (particularly children), cyclists, neighbourly meetings and even social events. Legislation has reduced the legal speed limit to 50 kph unless otherwise signposted. Most residential streets should be designed and detailed to encourage even slower speeds, generally in the 30-40 kph range.

Street trees contribute to a pleasant walking environment, provide shade and accommodate fauna. They are an integral part of the street types in Liveable Neighbourhoods.

Table 4 outlines the function and characteristics of local streets in Liveable Neighbourhoods. There are four types of local streets: Neighbourhood connectors; Access streets; Laneways and Small town centre streets.

Neighbourhood connectors

Neighbourhood connectors link neighbourhoods and towns, are carefully designed to calm traffic and facilitate pedestrian use and have frequent local street connections. The neighbourhood connector should not attract substantial long distance through traffic, but provide for safe and convenient local travel to and from arterial routes, sometimes at signal-controlled intersections.

Neighbourhood connectors spread local traffic loads and reduce intersection loadings, act as bus routes and support the location and viability of neighbourhood centres. Acceptable cross-sections for neighbourhood connectors are shown in **Figures 17 and 18**.

Access streets

The access street is the most common street in residential subdivisions designed under Liveable Neighbourhoods. The environment of the abutting land use dominates, traffic speed and volumes are low, and pedestrian and bike movements are facilitated by the streetscape and traffic behaviour. Vehicle speeds will be constrained by street length, on-street parking intensity, variation in width and alignment of the road, the presence of street trees, and type of road construction.

There are two typical access street pavement widths, 7.2 m and 5.5-6 m where opposing vehicles yield or give way to each other and speeds are constrained by on-street parking (**figure 11**).

In practice, there will be a balance in the use of 6.0 and 7.2 m access streets. The 7.2 m access streets are likely to be the most common street, and be used:

- close to activity centres;
- where there is a demand for on-street parking on both sides of the street;
- where there is a need for existing or future capacity for mixed land uses or higher densities; and
- where the street reservation needs to provide for larger scale street trees.

Further away from centres and activity nodes, where projected traffic volumes are less than 1000 vehicles per day and parking demands are not expected to be high, it may be appropriate to use the narrower access street for relatively short street lengths.

A wide access street (indicative pavement width of 9.7 m) is provided for use in quite dense residential areas (ie those with narrow rear lane lots or apartments on both sides), where parking demand is likely to be high and vehicle volumes are between 1000-3000 vehicles per day.

Another access street is an avenue access street, with median, and is particularly suited to use in valleys and along gentle slopes to incorporate swale drains.

Very low volume short length streets with low parking demand may be detailed as special mews-type shared streets for use by both vehicles and pedestrians.

Acceptable cross-sections for access streets under typical conditions are shown in **figures 19 to 22**.

Special purpose streets

Streets will occasionally be needed for situations that are not included in **tables 3 and 4**. These streets are considered special purpose streets. Where a special street is justified, its reserve width and pavement layout should be individually designed to suit its purpose. An explanation of the purpose and the design features, together with an explanation demonstrating that it satisfies the relevant objectives of Liveable Neighbourhoods should be provided.

Examples of special purpose streets include:

- one-sided streets opposite a rural edge;
- streets with mixed-use or higher densities on one side, where tourist and/or visitor traffic generates high parking demand;

- a main street with high volumes of slow-moving traffic, on-street parking and a high requirement for pedestrian amenity; and
- a main street serving as a primary distributor, for example in regional centres in rural WA.

Special streets may also include a shared space. The shared space is where pedestrians and cyclists have equal rights to access as vehicular traffic. They may be used in particular areas in town centres, or in public courtyard areas in densely developed residential areas, or other special applications. The need for any specific designation under appropriate legislation, such as the *Road Traffic Act 1974* (as amended) and Road Traffic Code 2000, should be investigated prior to application.

Other special streets may be needed where angle parking is provided. This may occur in town and neighbourhood centres, near schools, stations or sports fields. An acceptable cross-section for a small town centre street is shown in **figure 23**.

Laneways

Laneways are generally used when smaller lot layouts justify access to garages at the rear, and where alternative vehicle access is needed (ie for lots fronting major streets or parkland).

The design, layout and detailing of laneways and the strategic siting of buildings to overlook these laneways is an important consideration and is critical for community safety. An acceptable cross-section under is shown in **figure 24**.

Culs-de-sac

The maximum desirable cul-de-sac length is 120 m, serving no more than 20 dwellings. No more than 15 per cent of lots in a neighbourhood on culs-de-sac. Culs-de-sac should be laid out, so that pedestrians and cyclists can have through access, and where possible for longer-term through access for cars. Culs-de-sac should be located so that they do not impede the overall interconnectivity of the pedestrian and vehicle movement system. Culs-de-sac planned as future through roads should be designed on the basis that traffic volumes may rise.

Network connectivity and management

Liveable Neighbourhoods proposes a site-responsive network where traffic volumes and speeds are managed. This should not be interpreted as support for the return to the rigid grids of the past. The local street network should be highly interconnected with frequent junctions wherever possible with arterial routes to limit travel distances and to promote walking, cycling, public transport usage and a strong sense of community. Junction spacings are specified in **table 5**. In centres, parallel streets should be provided one street block back from arterial routes to facilitate local access and to take the pressure off arterial intersections. These parallel streets may be wide with extensive angled parking to serve the centre. They should be designed to make traffic behave appropriately by controlling the speed environment.

Control of vehicle speed in local streets

Liveable Neighbourhoods sets out several design components to contribute to limiting vehicle speeds on local streets, including:

- pavement width appropriate to traffic volume and parking demand, so traffic is impeded and slowed by parked and opposing vehicles, but capacity is not unduly constrained;
- short lengths between street junctions and/or slow points (tight corners, or traffic-calming devices) to encourage speeds of 30 to 40 km/h or less;
- visually and physically tight intersections (small kerb radii);
- promotion of short or local trips; and
- trees near roads or parking lanes, and different colouring of parking/cycle lanes to visually narrow the road.

Intersection controls

Intersection design for vehicle and pedestrian safety needs to take account of traffic volumes and type of vehicles, likely traffic speeds and turning movements, topography and the need for the junction to act as a slow point in one or more directions.

Solutions may range from simple stop signs, narrowed throats and raised pavements, mini roundabouts, or occasionally more complex traffic management devices.

Arterial routes will have signalised intersections, and these may be relatively closely spaced, especially in locations such as neighbourhood and town centres to provide pedestrian safety and convenience. Medians allow staged pedestrian crossing of the arterial routes.

Traffic signals have significant capital and recurrent costs, but can be a cheaper alternative to pedestrian underpasses. MRWA is responsible for all traffic signals and allocates priority for their installation. The WAPC considers that the full cost associated with the advancement in priority for signals should be borne by the developer (refer to Development Control Policy 1.7 General Road Planning and WAPC Planning Bulletin 18 Developer Contributions for Infrastructure).

The WAPC considers that the use of roundabouts on arterials should be minimised, as they are less conducive to pedestrians and cyclists, as well as providing fewer breaks in flow to support vehicle access into and out of side streets. Roundabouts may be considered on arterials where pedestrian and cyclist volume are very low, or as an interim treatment before a dual carriageway is constructed.

Proposals that contemplate intersection control using traffic signals should be discussed with MRWA at an early stage.

Pedestrian movement network

In conventional development, walking has been made difficult for many journeys because of the disconnected street system, lack of footpaths, unsafe routes and long distances to most destinations. To encourage people to walk, a place must have high pedestrian amenity and efficiency, be stimulating, legible and safe for pedestrians.

Liveable Neighbourhoods recognises the complexity of daily movement patterns and the need to make pedestrian trips as short and pleasant as possible. The primary pedestrian network is the street system, which is detailed to support pedestrian movement.

Footpaths should ideally be provided on both sides of all streets. For cost reasons, footpaths may be omitted from one side of lower order access streets, unless the street forms an important pedestrian link (eg to a school, centre or station).

Pedestrian interest, safety and efficiency

A relatively continuous building frontage can create interest for pedestrians and provide casual surveillance or assist security.

Footpaths should have ramps at all kerb corners for wheelchairs and pram access and cater for people with disabilities. Street lighting that adequately lights the footpaths should be provided in all streets. Placement of street trees needs to consider affect on lighting. Pedestrian crossing distances in local streets should be limited through kerb extensions and tight turning radii, which ensure vehicular traffic will slow to negotiate the tighter corners.

A standard footpath width of 1.5 m is specified. This enables two pedestrians to pass with comfort, and enables ease of use by people with prams, wheelchairs and other mobility aids. Shared paths of typically 2 - 2.5 m wide are to be provided on specified streets.

Walkable catchment (ped shed) efficiency

The efficiency of a particular street network layout in providing walking access to centres, stations, bus stops or schools can be measured using a walkable catchment, or ped shed, analysis. The technique for calculating walkable catchment areas is included in Appendix 2.

Typically, most people will consider walking up to 400 m (five minutes) to daily activities, or 800 m (10 minutes) to a train station or town centre. A well-connected street network should achieve at least 60 per cent efficiency (meaning 60 per cent of the area in a 400 m radius of the destination can be reached by a 400 m walk along streets).

Safe routes to schools, bus stops and stations

A network of quiet local streets, focused on schools, should be designed to ensure safe use by young pedestrians and cyclists. Secondary and private schools should be located to benefit from good public transport access with safe pedestrian routes between transport stops and schools.

Safe routes to stations and most bus stops require more consideration of surveillance to provide nighttime safety. Main routes to stations should be fronted by a

mix of housing and uses that are open at night (eg delicatessens, gyms, recreation centres), with minimal gaps in surveillance. Bus stops and their approaches should be in view of adjacent land uses and provided with adequate lighting. Streets used to access the stops should be fronted by development and have minimal breaks in surveillance. Where pedestrian access streets or paths cross linear parks, these parks may need to be narrowed to around 30-50 m in width to ensure they provide a safe night-time walking environment. Further detail is available in the WAPC Designing Out Crime Planning Guidelines.

Cyclist movement network

Good cycling conditions and encouragement of cycling should be designed into the urban fabric. This includes such measures as; bike parking facilities, slower vehicle speeds and low traffic volumes, appropriate lane widths along local streets to allow cyclists to share travel lanes with cars, marked cycle lanes on busy streets and shared paths and routes parallel to arterials with less traffic.

Bicycle arterial routes should be identified to efficiently serve key destinations such as schools, centres sports areas and stations. These may predominantly comprise on-street cycling on local streets, where detailed street design has provided safe and comfortable conditions for heavier cycle use. On bicycle arterial routes, bicycle head-start treatments may be required at signals.

Shared paths and dedicated bike paths

Much cycling for daily activities will be on streets. On busier streets close to schools, wider footpaths designed for use by pedestrians, cyclists, and other small wheeled-vehicle users are appropriate.

Long distance commuter cycling and recreational cycling may justify specially designed shared paths or cycle-only paths, usually in accordance with a regional structure plan, and relevant design and construction standards.

Movement network for users with disabilities

Access to and ease of use of the movement network for users with disabilities is an important emphasis of Liveable Neighbourhoods. The needs of disabled users must be considered during design. Liveable Neighbourhoods provides for these users in several ways:

- journeys can be carried out on the street network rather than through a separate open space network which is often poorly maintained and lacking surveillance;
- footpaths are required for most streets, often on both sides of the street, making journeys simpler and safer;
- footpath widths standardised at 1.5 m minimum, and kerb ramp design suited to people with disabilities in accord with Main Roads WA design details;
- access to public transport is easier, more direct and closer; and
- public transport should be more efficient and therefore more frequent.

The requirements of the *Disability Discrimination Act 1992* must be followed. The local government should also be consulted with respect to any disability service plan.

Public transport

Designing new areas to facilitate a much higher quality of public transport provision is a key focus of Liveable Neighbourhoods. Planning for the public transport mode and routes should be undertaken at the regional and district structure plan level. At these levels, the density, mix and distribution of land uses are also established. Detailed design to support use of the public transport service is achieved in the local structure plans and subdivision process. This includes the street network and layout, street design, detailed design of centres, and lot layout.

The WAPC's Development Control Policy 1.6 Planning to Support Transit Use and transit Oriented Development and Out Crime Planning Guidelines are also relevant.

Bus routes and stops

Bus routes are generally to be located on integrators and neighbourhood connectors, which should provide a direct and convenient route through a neighbourhood. Consultation with the Public Transport Authority and/or bus operator at an early stage of design is recommended.

The Public Transport Authority (PTA) 2004 Design and Planning Guidelines for Public Transport Infrastructure Manuals are also relevant.

The location of bus stops is also an important issue to consider in the design of neighbourhoods. These need to be located in places with good pedestrian access, have clear site lines from nearby buildings, and located at key destinations. In addition, bus stops need to be located where there are safe pedestrian crossings to and from stops.

Design detailing of bus stops should make them a feature in the local area, such as providing identity (for example, by providing each stop with a name), and providing seats and shelters where necessary.

Design of streets for buses should consider the comfort of passengers, and the efficiency of the route. In neighbourhood connectors and many integrator arterials, buses will normally stop in the roadway, at extended kerbs, rather than in embayments. This ensures that the bus has priority in the traffic, and also enables the bus to provide a periodic traffic-calming function.

Enhanced transit facilities including bus and/or light rail transit-ways

Provision of transit modes may involve alternatives to the current choices of train and on-street bus. This could include bus priority intersections, bus-only lanes and possibly even bus or light rail transit-ways.

Where bus or light rail transit-ways are planned, or may be warranted in future, consideration should be given to providing wide central medians on arterial routes.

Railway routes and station locations

New rail routes and station positions will need to be located in some areas. These routes need to take advantage of topography for under and overpasses, to facilitate interaction between the communities on both sides of the line.

Station location and spacing in urban areas should be reasonably frequent, to encourage pedestrian and cyclist users, and to encourage both short and long journeys. Consultation with the Public Transport Authority, at an early stage of design is recommended.

Railway station precincts

At rail station precincts, the detailed design of street networks and intersections to facilitate pedestrian and cyclist access is critical. In addition, provision needs to be made for appropriate bus and rail interchange. In many cases, bus stops may be provided on-street, rather than in a dedicated bus interchange.

Provision for car parking is also likely to be required at stations. Large commuter car parks can provide a valuable interim use, and should be laid out as future street blocks, to enable later intensification.

The street layout of land in a railway station precinct should be designed to accommodate future long term increases in density. This may involve providing services and street widths to accommodate future densities.

Developer contributions

Developer contributions may be required as provided for in the WAPC's Development Control Policy 1.7 General Road Planning and Planning Bulletin 18 Developer Contributions for Infrastructure (as amended).

Road safety audits

Road safety audits may be required for a range of situations. These may include:

- street network and overall street design assessment at the local structure planning stage;
- main streets and other streets and intersections in town and neighbourhood centres, or in rail station precincts;

- special streets with cross-sections different from those included in **figures 12 to 24**; and
- four-way junctions not meeting the requirements in R60-R63, and possibly for some busier or complex four-way junctions that do meet these criteria.

An audit must make balanced consideration of the safety of all users, not just car safety. The road safety audit team must have expertise in pedestrian, cycle and public transport safety matters.

Clearance to trees in streets

This element provides requirements (**table 7**) for the setback distance to trees from a moving travel lane.

These distances have been specified taking into account a range of factors. The design environment for urban streets is to create an environment of care, and the traffic-calming benefits of street trees relatively close to the pavement is an integral part of this. These clearances are therefore different to those typically specified for rural roads or urban highways and freeways where clear zones are established to cater for errant single vehicles at high speeds. There are some differences between the requirements in Liveable Neighbourhoods and current Main Roads WA policy. These may be addressed on the preparation and release of any WAPC road standards.

Integrator A - major arterial streets

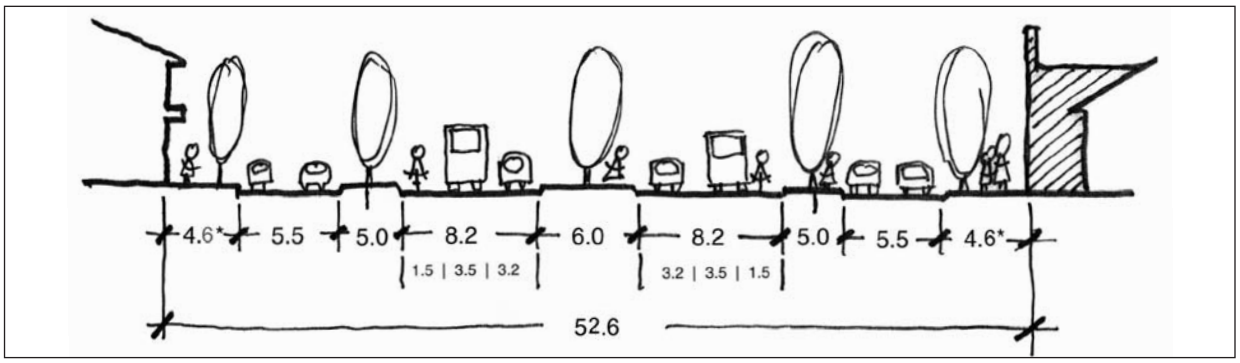


Figure 12: Integrator A – boulevard – 70 km/hr (15-35 000 vehicles per day).

Four lanes with central median, buses, cycle lanes and service roads fronted by development, and wide 2.5 m shared path on both sides.

Note: Where a narrower shared path is required, the verge may be narrowed, typically to 4.1 m and a total reserve width of 51.6 m.

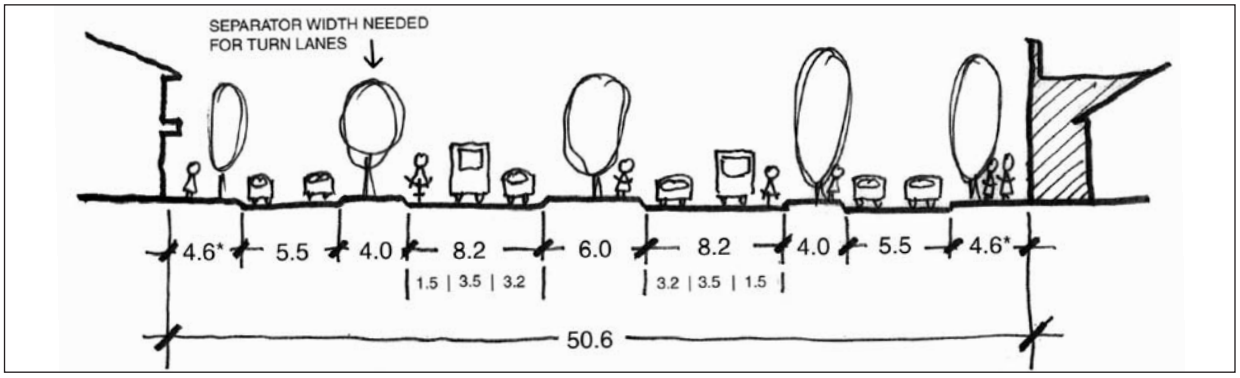


Figure 13: Integrator A – boulevard – 60 km/hr (15-35 000 vehicles per day).

Narrower bus travel lanes and narrower outer separators. Service roads with fronting development. Wide (2.5 m) shared paths on both sides as standard.

Note: Where a narrower shared path is required, the verge may be narrowed, typically to 4.1 m and a total reserve width of 49.6 m. Bus shelters in 4 metre-wide outer separators may need to be longitudinally offset from indented bus bays.

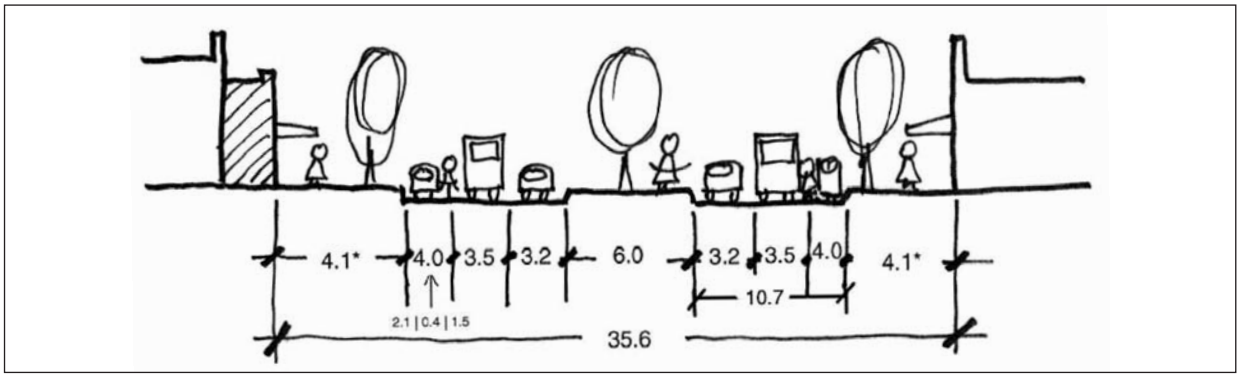


Figure 14: Integrator A – centres – 60 km/hr (up to 25 000 vehicles per day).

Arterial generally for business use in town centres, but not for retail main street. Four lanes, central median with parking and bike lanes, with development at or close to frontage to give visual containment.

Note: Must be of limited length (eg <800 m).

Integrator B - arterial streets

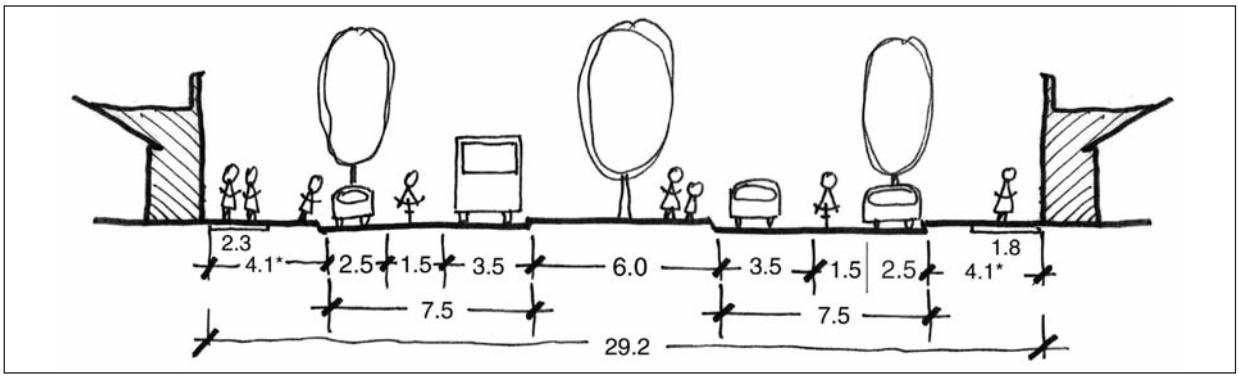


Figure 15: Integrator B – outside centres – 60 km/hr (up to 15 000 vehicles per day - see note 2).

Two lanes, central median, buses, cycle lanes and parking. Development fronting, forward vehicle exiting.

Note:
1. Central median may be reduced along sections where right-hand turn lanes are not required.
2. Traffic volumes up to 20 000 vehicles per day may be acceptable provided that detailed design addresses intersections, parking, access and bus movement (**table 1**).
3. The 6.0 m median is required for staged vehicle crossings and for clearance to trees.
4. The 2.5 m parking bays may be indented into the verge. If parking is indented, then the verge may be increased to 5.5 m minimum including parking, and reserve width may be decreased as a result, to 27 m.

* Where a wider shared path, extensive street furniture or provision for reversing into parking lane is required, the verge width will need to be widened. Typically verges may be up to 4.5 m and total reserve width 30 m.

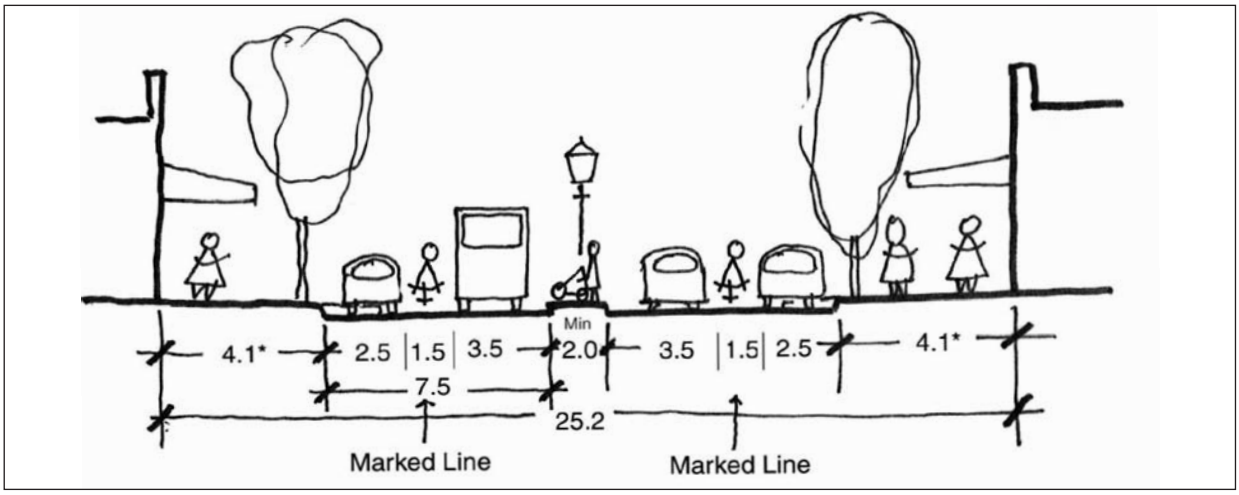


Figure 16: Integrator B – town centre main street – 40-50 km/hr (up to 15 000 vehicles per day).

Town Centre, main street suited to retail both sides, two lanes, small median, buses and parking, cycle lanes. Suitable for streets up to 400 m long in centres. Travel lane widths may be reduced to 3.3 m where street is less than 200 m in length.

Note:
1. Nibs may be placed in parking lane for pedestrian crossings, bus stops and at intersections. These must be a maximum of 2 m wide, to leave adequate space for cyclists.
2. The street is designed and managed to create a low speed differential between vehicles and cyclists; in essence, the street will typically operate at or below 40 km/hr, and preferably have a legal limit of 40 km/hr.

Neighbourhood connector streets

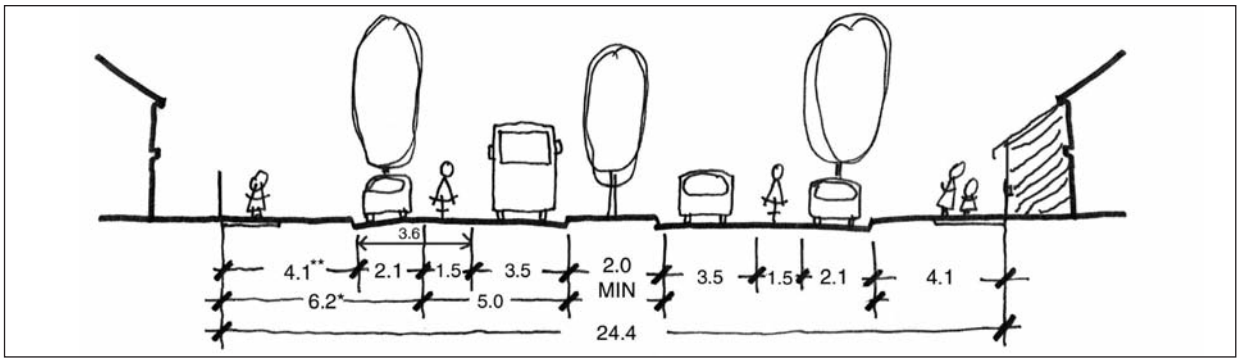


Figure 17: Neighbourhood connector A – 50 km/hr (up to 7000 vehicles per day, with >3000 vehicles per day preferred).

Central median, buses, cycle lanes and parking. Bus stops are normally in travel lane against kerb extensions in parking lane.

Note:
1. * For volumes less than 3000 vehicles per day and the street is not ever likely to be a bus route, the road pavement may be reduced from 5.0 m to 4.0 m with no marked cycle lane, and the total reserve width reduced to 22.4 m.
2. Reversing out from abutting dwellings is acceptable if less than 5000 vehicles per day. For 5000-7000 vehicles per day, protected reversing spaces may be used for larger lots using paired driveway crossovers with ability to reverse into the parking lane.
3. Median will need appropriately located breaks to allow U-turns to frontage-access properties.
4. ** Verge width (including parking) can often be reduced from 6.2 m to 5.5 m with indented parking, to reduce overall reserve width to 23.0 m.
5. For larger trees, central median widths of 2.5-4 m are preferred. For medians with drainage swales, a minimum median width of 6 m is suggested.
6. Where a visually narrower carriageway is needed to assist with speed control, or where parking turnover is high, the parking lane may be widened to 2.3 m and the cycle lane narrowed to 1.2 m.
7. In some circumstances the median may be omitted. On these sections, indented parking should normally be used to assist in visually narrowing the carriageway. If parking is indented, then the reserve width will be 22.4 m.

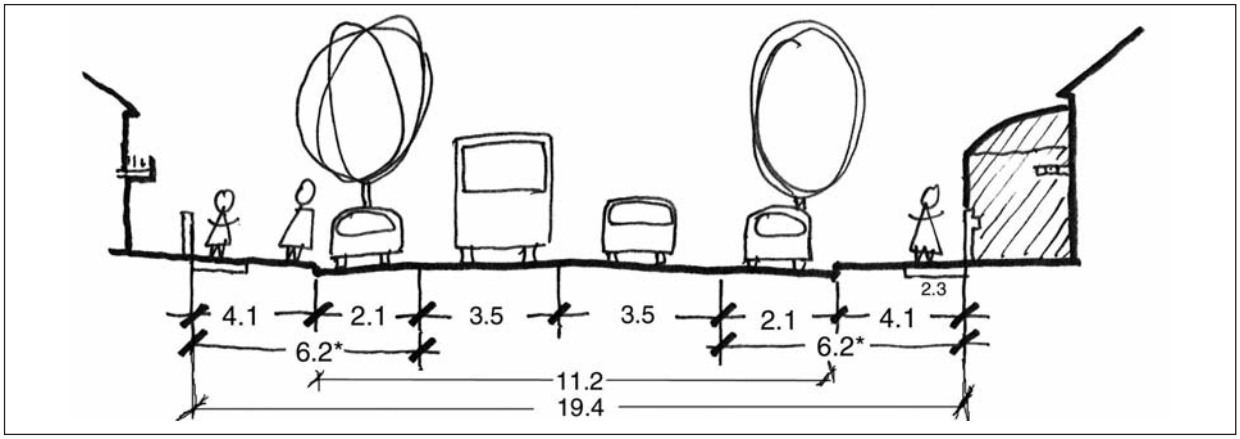


Figure 18: Neighbourhood connector B – 50 km/hr (<3000 vehicles per day).

Lower volume neighbourhood connector, bus route, no cycle lanes, parking. Typically a residential environment with low parking turnover. Detailing of design to visually narrow street (eg including trees in parking lane, painted parking line), together with other speed control mechanisms to limit typical operating speeds to less than 50 km/hr. Bus stops in travel lane against kerb extension in parking lane. A2-2.3 m shared path provided on at least one verge in lieu of on-street cycle lane.

Note: * Verge width (including parking) can often be reduced from 6.2 m to 5.5 m with indented parking, to reduce overall reserve width to 18.0 m.

Access streets

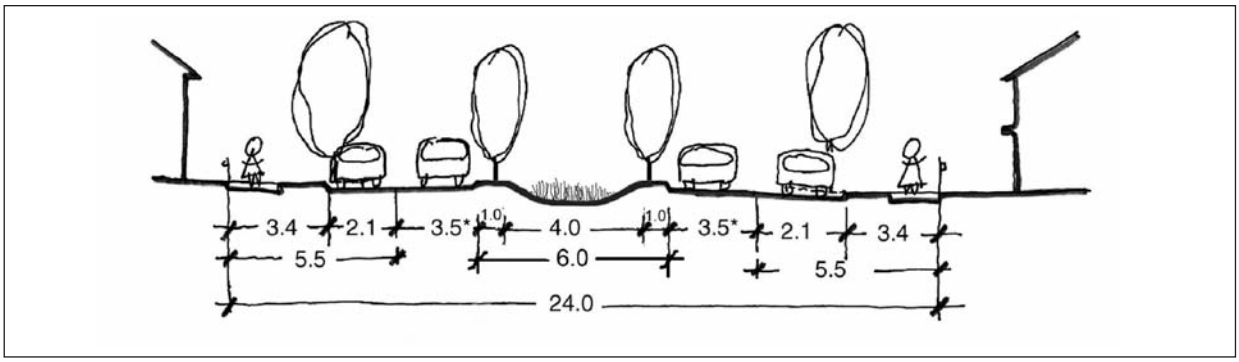


Figure 19: Access street a – avenue – Target speed 40 km/hr (<3000 vehicles per day).

Central median, indented parking, no separate cycle lane, no buses. Suited to 6 m-wide medians containing swale drains.

Note:
1. * Travel lane width must be increased to 3.6 m if barrier kerb used on median.
2. * Where length is greater than 500 m then the travel lane width is to be increased to 3.6 m.
3. Median may be reduced from 6 m to 2.0-2.5 m minimum (and reserve reduced to 20-20.5 m).
4. Reduce verge adjacent to park to 1.0 m when fronting public parkland.
5. Median will need appropriately located breaks to allow U-turns to frontage-access properties.

Services would be under verge and parking lane. Indented parking is used to keep street reserve width manageable.

Where the median contains a drainage swale, cross fall may be directed towards the central median (Element 5 – figure 4).

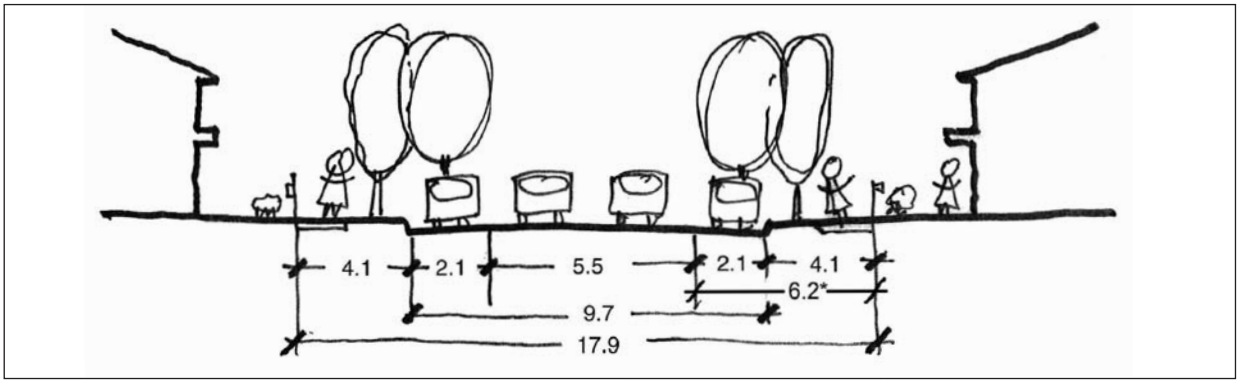


Figure 20: Access street B – wider access street Target speed 40 km/hr (< 3000 vehicles per day).

Wider access street suited to higher density residential areas (typically R30–R40+, or where dwelling density is greater than around 1 per 250 m^2) with higher parking demand. Extensive parking, no bike lane, no buses, trees in verge, with additional trees in parking lane if required.

Note:
1. May reduce verge adjacent to park to 1.0 m when fronting public parkland.
2. Trees may be in verge and/or in parking lane.
3. * Verge and parking lane as shown (6.2 m) can often be reduced to 5.5 m if parking is indented, and total street width reduced to 16.5 m.

Access streets (continued)

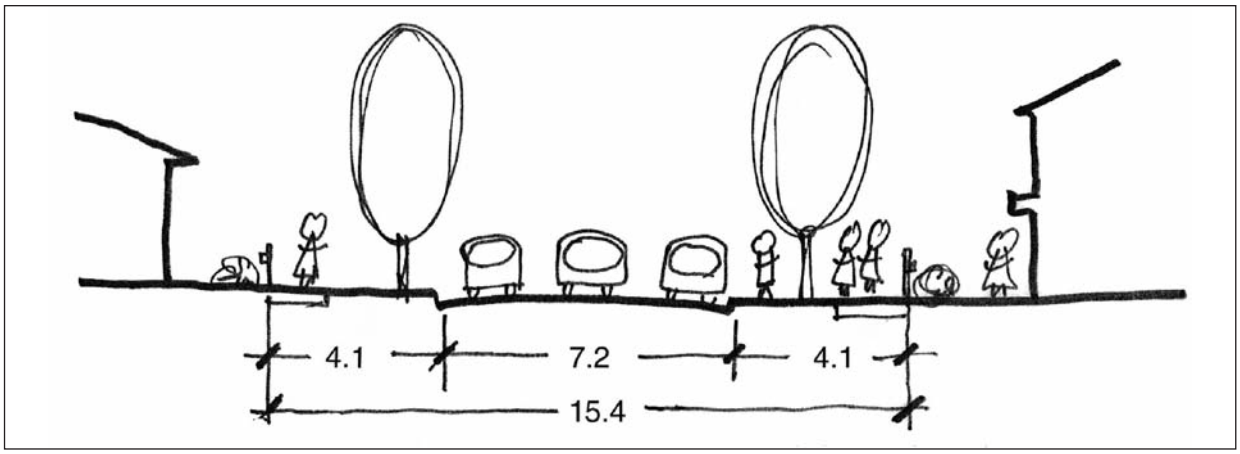


Figure 21: Access street C – yield (or give way) street – Target speed 40 km/hr (< 3000 vehicles per day).

Standard access street or yield (or give way) street. Relatively frequent parking on both sides of street (on the pavement) desirable and needed as part of speed control. No buses, no bike lane. This is likely to be the most common residential street in densities up to and often including R30 - R35 (or a typical lot size down to 250-300 m^2).

Note: May reduce verge adjacent to park to 1.0 m when fronting public parkland.

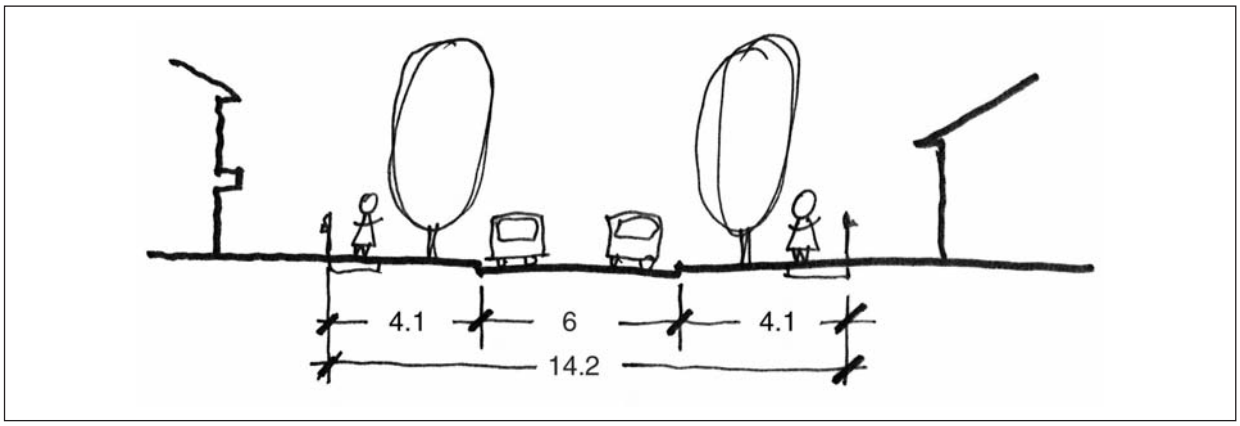


Figure 22: Access street D – narrow yield (or give way) street – Target speed 30 km/hr (< 1000 vehicles per day).

Narrower access street for shorter lengths, low parking demand, serving larger lots. No buses, no bike lanes, no indented parking. Staggered parking on both sides of street as part of speed control, low speed. Not through route, low traffic volume.

Note:
1. May reduce verge adjacent to park to 1.0 m when fronting public parkland.
2. Where the street is short and vehicle volume is less than 150 vehicles per day, pavement may be reconfigured as a slow speed, comprehensively-designed street, with a 3.4 m travel lane and 2.1 m embayed parking spaces. Passing bays are to be provided every 70-80 m, and maximum length 150 m. If a street is comprehensively designed and designated as a shared space for pedestrians and vehicles and target speed is <20 km/hr, no footpath may be required.
3. A pavement width of 5.5 m may be considered, subject to the agreement of the local authority. The reserve should remain at 14.2 m to allow for future flexibility.

Special streets

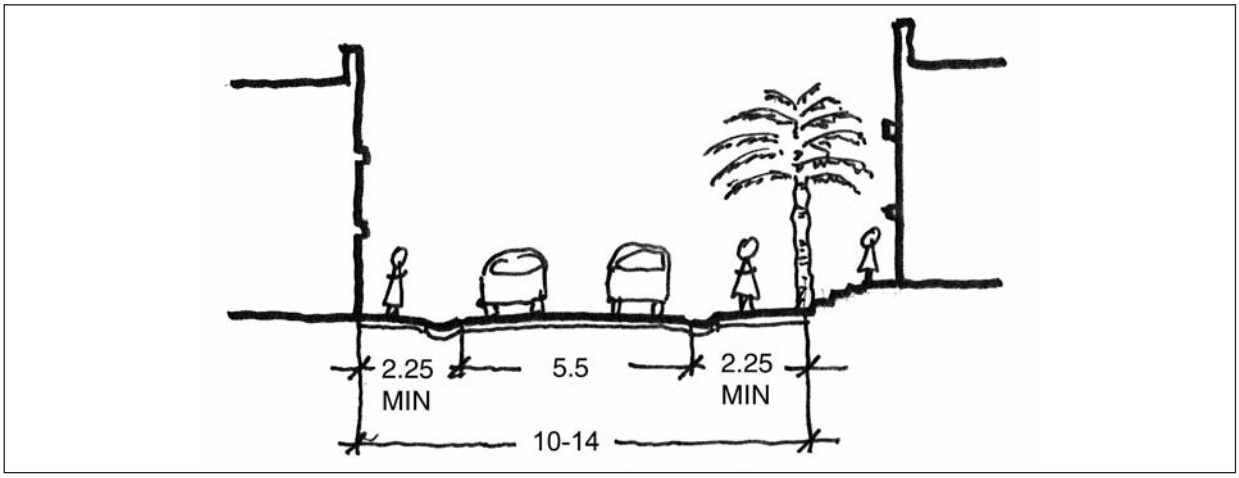


Figure 23: Small town centre street – Target speed 30 km/hr or less (up to 1000 vehicles per day).

Suited to small secondary streets in centres where a visually contained street is required. Shared by cars, pedestrians and cyclists in low speed environment. Short length (less than 150 m), low traffic volume, may have parking on one side of street if one-way, limited or no parking on street if two-way.

Note: Varied street design treatments possible, including decorative paving, flush kerbs and bollards as and where required. Landscape/public art may be designed in conjunction with adjacent development.

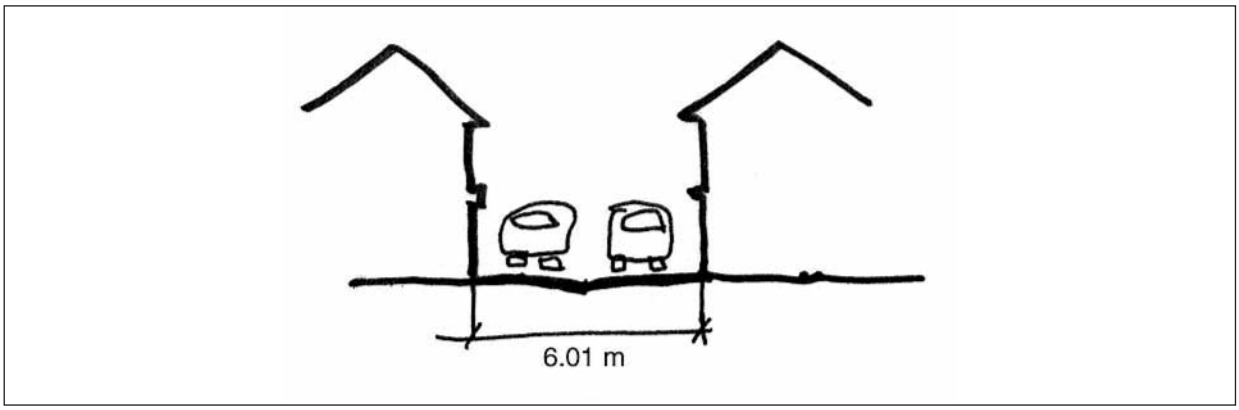


Figure 24: Laneway – for rear vehicle access – Target speed 15 km/hr.

Two-way. Normally no parking. Normally central-invert drainage. Wide enough to allow vehicle access into garages located on the property boundary. Studio units above garages. In some circumstances, studios may have balconies projecting over the lane, provided that they are a minimum of 2.7 m above the pavement. Pavement may be narrowed to 3 m or 5 m at laneway entries. This improves sightlines to footpaths.

Key

1 Integrator A – with service roads
2 Neighbourhood connector A or B
3 Access street A – Avenue
4 Access street B – Wider access street
5 Access street C – Yield (or give way) street
6 Access street D – Narrow yield (or give way) street
7 Rear lane

In most urban extensions, the two most frequently used access streets will be the 7.2 m yield (give way) street (figure 21) and the 5.5-6 m narrow yield (give way) street (figure 22). The key challenge for designers is deciding when to use which street.

The 7.2 m street is typically used in the following circumstances:

- For most streets in an 800 m radius of a town centre or railway station.
- For most streets longer than 150 m in a 400 m radius of a neighbourhood centre.
- For streets with typical lot sizes between 250 m^2 and 500 m^2.
- For most streets longer than 200 m.
- Streets around schools (see Element 8 - schools).

The 5.5-6 m street is typically used in the following circumstances:

- Short streets <150-200 m.
- Streets that do not provide part of longer, relatively direct through links.
- One-sided streets, eg opposite parks or bushland or other non-urban areas.
- Streets with larger lots (eg >500 m^2) and low parking demand.

Figure 24A: Indicative street network plan showing the typical uses of the different local street types.

Objectives

Street movement network

O1 To provide acceptable levels of safety and convenience for all street users in residential areas, while ensuring acceptable levels of amenity and minimising negative affects of through traffic.

O2 To provide a managed network of streets with clear physical distinctions between arterial routes and local streets based on function, legibility, convenience, traffic volume, vehicle speed, public safety and amenity.

O3 To support development that fronts streets wherever possible.

O4 To establish a movement network which provides convenient linkages to activity centres and local facilities either in or adjoining the development.

O5 To provide a movement network which is efficient, affordable, legible, minimises travel time, supports access to public transport and contributes to limiting fossil fuel use.

Public transport

O6 To design all urban areas to facilitate increased use of public transport.

O7 To ensure efficient and convenient public transit routes and to locate transit stops in a street network that facilitates access by pedestrians, cyclists, buses and cars.

O8 To accommodate a comprehensive public transit network that is efficient to operate, comfortable to travel on, and with bus stops that are conveniently and safely accessible by foot from most dwellings.

Cycle movement network

O9 To provide a safe, convenient and legible bike movement network to meet the needs of both experienced and less experienced cyclists, including on-road and off-road routes.

Movement for people with disabilities

O10 To provide a safe, convenient and legible movement network for people with disabilities, including those using wheelchairs and similar aids.

Pedestrian movement network

O11 To provide a safe, convenient and legible movement network for pedestrians, principally along the street network; to provide excellent accessibility between residences and safe and efficient access to points of attraction in and beyond the development.

O12 To design street networks to optimise the walkable access to centres, schools, public transit stops, and other destinations.

O13 To design major routes as integrator arterials with extensive and frequent opportunity for pedestrians to move safely along and across them.

O14 To design and detail new developments to promote and support walking to daily activities.

O15 To provide pedestrian paths through parks for recreation purposes wherever practicable.

Street design

O16 To provide attractive streetscapes which reinforce the functions of a street as important and valuable public places that add value to the amenity of adjacent housing and developments.

O17 To enable roads and verges to perform their designated functions in the street network, recognising, that streetscapes that are too wide encourage higher vehicle speeds.

O18 To provide street geometry which is safe and appropriate to the street function.

O19 To accommodate on-street parking where required, including parking for people with disabilities.

O20 To provide a safe, distinct and pleasant environment for residents and other users.

O21 To provide for stormwater run-off from paved areas in accordance with sustainable urban stormwater management provisions, together with Element 5 - urban stormwater management.

Street construction

O22 To construct roads to carry vehicles at a minimum whole of life cost to the community.

O23 To provide a road edge that is appropriate for the control of vehicle movements, performs any required drainage function, is structurally adequate, is detailed to accommodate pedestrian, cyclist and disabled user requirements and is sensitive to the context in which it is located.

O24 To accommodate public utility services and sustainable water management features.

Requirements

Application requirements

R1 Structure plans and subdivision applications must be accompanied by the relevant information listed in applications under Liveable Neighbourhoods section. A transport or traffic safety and management strategy and/or a road safety and public transport and pedestrian audit (including walkable catchment calculations) may be required, as provided for in the applications section in Liveable Neighbourhoods.

Arterial routes

R2 Arterial routes should be more convenient for long distance traffic than the local street network, and routes should be provided in accordance with **Table 3: Function and characteristics of arterial routes** and **figures 12 to 16**.

R3 Street networks should be designed to optimise the use of arterials by ensuring they can operate at high volume/capacity ratios at peak times.

R4 Development should front arterial roads wherever possible. Service roads should generally be provided to enable development to front. If street frontage is not provided, alternative means of accommodating fronting development with appropriate vehicle access should be used.

Local streets

R5 Local streets should be laid out to support short trips for local traffic moving in and between neighbourhoods and to spread traffic to keep volumes low. Local streets should be provided in accordance with **Table 4: Function and characteristics of local streets** and **figures 17 to 23** wherever practical. The WAPC may consider variations from these indicative cross-sections where alternative cross-sections and supporting analysis is provided.

R6 Local streets should be designed to discourage traffic travelling long distances from passing through.

R7 Streets should be designed to enable development to front all streets, including arterials, for most of their length.

R8 Development along integrator B and neighbourhood connector streets with ultimate vehicle volumes over 5000 vehicles per day should be designed either so vehicles entering the street can do so travelling forward, or are provided with alternative forms of vehicle access. Wider lots with paired driveways and protected reversing areas in the parking lane may be used on streets with up to 7000 vehicles per day.

R9 Wherever practicable, development should front onto streets along railway lines to provide business and home-based business opportunities, and to provide improved visual amenity.

Laneways

R10 Laneways should be used primarily as follows:

- to provide rear parking access for small lots;
- where lot widths are narrow;
- for medium density housing;
- for retail and/or commercial areas;
- to provide rear access to lots on busy streets;
- for development fronting open space in some circumstances; and
- to provide opportunities to improve amenity on selected streets.

Dimensions should be in accordance with **table 4 and figure 24**, wherever practical.

R11 Laneway design and layout should:

- provide good passive surveillance into, along and through lanes. (Straight lanes and T-lanes are preferred, while H-lanes, dog-leg lanes or tightly curved lanes should be avoided - **figure 18** in Element 3 - lot layout);
- not be longer than 140 m without a mid-lane link (Element 3 - lot layout, R38);
- incorporate independently-occupiable studio units or second storey windows at entries and at strategic locations to provide surveillance, activity and interest along the lane;
- be detailed as rear lane spaces, so as not to be confused with streets; without parking and with no garage setbacks required;
- be detailed to enable easy and safe access into and out of garages, but without using tilt-panel or other doors that open into the lane;

- not create a more direct through-route alternative for vehicles, cycles or pedestrians than the adjoining street network;
- be designed to ensure rear yards of properties can be fenced for security;
- ensure that any rear boundary treatment or tree planting does not create concealed recesses or provide illegal access opportunities into rear yards;
- minimise the use of rear lanes for metered services and other facilities requiring recesses;
- provide public lighting, but located so that poles are outside reversing vehicle paths;
- provide lighting, and adequate sightlines for both pedestrians and cars at junctions without excessive truncations on adjoining properties; and
- provide for utility services in accordance with Element 6 - utilities, R10 and R11.

Street network

R12 The street network should facilitate walking, cycling and use of public transport for access to daily activities, and enable relatively direct local vehicle trips in and between neighbourhoods and to local activity points.

R13 The street network should be site-responsive, and highly interconnected. Neighbourhood permeability should be provided by using street block lengths of not more than 240 m, and predominantly around 150-180 m in length. Street block length should generally be shorter closer to town and neighbourhood centres. The choice of movement direction and possible routes should be maximised, with streets and footpaths designed consistent with the principles detailed in the WAPC Designing Out Crime Planning Guidelines.

R14 A local street should be provided parallel to arterials particularly where arterials pass through town centres. Arterials may be widened to provide high capacity for on-street parking to serve the centre and should be designed to restrict vehicular speeds to a level appropriate for a town centre.

Schools

R15 A network of local streets should be identified and detailed to provide safe and efficient pedestrian and bike access to the school.

R16 The street network around schools should be designed to provide safe conditions for school buses, car collection and set down with on-site parking where practical (Element 8 - schools, R21 to R29).

Connections to existing and new urban areas

R17 Street connections to existing areas should be maximised to facilitate interconnection between the new and existing communities. Street connections to existing areas should ensure that the traffic volumes on connected local residential streets are commensurate with the design. Where vehicle access is not practical or presently achievable, pedestrian, bus and cycle access should be provided in a street reserve.

R18 Street connections to adjacent future areas should be provided at spacings of 200 m or closer to enable street connections to be made. The location of these connection points should consider the future overall network requirements of the district.

Intersection spacing

R19 Intersections between local streets and arterial routes and the spacing between intersections should be provided in accordance with **Tables 5 and 5A: Junctions spacing and signalised junction spacing** to reduce overloading on major intersections and to contribute to shortened vehicle trips. Junctions between local streets should be located to achieve a safe and permeable local network.

R20 Traffic signals should be located to balance movement for through traffic with local street access, bus stop access and pedestrian crossing ease. This may be achieved by using signal spacings generally in accord with **Table 5A: Signalised junction spacings**.

Table 5 – Junction spacing (measured from road reserve centreline to centreline of terminating street pavements)

Street type	L/R staggers (to avoid overlapping right turns)	R/L staggers To provide for left-turn deceleration lanes arterials and to avoid corner cutting on local streets	Junctions on same side of street
Local streets			
Laneway	NA	NA	
Access street*	20 m	20 m	20 m
Neighbourhood connector	40 m	40 m	40 m
Arterials			
Integrator B	60 m	40 m	40 m
Integrator A – 60 km/hr**	150 m	110 m	110 m
Integrator A – 70 km/hr**	190 m	130 m	130 m

* Laneways junctions are not to be located closer than 20 m from street intersections. There is no minimum spacing requirement between laneway junctions on local streets. Along integrator B streets, laneways should be offset a minimum of 20 m from each other (unless a median renders them left in/ left out). On integrator A streets, laneway junctions should be located no closer than 30 m from unsignalised intersections and 40 m from signalised intersections.

** Design speed used for integrator arterial street spacing is to be based on speed limit at full build out. Refer to Design speed **table 5B**.

Rationale behind Table 5: Junction spacing

L/R stagger spacings have been determined to suit typical deceleration and right-turn vehicle storage requirements at local street junctions along integrator arterials. Distances are determined from Austroads Guide to Traffic Engineering Part 5: Intersections at Grade, Table 5.6 for a design speed equal to the final posted speed limit (**table 5B**). Where medians are wide enough to allow right turns to overlap, the required storage and deceleration may be provided over a shorter distance.

Spacing for R/L staggers and Left in/Left out junctions on the same side of the integrator arterial have been determined to suit the left-turn lane requirements according to Austroads Part 5 Table 5.6 for a design speed equal to the final posted speed (**table 5B**). It should be noted that right-turn lanes are to be provided as a standard feature at junctions along integrator arterials (except for Integrator B's in some main street or commercial centre circumstances). Left-turn lanes may not be required on some junctions along integrator A's and would not typically be required along integrator B's except where turning demand is high).

Table 5A – Signalised junction spacing

Street type	Minimum signal spacing (typically used in town centres/city centres)	Desirable spacing (value depends on signal cycle length and the need for two-direction signal coordination)
Integrator B	Typically 300 m, but may be reduced to 150 m in larger centres	400-500 m
Integrator A – 60 km/hr operating speed at full build out	350 m	500-750 m
Integrator A – 70 km/hr operating speed at full build out	500 m	750-1000 m

Note: Ideal signal spacing for two-direction signal coordination is calculated according to Distance = CV/2 where C = cycle length in seconds and V = vehicle operating speed in metres per second. Example: D = 667 m for an 80-second signal cycle and 60 km/hr. The distance range indicated allows for acceptable variations on these theoretical values.

The minimum spacings in this table are provided for those urban areas typically resulting from Liveable Neighbourhoods designs, ie where there is a finer street block layout, higher pedestrian demands and traffic access demands are more concentrated.

Correction of figures in table. Element 2: table 5.

Table 5B – Target operating speed and design speed - applications and examples for the use of these different design parameters

Street type/design application	Design parameter
Local street	
Speed control through: Local area traffic management devices, lane and carriageway width, on-street parking, street leg length, road deflections and curvature, landscaping and supplementary speed camera enforcement.	Design speed = Target operating speed (eg 30-40 km/hr desirable operating speed target on access streets) (**table 4**).
Approach sight distance and safe intersection sight distance.	Design speed = 85th percentile operating speed or legal speed limit (whichever is greater).
Integrator A/B	
Approach sight distance and safe intersection sight distance.	Design speed = 85th percentile operating speed or legal speed limit + 10 km/hr at interim stage or full build out (whichever is greater). *
Intersection spacing ** (as determined primarily from deceleration + storage length requirements as set out in Austroads Part 5, Table 5.6). Street cross-section elements (eg lane width).	Design speed = legal speed limit at full build out.

Note: There may be situations for which it can be shown that vehicle operating speeds will be constrained and that sight distances (approach sight distance and safe intersection sight distance) can be reduced below the legal speed limit. Special traffic engineering investigation and reporting is required in these circumstances.

Interim speed limit may be greater than final speed limit and is thus the controlling case.

** Not all intersections may be able to be constructed during the interim stage, as constructed intersection spacings will need to be consistent with interim higher operating speeds.

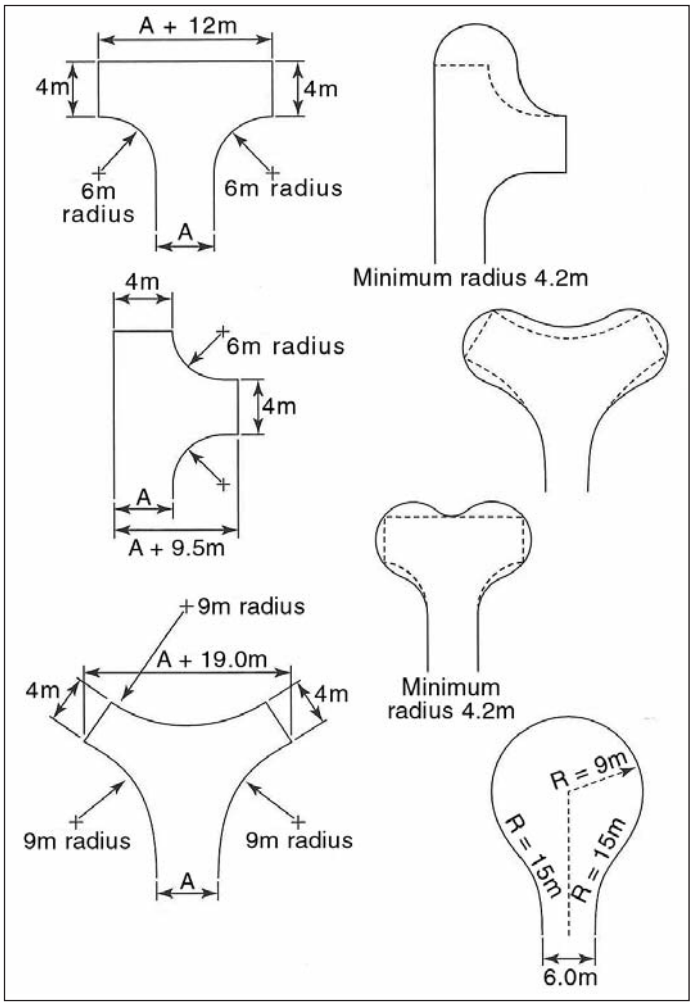


Figure 25: Recommended turning head dimensions.

Source: Guidelines for the Design and Geometric Layout of Residential Roads (Western Australian Planning Commission, June 1998).

Culs-de-sac

R21 No more than 15 per cent of lots in a neighbourhood should be served by culs-de-sac. The maximum cul-de-sac length should be 120 m.

R22 Culs-de-sac should be located in through street reservations with linking paths for pedestrians and cyclists. The possibilities for longer-term connection for through traffic should be incorporated wherever possible.

R23 Cul-de-sac heads should be designed to minimum dimensions but must allow a rubbish truck to make a three-point turn. Recommended dimensions for turning areas are set out in **figure 25**.

Traffic speed

R24 The arterial street network should be designed in accordance with the design speed parameters in **table 5B**.

R25 The local street network should be designed to normally produce the target operating speeds in **table 4**, and in accordance with the design speed for those parameters outlined in **table 5B**.

The street layout, street width, trees and parked cars on the standard street cross-sections in **figures 17 to 22** contribute to achieving target operating speeds. Additional measures to constrain speeds may be introduced, where warranted, generally in accordance with **table 6**.

Slow points should be designed so that they do not create pinch-points for cyclists. Refer to Guidelines for LATM Devices, MRWA, 2003.

Public transport

R26 Bus routes should be located on neighbourhood connectors or integrator arterials to provide highly accessible and relatively direct routes. An efficient bus service may be assisted by:

- locating bus stops conveniently for the walkable catchment served at an average spacing of 300-400 m to balance accessibility with running time;
- locating bus stops adjacent to traffic lights and median islands on busy roads;
- ensuring bus stops and most access routes to them will have some surveillance from surrounding development; and
- ensuring traffic management devices are bus-friendly.

R27 Streets designated as bus routes should have the indicative road widths specified for the street types in **tables 3 and 4**, (or an alternative that is based on supporting information including

Table 6: Street leg length and target operating speed

Street type	Target operating speed	Desirable leg length between slow points
Access street D* (6.0 m road width with parking on pavement)	30 km/h	70-80 m
Access street C* (7.2 m road width with parking on pavement)	40 km/h	100-130 m
Access street A & B (Avenue access street or Wider access street with travel lanes unconstrained by parking.	40 km/h	100-130m

* Additional speed constraint measures may not be needed on an access street C or D up to 200 m in length where the traffic volume is less than 1500 vehicles per day and the street pavement width combined with the adjacent land use will generate periodic parking on the pavement (not just on the verge).

** Slow points may include:
- the applicable street terminating at a T-intersection, or
- a street junction with the priority on the other street, or
- a roundabout, or
- any other local area traffic management device that will constrain speeds to 20 km/hr to 30 km/hr.

Refer to MRWA Guidelines for LATM devices August 2003, Austoads Part 10 LATM revision (when finalised) or PTA Traffic Management and Control Devices (bus routes).

cross-sections, bus frequency or likelihood of constrained bus passing conditions), and should comply with other requirements of the Department for Planning and Infrastructure and the Public Transport Authority.

R28 Streets near railway stations or bus interchanges should be focused towards transit stops to optimise the walkable catchments and have fronting uses which provide a high level of activity and surveillance. Walkable catchment analysis should be provided for train stations, neighbourhood and town centres, and bus stops where these are not located in centres.

R29 Where railway lines cut through or bound a proposed development, sufficient street crossings should be provided to integrate urban development on both sides. This may be achieved by:

- providing grade-separated street crossings typically at around 500 m spacing;
- additional grade-separated pedestrian crossings as required;
- taking advantage of topography to provide grade separations (including low clearance underpasses in residential areas) wherever practicable;
- providing controlled level crossings where the above are topographically impractical or where an over or underpass would be undesirable (eg at stations or in town centres);
- locating stations where efficient street over or underpasses may be provided;
- supplementing vehicle crossings with at-grade pedestrian and/or cycle crossings with electronic ped-gates if desired; and
- depression of lines to contain noise.

Footpaths and shared paths in streets

R30 Arterial roads and neighbourhood connector streets must have footpaths or shared paths on both sides in accordance with **figures 12 to 18**, and constructed to an approved construction standard.

R31 Access streets must have a footpath or shared path on one side in accordance with **figures 19 to 22**. A footpath or shared path may be required on both sides where pedestrian activity is high, (ie where the path forms part of a pedestrian link, near schools, shops or stations).

R32 Footpaths in streets should be 1.5 m minimum wide, and be widened to 2 m minimum in the vicinity of schools, shops and other activity centres. Footpaths 1.5 m wide are offset a minimum of 0.3 m from the property boundary, or are built at 1.8 m wide if abutting the property boundary (**figure 26**). Pram crossings are required at all intersections and should have a maximum grade of 1:10.

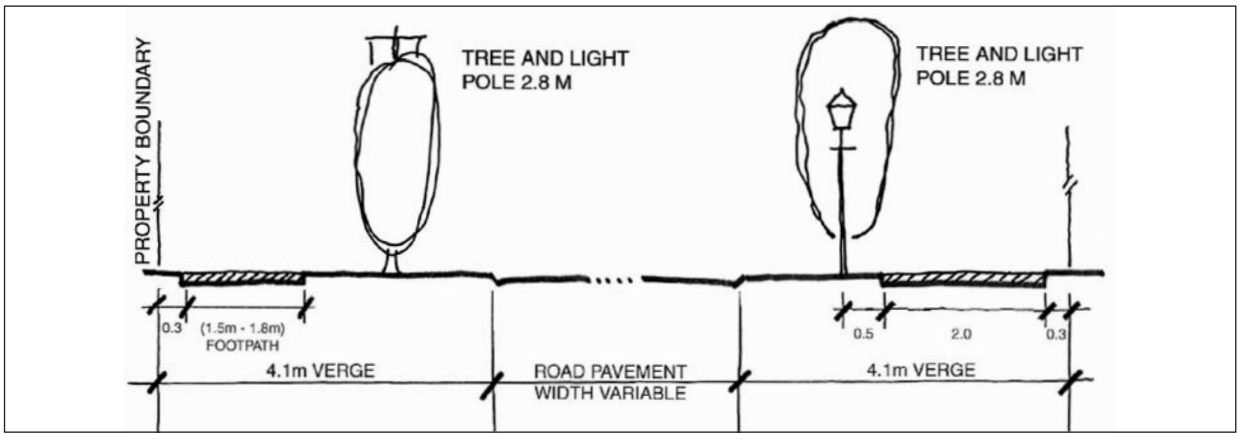


Figure 26: Typical footpath and/or shared path widths and trees, showing their locations in the verge.

Notes:
1. 0.3 m clearance required to property boundary for minimum footpath width of 1.5 m and minimum shared path of 2 m. The footpath or shared path may be paved to the property boundary in addition to minimum width.
2. 0.5 m clearance required between shared path and tree.
3. Setbacks shown to property boundary only. Road pavement may vary.
4. Trees and light poles are typically located 2.8 m from property boundary in the minimum width verge of 4.1 m.

R33 Footpaths should be separated from the street pavement, and usually located against or close to the property boundary. Footpaths may only be located abutting kerbs where site constraints preclude alternative siting, and where vehicle volumes or road design speeds are low. If footpaths abut kerbs, verges may need to be widened to accommodate trees in locations clear of services. Footpaths should be designed and located taking into account pedestrian amenity, sun and shade, street lighting, postal deliveries and likely use patterns. Footpath construction must be continuous across driveways.

R34 Shared space for pedestrians, cyclists and vehicles should be designed and detailed to enable pedestrians and vehicles to share the same pavement, particularly in town and neighbourhood centres, with a sense of equal priority.

R35 Pedestrian crossings of integrator arterials should be provided at-grade wherever practical. Grade-separated pedestrian crossings should only be used where topography can be used to advantage and is overlooked by adjacent development, or at freeways or other high speed distributor roads.

R36 Full height dividing fences must be avoided next to shared paths to improve driver sight lines at driveways.

Walkable catchments

R37 At least 60 per cent of dwellings should be in a safe 400 m walk from a neighbourhood or town centre, or an existing or potential bus stop, or in a safe 600 m walk from a railway station.

Cycling on streets

R38 A safe, convenient and legible bike network should be provided for both experienced and less experienced cyclists. The network may comprise both on-road and off-road routes, planned in accordance with any State plan or local walking trail or bike plan and responding to:

- projected bike travel demand;
- expected vehicular traffic volumes and composition;
- linkages between trip attractors such as schools, local centres and other community facilities; and
- safety, security and convenience for users.

R39 The local street network should provide a permeable network of routes for cyclists to promote on-pavement cycling to daily activities. Abutting cul-de-sac heads should have a foot and bike path connection. A continuous local street system for cyclists parallel to arterial streets to supplement paved shoulders and/or cycle lanes and shared paths along arterials should be provided wherever practical. In residential areas where projected traffic volume is less than 3000 vehicles per day, cycling should generally be on-street, shared with cars (**figure 27**).

R40 Cycle lanes should be provided on streets with projected traffic volumes of more than 3000 vehicles per day and near schools, stations, centres or where long distance commuter cycling and recreational cycling is likely.

Additional shared paths may be also be necessary for cyclist safety along streets with higher traffic volumes. Arterial roads should normally incorporate a cycle lane for on-street cyclists.

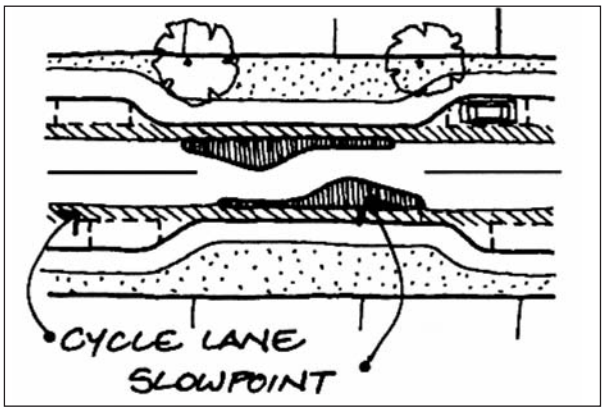


Figure 27: Example of slow point to accommodate cyclists.

Shared paths

R41 Off-street shared paths and bike paths should be designed to take into account the specific requirements of the route (eg of long distance commuter cycling and/or recreational cycling). Paths for the use of pedestrians, wheelchairs or motorised wheelchairs, and cyclists should be constructed in accordance with approved

construction standards, and take into account the safety requirements of all potential users.

R42 Shared paths must be provided with facilities for the separation of pedestrians and cyclists where appropriate (eg meeting points or junctions on high-use activity areas).

R43 Shared path width and design should cater for projected user types and volumes, and to facilitate ease of use by the disabled, aged and the very young. Grade separations can be provided where topography assists or where a direct route is desirable and can be safely achieved.

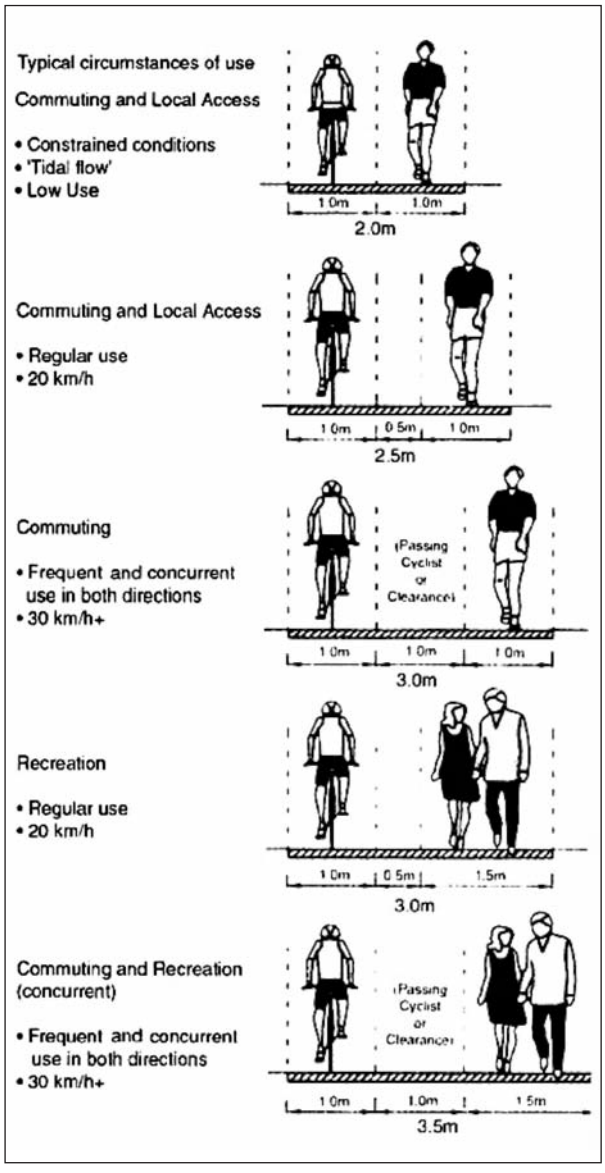


Figure 28: Indicative dimensions for shared paths.

Derived from Austroads Guide to Traffic Engineering Practice, Part 14: Bicycles, Figure 6.6.

R44 Shared paths on neighbourhood connectors or arterial routes providing major access to a school should desirably be 2.5 m wide and designated as a shared path in accordance with Austroads Guide to Traffic Engineering Practice, Part 14: Bicycles. **Figure 28** provides indicative dimensional criteria for shared paths.

Footpath and/or shared path construction

R45 Footpaths and shared paths must have a durable, non-skid surface with tactile ground surface. indicators at bus stops and traffic signals and at other road crossing points in activity centres, near stations and medical centres where there is high pedestrian usage. The path surface should be continuous across driveways.

Streetscape

R46 The design of each street should convey to the user its primary function, character and identity, and encourage appropriate driver behaviour. Street design should respond to landscape features, vegetation and landforms. Large trees should be set back from the edge of the nearest travel lane in accordance with **Table 7 - Tree clear zone for urban streets**.

R47 Street trees that provide a generous canopy at maturity should be planted in most streets (except rear laneways) for pedestrian shade and shelter, streetscape amenity, and traffic management.

Street reserves, road and crossovers

R48 The street reserve and road width must be sufficient to cater for all functions that the street is expected to fulfil, including safe and efficient movement of all users, provision for parking on the majority of streets, buffering residents against traffic nuisance, and provision of public utilities and landscaping. This may normally be satisfied by using the indicative street sections shown in **figures 12 to 24**.

R49 Despite R48, care should be taken to avoid unnecessarily wide streets and verges as this encourages higher traffic speeds, reduces the amenity of the adjoining land, and discourages pedestrian activity.

Table 7: Tree clear zone for urban streets (kerbed conditions)

Street type	Design speed (km/hr)	Frangible tree (trunk <100 mm)	Non frangible tree* (trunk >100 mm)
Integrator A and Integrator B	70	2.5 m	2.75 m
	60	2.0 m	2.5 m
Neighbourhood connectors and 50 km/hr Integrator Bs	50	0.75 m	1.15 m
Access street	50 or less	0.75 m	0.75 m

Notes:
1. Measurements determined to suit typical tree location in the medians and verge. Located to suit spacings of underground services as per **figures 64 and 65 in Element 6 - utilities**.
2. Clear zone dimensions to suit typical median widths and tree species for urban conditions.
3. * Measurements are from edge of vehicle travel lane to the near edge of mature tree trunk. For typical medium-trunk trees of around 500 mm diameter, add 0.25 m to get distance to tree planting line. For large trees of around 1 m diameter, add 0.5 m to get distance to tree planting line.
4. In areas with parking embayments, trees may be placed in kerb nibs and the above clearances do not apply.

R50 Alternative street sections should be used in circumstances requiring a special street. Detailed designs and justification must be submitted.

R51 The combination of road, verge and driveway crossover dimensions must allow unobstructed vehicle access to individual lots. Motorists must be able to enter or reverse from a lot in a single movement. The width of the crossover at the kerb should be:

- not less than 3.8 m in access street B;
- not less than 4.6 m on access streets A, C and D, and neighbourhood connectors with less than 3000 vehicles per day;
- paired driveways with a minimum combined width of 6 m, including minimum of 1.5 m splay on the left-hand driveway in neighbourhood connector streets where vehicle volumes are 5000-7000 vehicles per day and vehicles will be reversing out into the parking lane.

For crossovers onto arterial routes refer to Austroads Guide to Traffic Engineering Practice, Part 5 Intersections.

R52 The road width must allow vehicles to proceed safely at the target speed for that type of street. Minor delays caused by vehicles parking on the road are acceptable.

Verges and medians

R53 Indicative verge and median widths should be at least as set out in **figures 12 to 22**. Increases to allow space for trunk services, larger scale landscaping, retaining walls, wide shared paths or swale drains may be needed. Refer to Element 6 - utilities for underground servicing layouts.

Stopping sight distances

R54 Approach sight distance and intersection sight distances must be based on the design speeds for each street type. The minimum sight distances are to be in accord with Austroads Guide to Traffic Engineering Practice Part 5. Table 5.1 and 5.3 (under urban alerted conditions), and generally as set out in **table 8**, unless topography or site-specific design solutions are proposed to justify a lesser distance, or require a greater distance.

R55 Truncations of 3 m x 3 m should generally be provided on corner lots, except in site-specific circumstances where increased sight lines are required as a result of narrow verges, topography, street alignment or street reserve width. Truncations may be reduced or omitted where it can be demonstrated that a decrease in size or no truncation is warranted.

Truncations of 2 m x 2 m should generally be provided at the intersections of laneways and streets, where a footpath is located close to the property boundary. Alternatively, a narrowed entry to the lane may be used to ensure vehicles have adequate sight distance to footpath users.

Table 8: Minimum stopping sight distances

Design speed (km/h)	Approach sight distance (metres)	Safe intersection sight distance (metres)
40	35	60
50	40	80
60	55	105
70	70	130
80	95	165

Note: Derived from Austroads Guide to Traffic Engineering Practice, Part 5: Intersections at Grade Tables 5.1 and 5.3, and Figure 2.

General geometric criteria

R56 Cross-falls on street pavements should generally fall between two per cent and four per cent with up to seven per cent in limited circumstances. Longitudinal gradient should normally be less than 12 per cent, and should not exceed 15 per cent, except on access streets, which may have grades up to 20 per cent over limited lengths.

Intersections

R57 Kerb radii at intersections should be kept to the minimum, which satisfies the required turning templates. This may normally be satisfied by a 6 m kerb radius at access street to access street junctions and a 9 m kerb radius at neighbourhood connector to access street junctions.

R58 At intersections, turning vehicles must be accommodated using Standards Association of Australia design vehicles and turning templates, to enable turns to be made in a single forward movement as follows:

- for turns between arterial routes and neighbourhood connectors the design articulated vehicle (turning path radius of 12.5 m), without crossing the centreline of the pavement of the street being entered (figure 5.4 in AS2890.2, 2002);
- for turns between arterial routes and access streets the design articulated vehicle (turning path radius of at least 12.5 m), using any part of the access street pavement (figure B5 in AS2890.2, 2002), and the design single unit truck using the correct side of the access street pavement;
- for turns between neighbourhood connector or access street and an access street, the design heavy rigid vehicle (turning path radius 12.5 m), using any part of the pavement (figure 5.3 in AS 2890.2, 2002); and
- for turns between all streets except laneways, the B99 design car (turning path radius 8 m), using the correct side of the pavement only (figure B4 in AS 2890.1, 2002).

For each of these cases, the design vehicle is not to cross the arterial road centreline when turning left into or out of the access street.

R59 On wider streets, pavements should be narrowed by kerb extensions at intersections to keep pedestrian crossing distances to a minimum and control turning vehicle speeds, while allowing for safe passage by cyclists.

R60 On arterial routes and neighbourhood connectors, intersection design and management are either in accordance with the guidelines set out in Austroads Guide to Traffic Engineering Practice Parts 5 and 6 or with the intersection drawings in Main Roads WA Guidelines For LATM Devices, August 2003.

R61 For intersections in town or neighbourhood centres a typical curb radius of between 3 to 4.5 m can be used where:

- high pedestrian volumes are present of reasonably anticipated;
- volumes of turning vehicles are low;
- the width of the receiving intersection approach can accommodate a turning passenger vehicle without encroachment into the opposing lane;
- passenger vehicles constitute the majority of the turning vehicles;
- bicycle and parking lanes create additional space to accommodate the effective turning radius of vehicles;
- low turning speeds are required or desired; and
- occasional encroachment of design single unit truck into an opposing lane is acceptable.

Priority-controlled four-way intersections

R62 In low volume access street to access street junctions, priority-controlled four-way intersections may be used for a limited proportion of intersections in a development. Situations may include where they contribute to a more urban character, or facilitate efficient walkable catchments to centres, stations or schools, or form part of bicycle arterials, or assist legibility, or create or protect vistas, as well as in other site-specific situations.

These intersections may be used where:

- leg lengths on the minor street are less than 160 m, (and contain additional speed control devices provided on any lengths longer than 80 m if required under **table 6**);

- total vehicle volumes through the intersection are less than 2000 vehicles per day;
- safe intersection sight distances are satisfied;
- approach speeds will be low through use of appropriate access street widths in accordance with **figures 19-22**;
- design details indicate the presence of the intersection on all approaches; and
- appropriate stop or give way signs are provided.

Appropriate methods of indicating the presence of the four-way intersection may include one or more of the following design details:

- pavement narrowed in the minor leg;
- threshold treatments located before the intersection in one or both legs;
- special pavement treatments over the whole intersection;
- traffic and/or small splitter islands installed in either or both the major and minor streets;
- running the gutter line of the major street across the minor street to create a gentle dip;
- minor legs meet the major street at an angle that allows buildings to terminate the view down the streets into the intersection; and
- presence of additional signs in splitter islands or on both sides of the minor legs.

Figure 29 provides examples of priority-controlled access street four-way intersections.

R63 Priority-controlled four-way junctions for access street to access street intersections not meeting all the criteria in R63 may occur, providing that the demand for cross-movements on the minor street is low and by using pavement-offsetting treatments of up to 6 m on the minor street, together with a combination of several of the intersection-highlighting treatments listed in R63.

This may involve splaying or offsetting the street reserves up to 6 m. Offsets should ensure that right turns from the major street into the minor street do not overlap, and that through-movement across the major street does not generate corner cutting across opposing lanes (ie use a right/left stagger).

Figure 29A provides an example of a pavement offset access street four-way intersection.

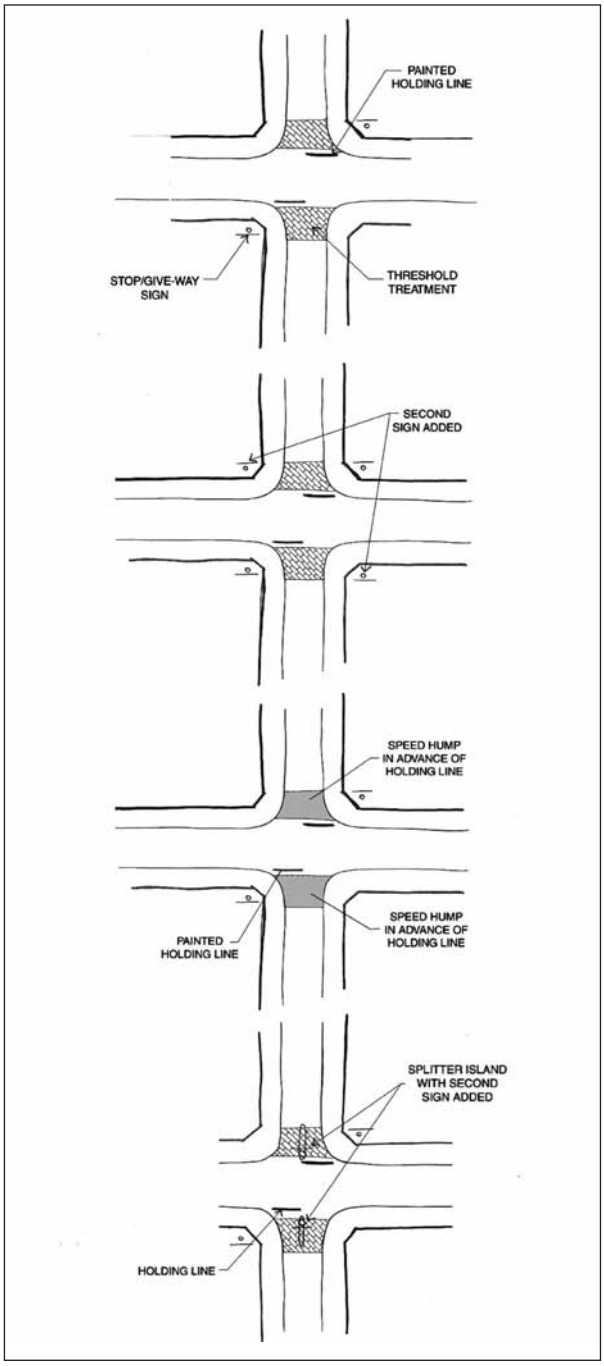


Figure 29: Examples of low volume access street to access street four-way intersection.

R64 Priority-controlled four-way junctions may be used for access streets meeting neighbourhood connectors in the following limited circumstances:

- demand for crossing movements in the access streets is very low;
- total vehicle volumes are less than 4000 vehicles per day, with the combined volume in the minor legs less than 1000 vehicles per day;

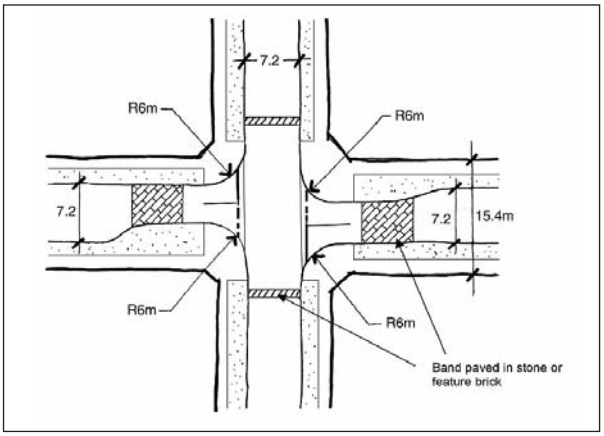
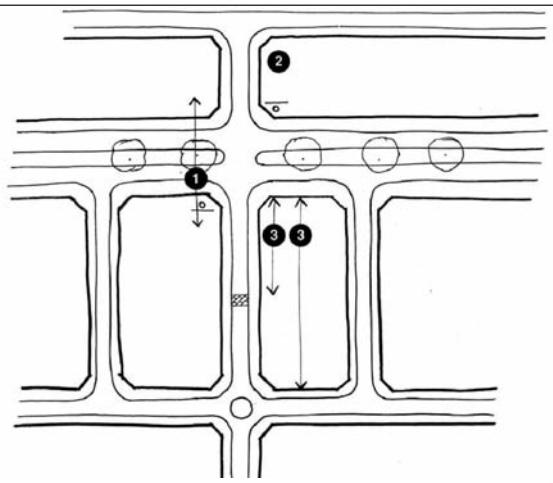


Figure 29A: Access street to access street with-four way and stagger.



Notes:
1. Low crossing demand (partially ensured by T-junction on one side)
2. Leg length <160 m terminating in T-junction.
3. <100 m to a 20 km/hr mid-block slow point or to a local street roundabout.

Figure 30: Access street to neighbourhood connector four-way (illustration of key requirements).

- one of the minor legs is less than 160 m long (**figure 30**) and terminates in a T-junction, and the other has a leg length of less than 100 m to a 20 kph slow point;
- design details indicate the presence of the intersection on the minor legs (R63);
- an appropriate right/left staggered T-treatment (eg **figure 31** for undivided neighbourhood connector B);
- design details indicate the presence of the intersection on the minor legs (see R61); and
- a detailed justification is provided.

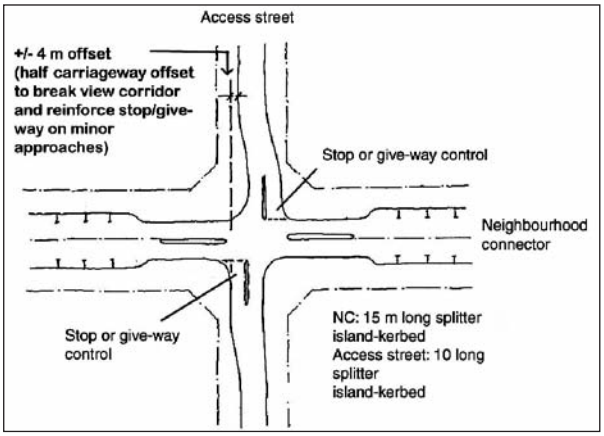


Figure 31: Left-right minor offset four-way on neighbourhood connector (derived from Austroads Guide to traffic engineering, Part 5 Intersections, Figure 5-8).

R65 Priority-controlled four-way junctions may be used for access streets meeting integrator B streets in the following limited circumstances:

- demand for crossing movements in the access streets is very low;
- vehicle volumes on the integrator are less than 10 000 vehicles per day, with the combined volume in the minor legs less than 1000 vehicles per day;
- one of the minor legs is less than 160 m long and terminates in a T-junction, and the other has a leg length of less than 100 m to a 20 kph slow point;
- design details indicate the presence of the intersection on the minor legs (R63);
- the integrator B contains a six-metre median suited to a staged crossing;
- a parallel route to a controlled intersection on the integrator is available so that motorists on the access streets can take alternative routes; and
- a detailed justification is provided.

Roundabouts

R66 Four-way intersections of access streets not designed in accordance with R63 or R64 should be managed with small roundabouts of up to five metre central island radius, in accordance with approved standards (including Main Roads Guidelines For LATM Devices 2003 (Figure 124 Roundabout - Non Bus Route (5 m).

Roundabouts on bus routes should generally be managed with 7 m central island radius and a

6.5 m circulation space and suit the swept path of the specified bus.

Roundabout dimensions may need to be varied to suit different median dimensions, in order to satisfy the required vehicle path deflections. Refer to Austroads Guide to Traffic Engineering Practice, Part 6 as a guide.

Service roads

R67 Integrator arterials should be abutted by service roads. These should be one-way and preferably linked to the arterial, rather than provided by local access loop streets. One-way service roads must be used on arterial segments in close proximity to centres, unless topographic conditions, street junction spacing or other site constraints exist.

Service roads are designed to ensure that vehicle entry and exit is safe given the nature of the traffic movement on the arterial and cross streets. Entry and exit points near integrator B and neighbourhood connector streets are generally in accord with **figure 32** (refer also to Austroads Guide to Traffic Engineering Practice, Intersections, Part 5) subject to site-specific justification.

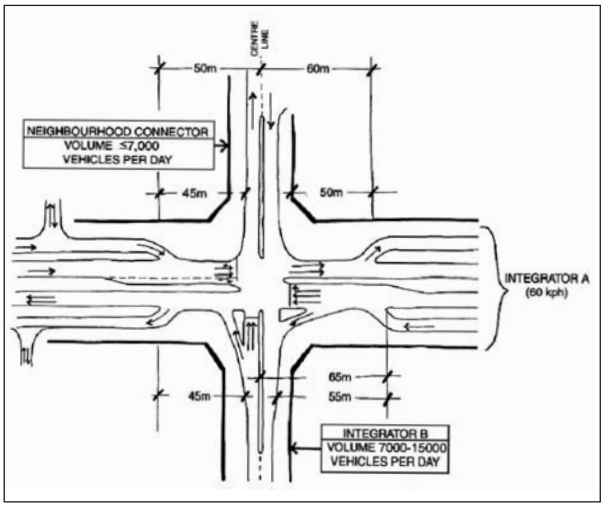


Figure 32: Typical service road entry and/or exit points for intersections with integrator B arterials with volumes <15 000 vehicles per day for neighbourhood connector streets.

Note: Where intersections are with higher volume integrator B arterials or with integrator A arterials, a greater length of left turn lane will normally be required than the 55 m/65 m shown above, and will thus require the service road exit to be further from the intersection.

Bushfire requirements

R68 Streets abutting areas of high bushfire hazard on the long-term urban edge or conservation area should be designed to the requirements of the Fire and Emergency Services Authority and in accordance with the WAPC Bushfire Hazard Guidelines to provide adequate access to fire and other emergency vehicles particularly under conditions of poor visibility.

Road construction

R69 Road pavements must be of design strength not to be damaged by construction or building equipment.

R70 Paved surfaces must be of design quality and durability to ensure the safe and appropriately comfortable passage of vehicles, pedestrians and cyclists, and discharge of stormwater by ensuring that:

- flexible pavement design is based on the ARRB residential street design method (ARRB, 1989) using a 25-year design life;
- concrete pavement design is based on the Cement and Concrete Association of Australia guidelines (CCAA, 1984) or Austroads Pavement Design Guidelines using a minimum 25-year life span; or
- interlocking block pavement design based on the ARRB interlocking block pavement design method (ARRB, 1985), to a minimum 20-year life span; and
- ensuring that rough-surfaced brick or block-type pavements are not used where white-painted stop or give way pavement lines are to be applied.

Insert correct figure. Element 2: figure 32.

Liveable Neighbourhoods

a Western Australian Government sustainable cities initiative

Element 3

Lot layout

Introduction

This element principally outlines requirements for residential lots in a planning context where a mixture of compatible uses is encouraged.

This element has an important relationship with the objectives of the community design element and the movement network element. It is intended that when read together, the three elements create a cohesive framework to guide the design of urban areas.

Key differences from conventional practice

There is a range of requirements that differ from current residential lot layout practice. They include:

- emphasis on greater lot size variety for housing choice and affordability;
- emphasis on the establishment of higher densities;
- provision of lots in appropriate locations for mixing of compatible uses;
- provision for minimum densities to be provided through structure plans;
- permitting a variation to the minimum lot size set out in the Residential Design Codes (2002) thus achieving diversity through detailed area plans;
- emphasis on greater site-responsive lot design;
- lot design for climate-responsive dwellings;
- lot design facilitating development fronting major streets and public open space to support safety and surveillance;
- smaller corner lot truncations are generally permissible;
- allowing detailed area plans to define building envelopes and access requirements for small lots (lots less than 350 m^2 require planning approval);
- lots for business are to be identified; and
- lots with rear lane access to provide opportunities for studio units above garages.

General principles and background to objectives and requirements

Lot layouts for housing diversity and density

The present limited lot diversity in many subdivisions, resulting from use of the Residential Design Codes, may be varied under this element to achieve greater diversity and density.

In new urban areas, the WAPC is guided but not constrained by table 1 of the Residential Design Codes in respect to minimum and average lot sizes. Where any requirements of Liveable Neighbourhoods conflicts with any mandatory specification of the Residential Design Codes, the Residential Design Codes will prevail unless varied by an approved detailed area plan.

The WAPC encourages a mixture of lot sizes distributed throughout neighbourhoods to provide housing choice. A wide range of both lot sizes and housing types is needed to cater for increasingly diverse household types. These may range from those targeted to upper-income households, including conventional larger lots with views, but also well-located higher quality medium density housing, to those at the more affordable end, including smaller lots, duplex lots, and possibly apartments and studio units, sometimes over garages along back lanes.

Medium density housing and small lot development should be made more appealing by being located in high amenity areas such as close to town and neighbourhood centres or overlooking parks. Smaller lots need to predominate near town and neighbourhood centres and public transport stops to support these facilities. Sites intended for multi-dwellings or future small lot development should be identified on structure plans.

Lots for special uses and future residential and/or business intensification

Where a structure plan has been produced, areas for business, employment, home-based businesses, schools and other activities should have been identified. Lots with appropriate dimensions and characteristics need to be provided to facilitate these activities.

Often, mixed commercial and residential development near centres will be proposed, yet only the residential component will be built in the first phase of development. Non-residential lots should be defined,

and longer term detailed area plans specified to facilitate incremental redevelopment. These guidelines should provide for efficient layout and access for rear parking, together with, for example, large front setbacks that would enable a business to be constructed in front of a dwelling later, if residential use is allowed in the interim.

In some urban fringe areas, residential land may be developed on sites near proposed railway stations or town centres well in advance of these facilities. In these areas larger lots could be required to incorporate detailed area plans that facilitate future intensification. For example, a house on a 700 m² lot could be sited and designed to enable future subdivision and an additional dwelling to be built.

Lot design for climate responsive dwellings

Western Australia has five climatic zones (**figure 33**):

- tropical (coastal, generally Broome and further north);
- arid subtropical to warm temperate (coastal, generally Broome to Karratha and inland);
- arid subtropical (coastal, Exmouth and further south and inland, including Kalgoorlie);
- temperate, mainly moderate rainfall (coastal, Esperance and inland); and
- temperate, mainly moderate to heavy rainfall (coastal, mainly south of Geraldton to Albany.

Each zone requires different lot layout and dwelling design responses to maximise the opportunities presented by the characteristics of the climate. While some requirements are provided for the various zones, it is stressed that local governments may wish to develop and refine these concepts.

The use of breezes to cool dwellings is an important response to the climatic conditions in northern Western Australia and may affect lot orientation and length-to-width ratios, as well as contribute to the vernacular architecture and local identity.

In the temperate zone, design to capture winter sun and block summer sun predominates. Lot layout for solar access requires a predominantly north-south or east-west street orientation. The correctly orientated lots should have guidelines specifying appropriate building setback from the northern property boundary to enable good winter sun access to suitably located and sized windows.

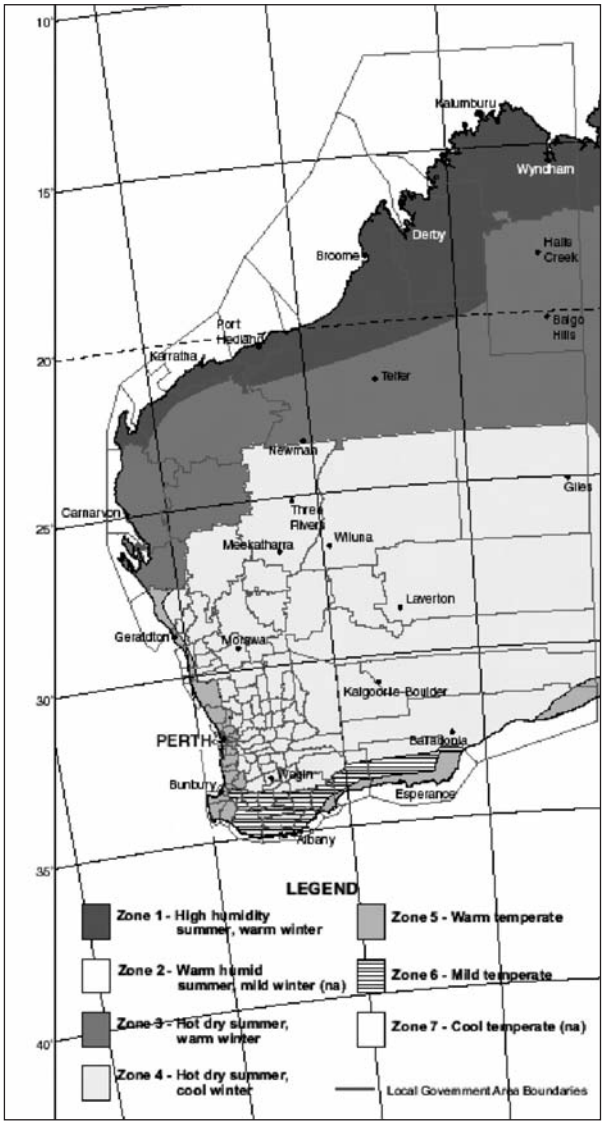


Figure 33: Climatic zones in Western Australia

(Source: ABC Board Energy Efficient Zones map 2002)

Lot layout to front parks and natural areas

Streets, with lots fronting them, should edge the majority of parkland and bushland. This provides higher amenity and greater safety for both the open space users and residents. Where a lot fronts onto a park and/or turns its back to the street, a detailed area plan will be required to address amenity and safety issues both for the park and the street. Where full street frontage is impractical, or where streets on both sides of a linear park are unnecessary, lot layouts can provide development frontage through designs incorporating rear lanes or battle-axe lots, with dwellings to front the park and/or footpath.

Lot layout to front major streets

On major streets careful lot layout is critical to achieving appropriate vehicle access, mixed-use potential, noise management, visitor parking and urban amenity.

Development backing onto major streets has become commonplace in more recently developed suburbs. This solution arose as an initial response to prohibit vehicles from reversing out into heavy traffic.

It is now recognised that there are many economic, environmental and community safety disadvantages of the back fence response to this problem.

New solutions solve the vehicle access and reversing problem by providing alternative vehicle access. It is possible to capitalise on the benefits associated with development fronting all streets other than controlled access highways and freeways. Service roads, car courtyards, on-lot manoeuvres for frontwards exit, rear lanes and battle-axe lots can all provide solutions.

Lot layout and garage locations

Residential lot dimensions should suit efficient garaging and have regard for on-street parking provision.

Lot widths should suit dwellings with garages located behind the dwelling frontage so that garages do not dominate the streetscape.

Some approaches to reduce the impact of garaging are to encourage the use of rear lanes where lots are narrow, and the use of single width garages. These options also increase the quantity of on-street parking as driveway crossovers are reduced.

Corner lot truncations generally not required

In Western Australia, corner blocks have traditionally been splayed or truncated typically 6 m x 6 m, to provide for sightlines. Sightlines are rarely needed to provide adequate safety at stop signs or other slow point controlled junctions. Many poorly-shaped corner lots resulted, and this has been highlighted over the past several years as lots have become reduced in size and the impact of truncations has increased.

A balance is required to allow for ease of pedestrian movements at crossings and safety for street users as well as providing for the necessary services in the street reserve. To appropriately align and position stormwater and other services at intersections, a small truncation is generally needed. This should be minimal to keep vehicle speeds low because the kerb return radii also influences the swept path of vehicles and the speed at which those turns are made.

As a result, Liveable Neighbourhoods provides for corner truncations of 3 m x 3 m as a default in the local street network. Specific situations may require an increase in the default requirement (eg for road geometry where there is an acute angle of intersection between two streets), or a decrease in the default requirement, or no provision (eg in a location of proposed narrow frontage lots where services can still be accommodated).

These situations should normally be handled at the detailed planning and engineering design phase, following conditional approval.

Truncations may also be needed for the intersections of laneways and streets where a footpath is located close to the property boundary. In this circumstance a 2 m x 2 m truncation will be required. Where no path is provided along the property boundary, no laneway truncation will be required.

Layouts to facilitate noise protection

Throughout urban areas, many major roads, some rail lines, and some industries generate high levels of noise which may be detrimental to residential amenity. In conventional development, solutions have often required large setback distances, noise mounds and high solid walls. These solutions have sterilised land and reduced mixed-use development opportunities. It is also now recognised that the residential population is highly varied in its sensitivity to noise. Design solutions exist to enable lots to be provided and developed adjacent to noise-generators. These include providing a continuous wall of business buffer buildings, specially detailed noise-buffering home business or home workspace lots, through to dwelling layouts that locate bedrooms away from noise sources.

Detailed area plans

Achieving better residential design outcomes requires a mechanism to enable lot design to be linked to a future building without the building plan being submitted at subdivision. This is particularly important for small lots where design coordination is required to ensure that buildings work both for the occupier and the streetscape.

The draft model scheme text provisions for structure plans provides for a detailed area plan to be prepared for a particular lot or group of lots and submitted to

council for approval. Once approved, the detailed area plan is used as the basis for subdivision and development.

The WAPC will use currently available mechanisms pending implementation of the model provisions (**figure 51**).

Subdivision

Where design coordination is likely to be required of a subdivision but a detailed area plan has not been approved, the WAPC may approve an application for subdivision subject to a condition requiring the applicant to submit and gain local government approval to a detailed area plan prior to final subdivision approval. Future purchasers will be required to be notified.

Design coordination

Where a local government has not incorporated the model text provisions for structure plans in its town planning scheme, the WAPC, may require alternative design coordination, for example through restrictive covenants for a specified period executed by the owner.

Rear lanes

Lots may be provided with rear lanes to allow for rear access and provide the opportunity for studio units.

Objectives

O1 To provide a range of residential lot sizes to suit the variety of dwelling and household types in Western Australia with area and dimensions that meet user requirements.

O2 To ensure that urban development lots have a suitable level of amenity, services and access.

O3 To facilitate increased densities in existing and future urban areas, particularly around centres and transit nodes and corridors.

O4 To produce lot layouts that accommodate the landform, views, prevailing breezes, and environmental features, and take account of site constraints, but wherever possible optimise orientation to suit energy efficient housing.

O5 To arrange lots to front streets, major streets and parkland such that development enhances personal safety, traffic safety, property safety and security; and contributes to streetscape and park quality.

O6 To facilitate development which uses land and infrastructure efficiently, and which encourages cost savings in housing to benefit the economy and the environment.

O7 To provide for smaller lots and lots capable of supporting higher density development in and around town and neighbourhood centres and public transport stops, and adjacent to higher amenity areas such as parks.

O8 To provide lots in appropriate locations which are suited to business development to reduce travel and provide jobs.

O9 To guide building layout and access on special sites, smaller lots and mixed-use development sites to enable efficient use of sites, and streetscape amenity, parking optimisation, or to enable future intensification.

O10 To provide lots which facilitate safe and efficient vehicle access without street frontages being dominated by garages and parked cars or creating unsafe conditions along arterial routes.

O11 To provide lots which facilitate noise management.

O12 To ensure development on lots served by rear lane access are able to address issues of personal and property safety.

Requirements

Application requirements

R1 Structure plans and subdivision applications must be accompanied by the relevant information listed in the applications section under Liveable Neighbourhoods. Detailed area plans may also be required in particular circumstances.

Density and diversity

R2 A variety of lot sizes and types should be provided to facilitate housing diversity and choice and meet the projected requirements of people with different housing needs (**figure 34**).

R3 To facilitate lot diversity and an urban structure that is pedestrian friendly, street and lot layouts should provide for perimeter street blocks that are generally in the range of 70-120 m deep by 120-240 m long. Laneway blocks should generally be shorter in length (R38).

R4 Smaller lots and lots capable of supporting higher density should be located close to town and neighbourhood centres, public transport and adjacent to high amenity areas such as parks.

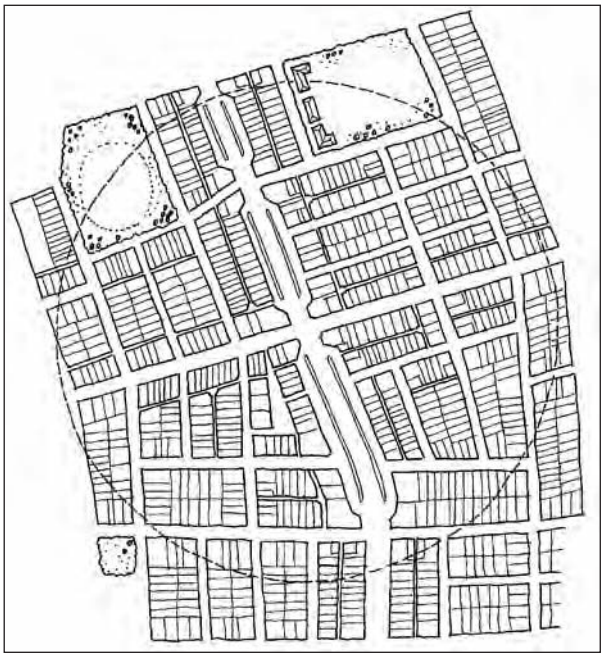
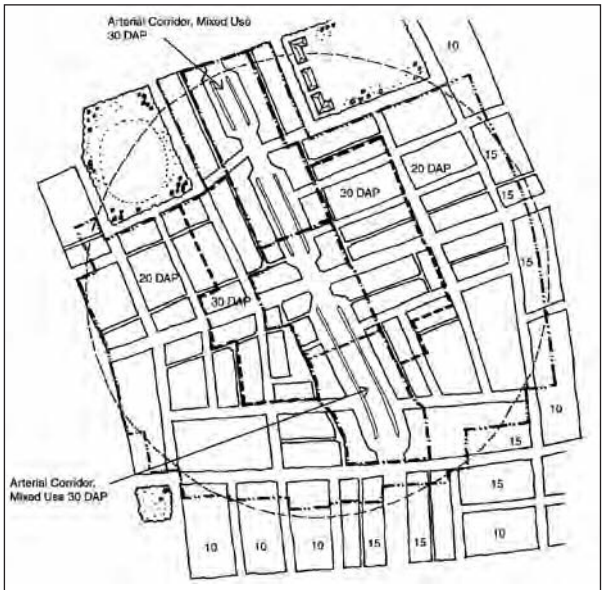


Figure 34: Example of layout which achieves diversity of lots.

R5 Lots intended for re-subdivision and/or development of more than one dwelling should be identified as such on a plan of subdivision. A principal dwelling and ancillary dwelling may be constructed on any lot provided it meets any detailed area plans or R-Code requirements.

R6 The subdivision layout should provide a lot yield that satisfies the minimum target density set in a district, regional or local structure plan. Diversity of lot size is achieved through average density targets (eg 30 dwellings per site hectare) notated on a detailed area plan (**figures 35 and 36**). Density targets may vary depending on the locational requirements of the structure plan including areas in 400 m of a neighbourhood or village centre and 800 m of a railway station or major activity centre.



Neighbourhood centre – detailed area plan: Neighbourhood centre – detailed area plan required.

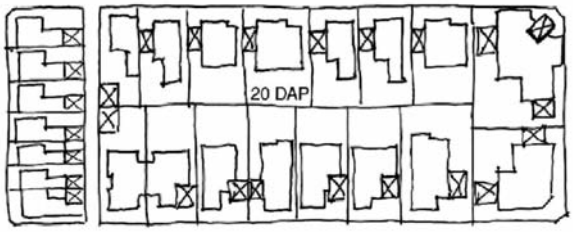
30: Target density of 30 dwellings per site hectare average for all lots in 200 m of neighbourhood centre – detailed area plan required where:

1. lots less than 350 m^2 .
2. Mixed-use and access required.
3. A variation to the Residential Design Codes to achieve the outcome is needed.

15: Target density for street block in 200 m and 400 m of neighbourhood centre 15 dwellings per site hectare average – No detailed area plan required.

Figure 35: Example of structure plan showing density targets to be delivered through the subdivision and detailed area plan process.

The target density is indicative of a density associated with a future activity centre or railway station, and the development substantially precedes these facilities. In this case, a subdivision may be approved provided that incremental intensification of the first stage development to the target density can occur without significant demolition (**Figure 37**).



Subdivision layouts of street blocks must provide the lot yield or target density that satisfies the minimum density set in a district, regional or local structure plan. Diversity is achieved by varying lots sizes through the detailed area plan process (eg 20 dwellings per site hectare with detailed area plan required in particular circumstances).

Figure 36: Density and diversity.

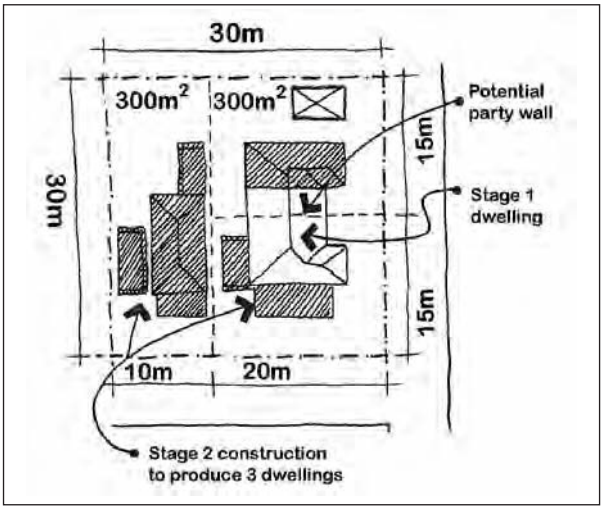


Figure 37: Example of larger lots designed with future residential intensification potential.

Lot size and shape

R7 Lots must have appropriate area and dimensions to enable efficient siting and construction of a dwelling and ancillary outbuildings, provision of private outdoor space, convenient vehicle access to a public road and adequate parking.

R8 An application for subdivision should conform to the relevant provisions of the Residential Design Codes where the Residential Design Codes apply, or provisions of a detailed area plan where a detailed area plan applies.

R9 When an applicant demonstrates to the satisfaction of the WAPC that the market may not support higher densities at the time of subdivision, it may accept a design for larger lots which is accompanied by detailed area plan(s) setting out an overlay plan demonstrating how higher densities can be achieved in the future.

R10 Residential lots should generally be rectangular in shape to accommodate project housing, with preferably a greater depth than width to maximise private space, privacy and amenity together with an economy of street frontage. Where there is an objective to provide north-facing, front-access lots that facilitate better energy efficient dwellings, squarer lots are generally more appropriate.

R11 With lots of less than 350 m^2 in area, the shape of the lot becomes more critical, since the proportion covered by a building tends to increase with reductions in area. Accordingly, the WAPC may require a detailed area plan for irregular shaped lots under 350 m^2 Development near centres and stations.

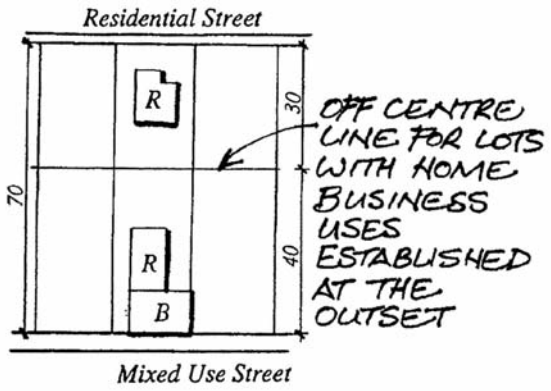
R12 In areas close to town centres, railway stations and major bus stops, lot sizes should be provided which enable sufficient amount of housing to support the facilities and/or public transport service. This may be achieved by:

- providing for residential density of at least 30-40 dwellings per site hectare in 400 m of railway stations, and at least 20-30 dwellings per site hectare from 400 m to 800 m of stations;
- ensuring residential densities of at least 20-30 dwellings per site hectare in 400 m of town centre and with 250 m of major bus stops; and

- provide for a choice and variety of housing product.

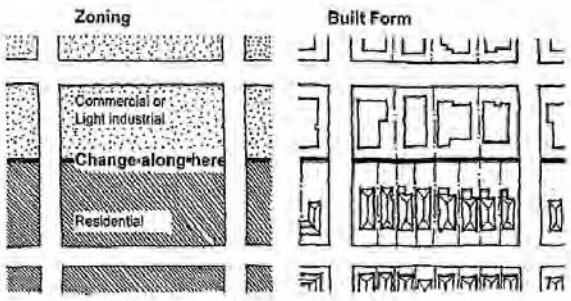
R13 In areas that are being developed in advance of a proposed nearby major urban centre or railway station, lot dimensions and development should be designed to facilitate future intensification. This should be achieved using detailed area plans providing for dwellings to be located to enable re-subdivision adjacent to the existing house for one or more additional dwellings. On smaller lots, dwellings should be capable of being extended in future for a separate dwelling.

R14 Where a town or neighbourhood centre is proposed, appropriate lots for retail, business and community purposes should be provided. These lots should enable building layouts along street frontages with provision being made for both on-street and off-street car parking at the rear or side of the lot. (Element 7 - activity centres and employment) (**figure 38**).



Typical 70 m deep block with off-centre midline creating deeper lots for business use.

Figure 38: Illustration of how to vary lot depth to accommodate mix of uses.



Aim for like or compatible uses to face each other across streets where possible.

Figure 39: Illustration of how to change land use at rear of lots.

Mixed-use development

R15 Lots for non-residential or mixed-use development should be provided in appropriate locations to facilitate business and employment generation, taking into account:

- the need for business and home-based business to locate around town and neighbourhood centres and along arterial routes (**figure 39**);
- opportunities for home-based business workspace, often backing onto or fronting across to industrial development;
- uses and building forms to act as noise buffers to external noise sources such as major roads, railways or industries;
- the capacity of potential mixed-use lots initially developed for housing, to efficiently convert to or add a business use;
- opportunities to allocate highly accessible strategic sites on transport routes to large scale industrial or distribution uses;
- where non-residential land uses are provided, the change of use should occur along the rear boundary line of lots, rather than the street frontage, to provide a compatible use transition (**figure 40**); and

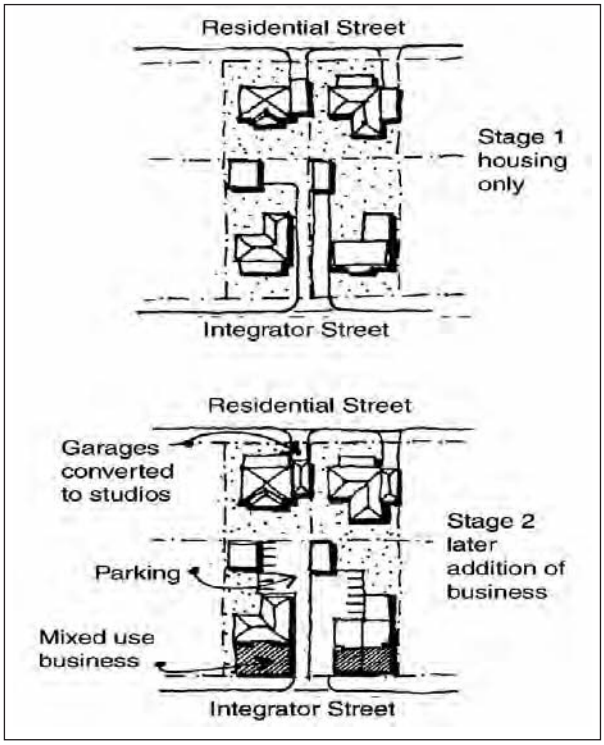


Figure 40: Illustration of lot design, dwelling and parking placement on mixed use lots which enables intensification to business and home business development.

- where land for industrial or similar uses is proposed, the size and dimensions of lots abutting or across streets from residential lots should be appropriate and available for development that provides an effective high amenity transition.

Neighbourhood centres

R16 Lots should be of a size and shape to accommodate small retail and related uses that will make up the local neighbourhood centre. Street reserves should be of sufficient width to enable on-street parking to accommodate as much of the parking requirements for non-residential land uses as is possible.

Subdivision orientation and response to the site

R17 Lots should be shaped and oriented to enable the dwellings built on them to be sited to:

- facilitate climate-responsive and energy-efficient housing;
- protect natural and cultural features;
- acknowledge site constraints including noise, soil erosion, poor drainage, saline or acid sulphate soils and bushfire risk;
- minimise earthworks and retaining walls on sloping sites;
- capitalise on views;
- minimise overlooking and overshadowing; and
- provide space for appropriate planting for microclimate management and energy conservation.

R18 Additionally, subdivisions which create **new streets** and are located **south of latitude 26** are required to meet the following **performance standard**. Lots are shaped and oriented to enable the dwellings built on them to have sunny outdoor space and to achieve passive energy efficiency through minimising the need for heating and cooling. Specifically, lots should enable dwellings to have the main living areas facing north, for solar access and to have shade on the main windows in summer. The following subdivision design approaches are deemed to comply with this requirement.

Portions of subdivisions with single dwelling lots with areas between 400 m² and 2000 m².

- New streets have a north-south and/or an east-west orientation.
- Lots are square to rectangular in shape.
- Dwellings can be located on the southern portion of the lot, with usable open space and solar access on the northern portion.
- Lots on south-facing slopes are wider to allow solar access on the northern face of the dwelling.
- Where dwellings are expected to have two storeys the lots are shaped to allow the standard to be met.

Portions of subdivisions with single dwelling lots with areas below 400 m², subdivisions with attached dwellings and subdivisions with lots for multiple dwellings.

- New streets have a north-south and/or an east-west orientation.
- Lots are square to rectangular in shape.

Portions of subdivision with single dwelling lots with areas greater than 2000 m².

- The design of the new streets responds to solar access, breezes, topography, vegetation, views, soils, heritage and drainage.
- Alternatively, if the WAPC considers that there may be long-term potential for redevelopment or further subdivision into smaller lots, new streets have a north-south and/or an east-west orientation.

Where terrain, boundary or other constraints preclude these subdivision design approaches, the design of the subdivision should still enable dwellings to have sunny outdoor space, to be energy efficient, to have the main living areas facing north and to have shade on the main windows in summer. In these cases subdivision proposals are to be accompanied by detailed area plans showing, for instance, mandatory dwelling footprints, envelopes, dwelling design requirements or other **controls and measures which allow the performance standard to be met**.

This requirement generally has priority in attempts to reconcile competing requirements, including lot and dwelling yield. The WAPC may **relax other standards**, and will encourage a diversity of lot and dwelling sizes and types, if this allows the requirement to be met.

R19 For subdivisions **north of latitude 26**, lots should be shaped and oriented to enable the dwellings built on them to take advantage of micro-climate benefits, particularly cooling breezes, shading and canopy vegetation.

Figure 41: deleted

Figure 42: deleted

Battle-axe lots

R20 The design of battle-axe lots should have regard for the requirements specified in the WAPC's Development Control Policy 2.2 Residential Subdivision.

R21 Battle-axe lots should only be used where they can achieve adequate amenity for residents and neighbours, and enhance community safety, in situations including (**figures 43, 44 and 45**):

- overlooking parkland;
- providing frontage to major streets, where vehicle access is not desirable or possible;
- elevated views;
- providing vehicle access to sloping sites; and
- in very limited circumstances, larger (eg. special residential 3) lots adequate for self-containment of a dwelling and its outlook.

R22 Lots sizes should comply with the Residential Design Codes except where detailed area plans have been approved which provide for such variations, in which case the lot sizes and development standards should comply with the detailed area plan.

R23 Access leg widths for each lot should be a minimum of 4 m. The WAPC may consider further reduction down to 3 m on the advice of local government and servicing authorities. Joint access legs should be a minimum of 3 m each and will be subject to the subdivider entering into an agreement with the local government to ensure that reciprocal rights of access over adjoining battle-axe legs are provided. The reciprocal rights should also allow for a shared turning area where required.

R24 A 3x3 m truncation should be provided at the point where the access leg joins the effective area of the lot, to allow for improved vehicular access into the lot. In addition, a further truncation should be provided at the point where the access leg meets the road reserve in order to improve visibility for vehicles entering or leaving the lot.

R25 When battle-axe lots are developed as a coordinated group of dwellings, truncations and adequate garage separation areas will be required. Where garages/carports are provided abutting/adjacent each other the driveway width should be between 6.4 and 7.0 m to provide sufficient space for vehicle manoeuvring (**figure 45**).

Access to residential lots

R26 Lots having road access to both front and rear boundaries, other than rear lanes are not generally favoured, although exceptions may be made if the proposed lot is specifically designed for multiple or grouped dwellings or the proposal is consistent with the operational and safety requirements of the abutting streets.

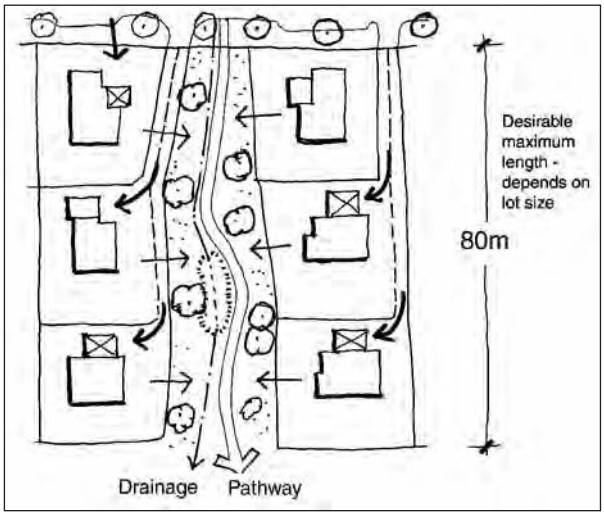


Figure 43: Battle-axe lots incorporating tree retention and water-sensitive urban design; rural model, front and rear loaded.

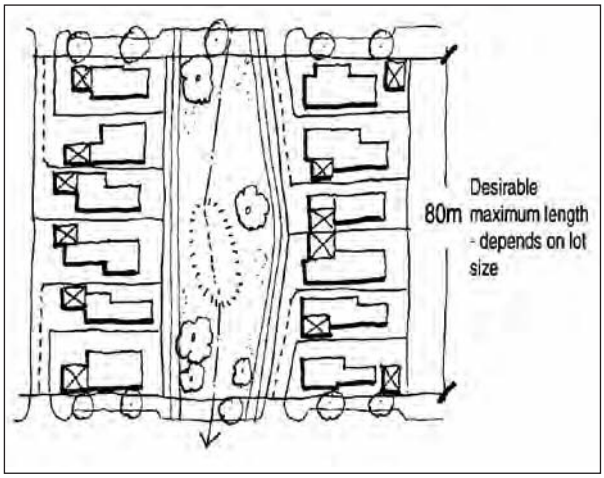


Figure 44: Battle-axe lots incorporating tree retention and water-sensitive urban design; urban model, front and rear loaded.

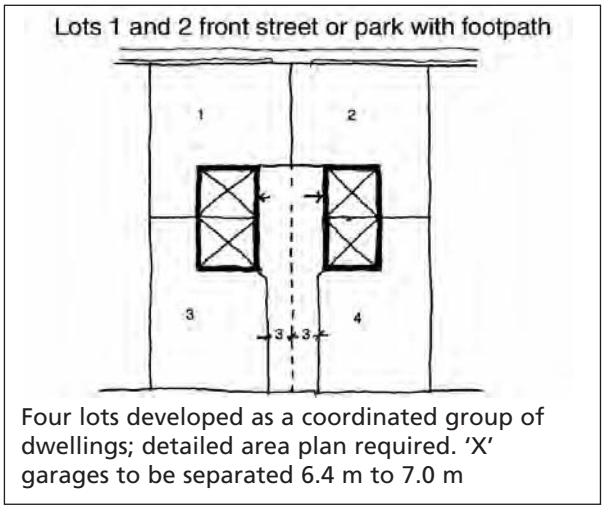
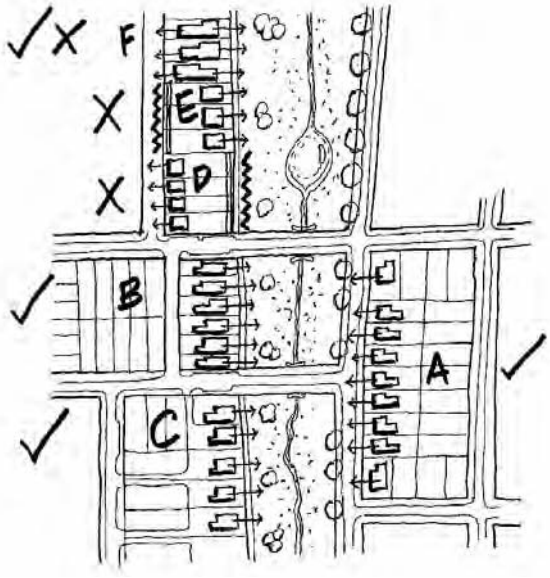


Figure 45: Example of four pack battle-axe lots developed as coordinated group of dwellings; detailed area plans may be required.

Introduction of subdivision orientation policy. In Element 3: amend R17-19, delete figures 41 and 42.



A Lots fronting park across a street; preferred solution.

B Rear lane along end-block with footpath frontage, acceptable where there is a street on opposite side, maximum length 80 m and visitor parking provided on adjoining streets.

C Side or rear access battle-axe lots with footpath, acceptable where there is a street on opposite side.

D Lots backing onto park ,not supported.

E Lots backing onto street, not supported.

F Lots fronting onto both street and park, acceptable only where design of house achieves surveillance of both street and park and adequately provides for private open space, and street frontage is not dominated by garage doors.

Figure 46: Examples of lot and dwelling layouts to front open space.

Frontage to parks and natural areas

R27 Frontage to parks may be achieved by a variety of lot layout solutions. Lots should be orientated to front parkland and natural areas to enhance amenity while contributing to personal and property security and deterrence of crime and vandalism.

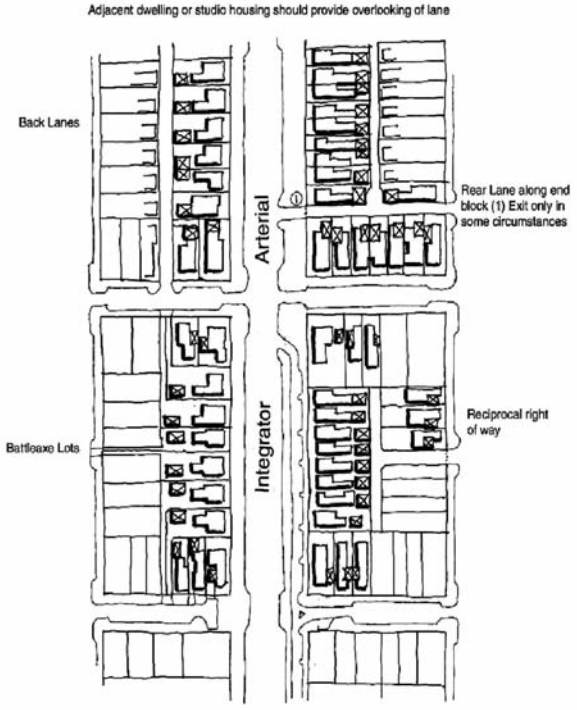
R28 Lots with boundaries that abut parkland should be provided with uniform fencing which addresses appropriate height, character, visual permeability and appropriate relationship to the parkland. Detailed area plans may be required to correctly orientate buildings towards the parkland.

Frontage to streets and arterial routes

R29 Lots should be orientated to front streets and arterial routes to provide good streetscape amenity and surveillance, and to facilitate business and home-based business development.

R30 On streets with vehicle volumes greater than 5000 vehicles per day, lot layout must ensure that vehicle egress will not involve reversing into the street (element 2, R8) (**figure 47**). Appropriate egress may be achieved by a variety of lot layout solutions that still maintain frontage, including:

- using service roads to busier arterial routes;
- using battle-axe lots to provide vehicle access from side or rear streets;
- arranging lots to side onto busier streets, with vehicle access from a side street;
- providing for frontwards exit layouts for garages and driveways for some larger lots fronting neighbourhood connectors through the use of detailed area plans; and



The battleaxe layout is not preferred in urban fringe situations, but may be appropriate for urban infill. Detailed area plans may be required.

Figure 47: Example of lot layout to avoid vehicles reversing into busy streets.

- providing shared driveways to garages at rear, arranged to require frontwards exit through the use of detailed area plans.

Lots along arterial roads

R31 Lots along arterial roads should front those roads, and be provided with service roads, rear lanes or other forms of vehicle access that enable possible future business or home-based business. In general, looped residential streets should not be used as a frontage mechanism except where conditions exclude service roads. Lots backing onto arterial roads and/or the use of solid walls should be avoided.

R32 Lot widths should enable car parking, garaging and driveway access in a manner that does not result in garages or carports dominating the street frontage. This may be achieved by:

- providing rear lanes for garage access where most of the lot widths are less than 10 m;
- using detailed area plans on lots less than 13 m wide to require garages accessed from street frontages to be single width, setback behind dwelling fronts and accessed by a single width kerb crossover; and
- specifying car parking, access locations and building envelopes through detailed area plans to setback garages behind the front of a dwelling with at least 5 m from the street frontage to provide an additional tandem parking space.

Noise-buffering

R33 Subdivision layouts abutting external noise-sources such as arterial routes, railways, or industries should provide lots capable of accommodating:

- non-residential uses which provide a shield to residential uses behind;
- home-business uses with the workplace providing the buffer;
- dwelling layouts which locate the more noise-sensitive rooms away and protect from the noise source;
- other noise mitigating measures;

Detailed area plans for small lots and special site conditions

R34 Detailed area plans should be prepared for:

- lots with an area less than 350 m^2;
- lots where it is important to control vehicle access and egress;
- lots abutting public open space;
- narrow lots that require special conditions to be set;
- lots and streets in the centre of neighbourhoods that have been identified to accommodate a future change of use;
- neighbourhood and town centres;
- steeply sloping land where high retaining walls to streets or boundaries are proposed; and
- addressing noise-buffering requirements.

R35 For smaller lots, detailed area plans and lot dimensions should encourage building to one or both side boundaries, and to front or rear boundaries to the streetscape and site conditions.

Detailed area plans must cover matters listed in **table 9** that are applicable to any of the situations identified in R31. The detailed area plan will be evaluated against criteria in **table 10** and the Residential Design Codes objectives and should include as a minimum the following matters:

- **parking and access:**
  - specify the vehicle access point in a manner that optimises on-street parking; and
  - specify the garage location and size and ensure it is set back a minimum of 5 m behind the frontage of the dwelling.
- **building envelope and windows:**
  - specify the minimum frontage setback and maximum building height, build-to-boundary locations, and other side and rear setbacks (eg relating to solar access, tree protection, easements).
  - private open space and fencing:
  - flexibility for the location of outdoor living areas needs to be maintained to provide individual choice;

1 Straight rear lanes enable passive surveillance down their length along both directions from adjoining streets. A studio is desirably positioned at either lane entrance.

2 'T' rear lanes enable passive surveillance down the full length in both directions along the top of the 'T' and viewing down the stem of the 'T' from one direction. A studio is desirably positioned at the lane intersection.

3 'H' rear lanes enable viewing down the full length of the short legs, but prevent viewing from adjoining streets to the connecting lane, limiting passive surveillance. Not preferred.

4 Dogleg rear lanes enable viewing into the shorter legs along only one direction from adjoining streets, with no viewing into the connecting leg, thereby limiting passive surveillance. Not preferred.

5 Bent rear lanes enable viewing from at least one direction along their length, and safety is improved if a studio is located at the bend for passive surveillance obliquely along both legs of the rear lane.

6 Cruciform rear lanes enable viewing along both lengths of the rear lanes from adjoining streets, plus at least one mandatory studio is located at the intersection of the rear lanes.

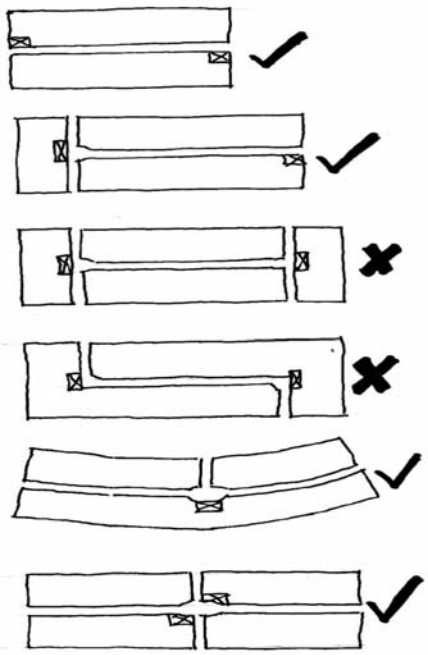


Figure 48: Rear lane types with desirable locations of studio housing, including above garages.

Table 9: Matters for inclusion in detailed area plans.

Building envelope – ground floor and upper floor setbacks, building envelopes, north boundary setback for solar access, nil setbacks.

Parking – location (mandatory or desired), potential additional parking location for duplex-sized lots.

Vehicle Access Point – location of vehicle access point, particularly where laneway access is available.

Fencing – heights, detailing, retaining walls, developer-provided fencing.

Services – easements.

Private open space – location of strategically important outdoor living areas.

Landscaping – location of existing trees to be retained in the street or in lots (as agreed with the local government).

Noise-buffering – location and type of noise-buffering and/or attenuation measures.

Ancillary dwellings and/or studio dwellings, home business or home workspace – potential location and size, parking provision and location.

Encroachments – reciprocal rights-of-way, party walls.

Variations from the Residential Design Codes.

Mechanisms for expiry or variations of detailed area plan(s).

Table 10: Criteria for evaluation of detailed area plans.

- Detailed area plans should result in residential development that satisfies the following matters:
- day lighting, visual and acoustic privacy, occupant and community safety, solar access for amenity and energy efficiency;
- useable private recreational open space;
- amenity protection for existing abutting neighbours from overlooking, overshadowing, noise intrusion or visual bulk adjacent to principal private open space areas;
- streetscape quality and neighbourhood character, including building scale and character, fencing and landscaping, location of garages behind the fronts of dwellings;
- opportunities as identified for future intensification or business development;
- adequate on and off-street car parking, vehicle access, storage and servicing requirements; and
- protection or response to any specific site features.

- where there is a desire to ensure good planning outcomes for active interfaces with public areas (eg outdoor areas overlooking abutting parkland) the detailed area plan should identify locations for outdoor living areas; and
- limit front fence height to a maximum of 1 m if solid, and to 1.5 m if more than 50 per cent transparent.

- **time limits and variations:**
  - consideration should be given to enable the detailed area plan to expire after five years, after which either a new detailed area plan is adopted or the standards required by the Residential Design Codes apply; and
  - detailed area plans should not be varied, except with the written approval of the local government following consultation with abutting owners.

Lots with rear lane access

R36 Lot layout in areas served by rear lanes (Element 2, R10 & R11) should be detailed to ensure that appropriate development occurs to provide personal and property safety in the laneways (**figures 49 and 50**). This may be assisted by:

- identification of lots at both the ends of lanes and at the junctions of lanes where provision for rear studio units are desirable;
- ensuring that these studio units are designed for independent occupation, have good sized windows overlooking the lane, and have an independent entry from the street or lane;
- detailed area plans indicating the desired location and provision for studio housing;
- limiting the length of lanes to less than 140 m, or providing a mid-block lane or pedestrian link if greater than 140 m, desirably with a studio unit overlooking the lane and link;
- encouraging additional studio units to be constructed along the lane;
- ensuring that the lane design minimises the requirement for building or fence setbacks on lots, particularly where these could result in hidden recesses; and
- limiting lane layouts to straight lanes, T-lanes or gently curving lanes that provide good visibility along them and into them from adjoining streets.

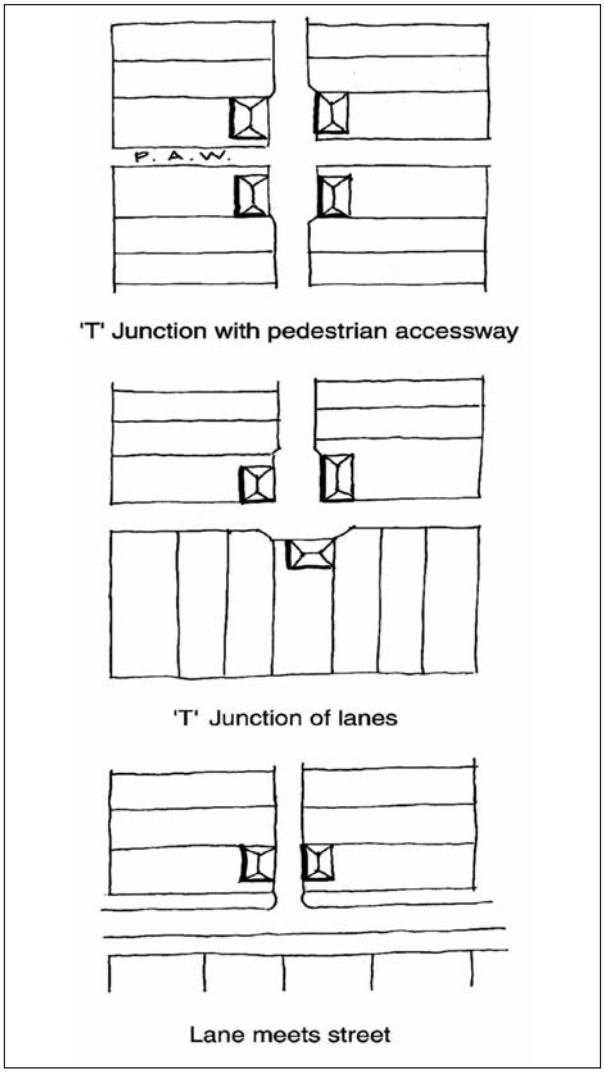


Figure 49: Examples of studio units which may be located at rear lane intersections to provide surveillance.

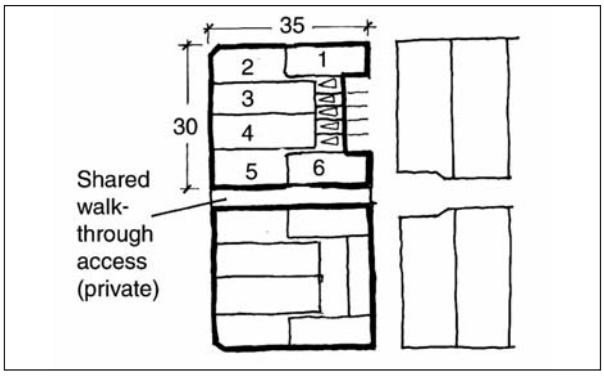
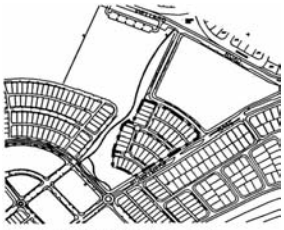


Figure 50: Example of end block corner group development mansion apartments using rear lanes.

DETAILED AREA PLAN Residential Design CODE VARIATIONS

The district town planning scheme and Residential Design Codes are varied in the following manner:

1. the dwellings (including patios and gazebos) must be confined to the building envelopes;
2. the general site area requirements of the Residential Design Codes are varied as shown on the detailed area plan;
3. the performance criteria of the Residential Design Codes and any other requirements of the town planning scheme shall be satisfied in all other matters;
4. the requirements to consult with adjoining or other land owners to achieve a variation of the Residential Design Codes is not required for any development consistent with this detailed area plan;
5. a minimum open space site coverage of 30 per cent is applicable for laneway lots and parkland lots;
6. development shall be designed so that its shadow cast at midday, 21 June, onto any adjoining property does not exceed 40 per cent of the adjoining property's site area;
7. all dwellings are to be constructed with a store area (minimum 4 m^2) under the main roof areas of the residence;
8. sheds and outbuildings that do not match the construction materials and colours of the dwelling are not to be visible from the street or parkland; and
9. second storey construction on parkland lots with an east-west orientation to be limited to the front 65 per cent of the site.



LOCATION PLAN

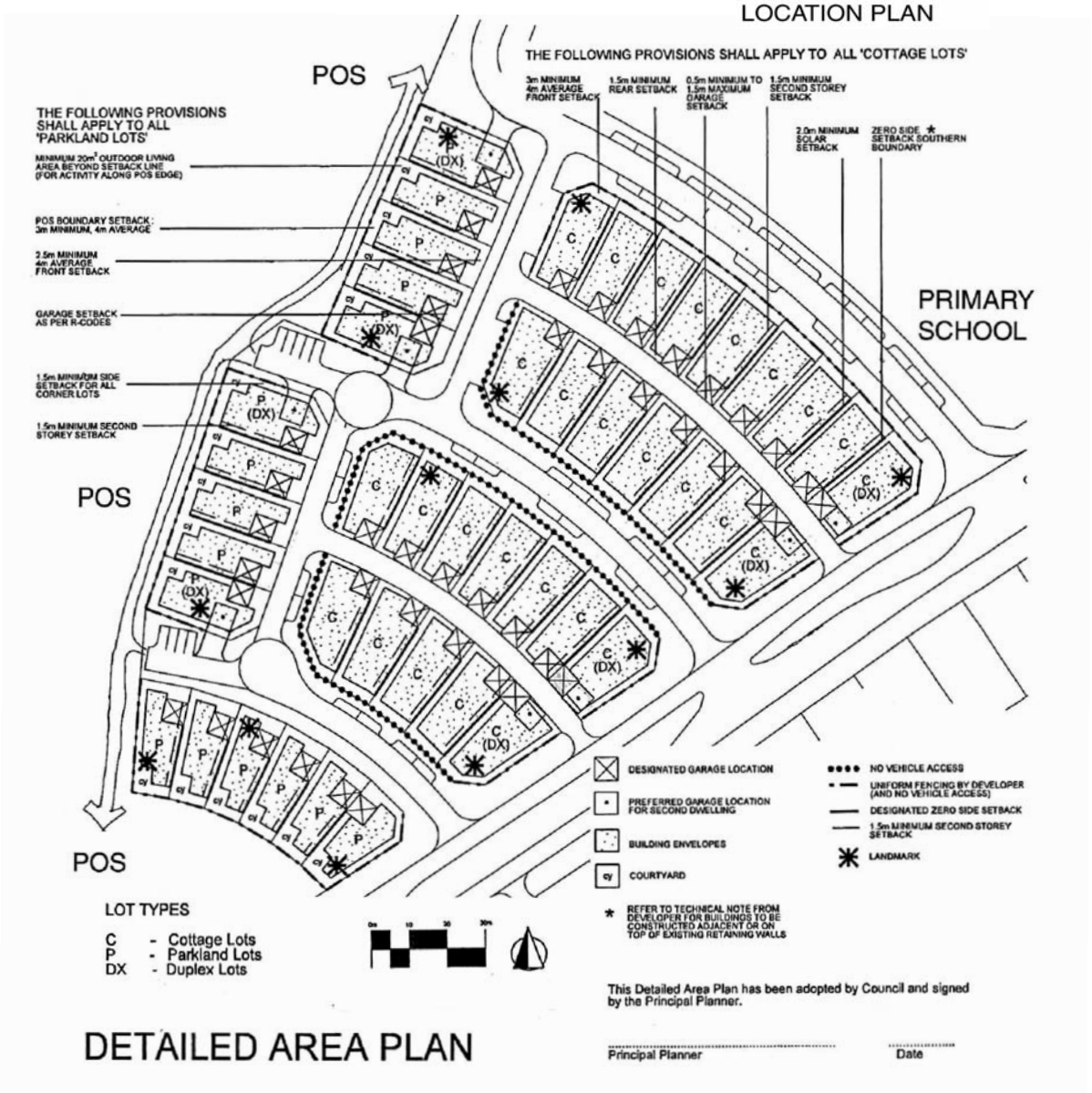


Figure 51: Example of a detailed area plan involving streets, lanes, mews and lots fronting public open space.

Liveable Neighbourhoods

a Western Australian Government sustainable cities initiative

Element 4

Public parkland

Introduction

Public parkland that can be used by a wide range of people living or working in urban areas, contributes significantly to quality of life. Regional, district and local open space can be created efficiently through careful structure planning and site-responsive design. Parklands can contribute towards legibility, identity and sense of place that helps build community.

There are three types of public parkland.

- **Regional open space** as defined under a regional or sub-regional structure plan and/or included in a region scheme and set aside for acquisition. Regional open space should accommodate active and passive recreation such as major playing fields as well as conservation and environmental features.
- **Foreshore reserves** which are contributed free of cost by the owner through the subdivision process (eg land abutting a river, creek, lake or coast).
- **Public open space** which is contributed free of cost by the owner through the subdivision process (eg district park, neighbourhood park, local park, special purpose parks, playing fields, community purpose sites.).

Bush Forever sites that are not included in the above will be dealt with in accordance with the State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region.

This policy sets out the requirements of the WAPC for foreshore reserves and public open space and the provision of land for community facilities in urban areas.

Key differences from conventional practice

In the past, some public open space has been inconveniently located, and inappropriately sized or poorly designed from a safety and surveillance point of view.

This policy provides not only for well-located and well-designed public parkland but also in the case of public open space it provides that generally there will be a minimum standard of earth working and landscaping as a condition of subdivision.

In the past, restraints on local government expenditure have limited local government's ability to develop and maintain public open space. This has resulted in some local governments proposing much public open space being provided as large playing fields (sometimes combined with schools and other community facilities) for ease of maintenance. More recent trends have seen the creation of smaller, more accessible parks.

The WAPC favours a balanced provision of open space, with a range of open space types being provided to meet the needs of all users and age groups, particularly the young.

Linear open space is generally supported along valleys, rivers, creeks and regional flood paths, to retain key landform and urban water management elements. Linear public open space with pedestrian and cycling networks separate from the street system will only be supported where matters of surveillance and personal safety have been duly considered and resolved and where there is adequate allocation of land for the full range of park types in the structure plan area.

Public parkland should be overlooked by development, rather than backed onto by development, highlighting the need for appropriate edge treatments (ie public roads, pathways, visually permeable fencing and lighting).

General principles and background to objectives and requirements

A wider range of parks and other open space

The WAPC seeks to provide a range of site responsive urban parkland which have clear sightlines from nearby buildings and are safe and conveniently located for the majority of the residents they are intended to serve.

Liveable Neighbourhoods also favours a balance between neighbourhood and local parks (readily accessible to residents) and district playing fields (to be shared between neighbourhoods). Small local parks or special purpose parks (up to 3000 m^2) are encouraged for local children's play, for identity and sense of place, and as resting places for the elderly or disabled people in appropriate circumstances. The WAPC will be guided by the local government, particularly on matters relating to the size and distribution of public open space, landscape design and park maintenance arrangements.

Community purposes sites

Sites for community purposes such as community centres, meeting halls, branch libraries and kindergartens are increasingly important for community development.

Upon the request of the local government, the WAPC may accept a community purpose site(s) being included in the 10 per cent public open space contribution.

Community purposes sites should preferably be located in neighbourhood and town centres to assist in forming a community focus. They may also be located adjacent to open space where joint use of the facility with the park is envisaged. The proposed location must be explained in terms of its purpose, benefit to urban structure and accessibility to likely users.

Natural areas and cultural features

There may be opportunity for natural areas and cultural features to be incorporated into neighbourhood and district parks. The WAPC will be guided by the local government that active and passive recreation needs of future residents will be adequately catered for before it will agree to the inclusion of natural or cultural areas in the 10 per cent public open space contribution.

Visual surveillance of parks - promoting safety

Liveable Neighbourhoods aims to ensure that the design of subdivisions surrounding parks always results in parkland being overlooked by nearby buildings. Perimeter streets will generally be required around open space. Where a street is not provided, it must be demonstrated that other means will be used to ensure overlooking and surveillance from adjoining buildings (Element 3 - lot layout).

Joint parkland and drainage provision

Parkland should be provided in conjunction with the urban water management system (Element 5 - urban water management). The WAPC may allow urban water management facilities to be included in public open space.

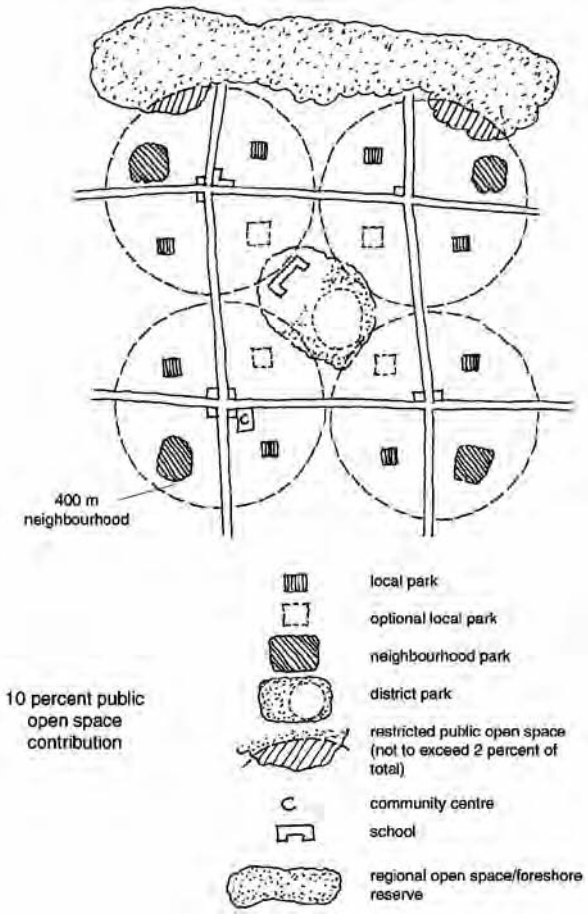
Foreshore reserves and regional open space

The WAPC will require provision of a foreshore reserve free of cost where subdivision abuts a watercourse, such as a river or creek, or a body of water such as a lake, or the coast, in accordance with State Planning Policy 2.6 State Coastal Planning Policy and State Planning Policy 2.9 Water Resources. The WAPC will generally not include a foreshore reserve in the 10 per cent public open space contribution.

Key challenges in relation to parkland provision

Liveable Neighbourhoods seeks to achieve a balance between bushland and/or vegetation retention and provision of water management features with the provision of useable (ie unencumbered) open space. There is clear recognition by the WAPC of the value of natural features and conservation values as an integral part of a parklands appeal to the community. There needs to be a balanced approach that:

- improves land efficiency through the use of multi-purpose parks (eg shared sports fields with schools);
- maximises the use of smaller parks close to or in the core areas (town centres, neighbourhood centres) and locates larger parks nearer to the edges of neighbourhoods;
- provides for efficient and more sustainable urban structure through convenience, walkability and close proximity of useful parklands; and
- avoids where practical, the separation of communities into dislocated and unconnected precincts with unusable or fenced-off parklands.



Policy requirements:

most dwellings in 400 m of a park;

- larger district and neighbourhood parkslocated on edge of neighbourhood;
- at least one neighbourhood park per neighbourhood;
- all parks (public open space) landscaped to a minimum standard; and
- some ovals can be shared with schools.

Figure 52: Public open space model.

Objectives

O1 To ensure that public open space of appropriate quality and quantity is provided in a timely manner to contribute towards the recreational and social needs of the community in appropriate locations.

O2 To integrate urban water management functions with public open space.

O3 To facilitate the provision of land for community facilities where appropriate, as part of land ceded for public open space.

O4 To protect and conserve margins of watercourses, water bodies and wetlands and establish public foreshores along the coast and watercourses adjacent to urban development.

O5 To provide public open space that is safe and overlooked by nearby buildings.

O6 To facilitate the provision of the public open space contribution and its development as part of the subdivision process and to enhance local amenity.

O7 To ensure that public open space is integrated into the urban structure to produce both land use efficiency and long-term sustainability.

O8 To provide a practical cash-in-lieu mechanism for open space allocation and improvements

O9 To provide for regional variations that best reflect local community requirements.

O10 To ensure the provision of adequate land to protect, and to provide public access to, river, creek, lake and ocean foreshores.

Requirements

Application requirements

R1 Structure plans and subdivision applications must be accompanied by the relevant information listed in applications under Liveable Neighbourhoods. A parkland management strategy and/or agreement may be required where the subdivider proposes to develop parkland over and above the minimum standard landscaping and earthworks requirement.

R2 An open space schedule must be provided detailing the amount, distribution and staging of the delivery of open space.

Parkland function and distribution

R3 Public parkland should:

- provide a balance between conservation and active and passive recreational uses in district, neighbourhood and local open space;
- support legibility of the urban environment and the establishment of neighbourhood identity by incorporating natural and cultural features and landmarks;
- incorporate land for connected or linear open space for walking and cycling;
- provide for district parks for a combination of passive (informal play areas) and active (formal playing fields) (R17 - R29);
- provide for neighbourhood parks for active (informal play areas) and passive use (R15, R16);
- provide for local parks in a safe walking distance from all dwellings (R14);
- provide for the development of parks by the subdivider to a minimum standard to enhance residential amenity;
- take into account shared use of open space (eg ovals and schools);
- incorporate drainage wherever practicable using contemporary urban water management principles (Element 5); and
- accommodate water-sensitive urban design in public parkland areas where usability for recreation purposes has not been compromised or where conservation values are enhanced.

Amount of public open space

R4 A minimum contribution of 10 per cent of the gross subdivisible area must be given up free of cost by the subdivider for public open space and may comprise:

- A minimum of eight per cent active and passive recreational purposes where the remaining two per cent (of the overall minimum 10 per cent, or one-fifth) comprises restricted use public open space uses as outlined in R5.

R5 The WAPC will accept a minimum of eight per cent public open space for the purpose of active and passive recreation, where the remaining two per cent (or one-fifth) is allocated for any and/or all of the following restricted use public open space types and in accordance with R29:

- natural areas and cultural features;
- urban water management measures such as swales and/or detention areas;
- artificial lakes/permanent drainage ponds; and
- natural wetlands.

R6 The restricted use public open space may exceed the maximum two per cent as defined in R4 and R5, where an appropriate management plan is agreed by the WAPC in consultation with the local government and the subdivider. A public open space contribution allowance will not be given for any land identified as restricted use public open space over and above the two per cent.

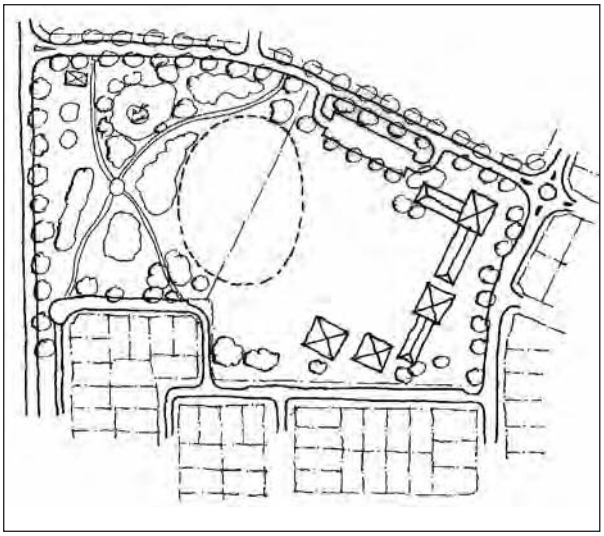


Figure 53: District park shared with school.

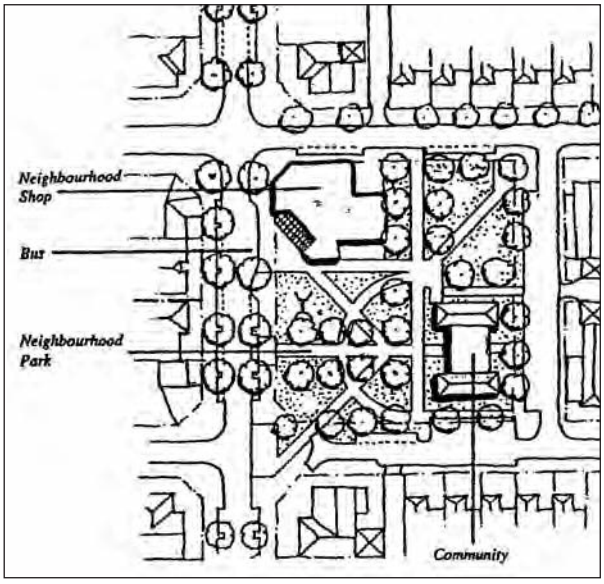


Figure 54: Example of neighbourhood park of about 3000 m² with shop, child minding centre, hall, bus stop and nearby homes and mixed land use.

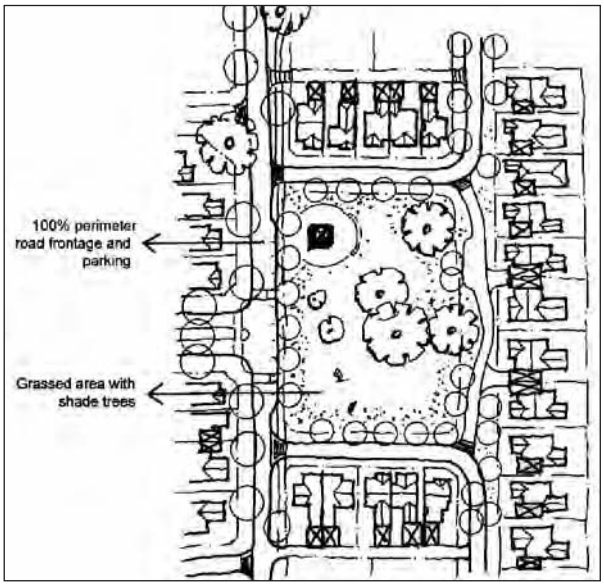


Figure 55: Example of local park of about 6000 m² with adjacent medium density housing overlooking features. Retention of significant trees.

Regional open space

R7 Regional open space identified in a region planning scheme which cannot be dealt with as either foreshore reserve or as part of the subdivider's 10 per cent public open space contribution, should be shown as a separate lot pending acquisition.

R8 The WAPC may accept part or all of the regional open space as part of the subdivider's 10 per cent public open space contribution, providing:

- the WAPC and/or the relevant authority is satisfied that the subject land can continue to be available for local public open space without compromising the planning objectives of the regional open space, that includes the protection of any environmental values; and
- there is agreement with the future management authority regarding ongoing management of the land.

Foreshore reserves

R9 The WAPC will generally require the ceding of a foreshore reserve free of cost and without payment of compensation by the Crown, where a subdivision includes land abutting the coast, water body (eg a lake), or a watercourse (eg a river or creek).

The required width of the foreshore reserve will vary according to the nature of the coast, water body or watercourse, and the condition of its banks, shore, or coastline, having regard to the foreshore's erosion and inundation potential and the environmental or landscape significance of fringing vegetation or landforms. Non-perennial streams and drainage channels may not always require foreshore reserves. Foreshore widths are to be determined as follows.

- Coast: in accordance with State Planning Policy 2.6 Coastal Planning Policy.
- Water body and watercourse: in accordance with State Planning Policies 2.9 Water Resources and 2.10 Swan-Canning River System.

R10 The foreshore reserve, together with the watercourse or water body (where these form part of, or are adjacent to, the application area or are in a structure plan area), shall be ceded to the Crown free of cost and without payment of compensation by the Crown and will be in addition to the 10 per cent public open space contribution. The area of the foreshore reserve and watercourse and/or body should not be included in the gross subdivisible area on which the public open space contribution is determined (R29).

Wetlands and buffers

R11 The boundary and extent of a wetland and its buffer must be determined in accordance with State Planning Policy 2.9 Water Resources, based on the merits of the proposal.

An Environmental Protection Policy wetland, conservation category wetland, or wetland of a similar environmental value shall be ceded to the Crown free of cost and without payment of compensation by the Crown in addition to the 10 per cent public open space contribution. The area of the wetland should not be included in the gross subdivisible area on which the public open space contribution is determined.

Parkland frontage and surveillance

R12 The location, layout and design of subdivision and development surrounding public open space should minimise potential problems relating to personal security, property security, vandalism and poor visual amenity in relation to the park and its boundaries. Usually this should be achieved by bounding public open spaces with streets and ensuring adjacent buildings front and overlook both the street and open spaces. In some instances it may be acceptable to front lots onto and overlooking public open space, where a footpath and front fencing is provided that allows buildings to overlook the open space, and where the need for visitor parking is addressed.

R13 Subdividers should include provision for lighting in parks, where appropriate, in accordance with Australian Standard 1158.1 (1986).

Local parks

R14 Local parks up to 3000 m² should be provided for local children's play and as resting places, designed as small intimate spaces, where appropriate, and to allow pedestrian connectivity, and create a sense of place. Lot, street and landscape layout should provide good visual supervision. Local parks should be provided in 150 to 300 metres (of safe walking distance) to all dwellings (**figures 56 and 57**).

Local parks can include small parks, special purpose parks and squares, and be responsive to specific site requirements (eg tree retention, public art, significant landscape features) that add to a sense of place (**figure 58**).

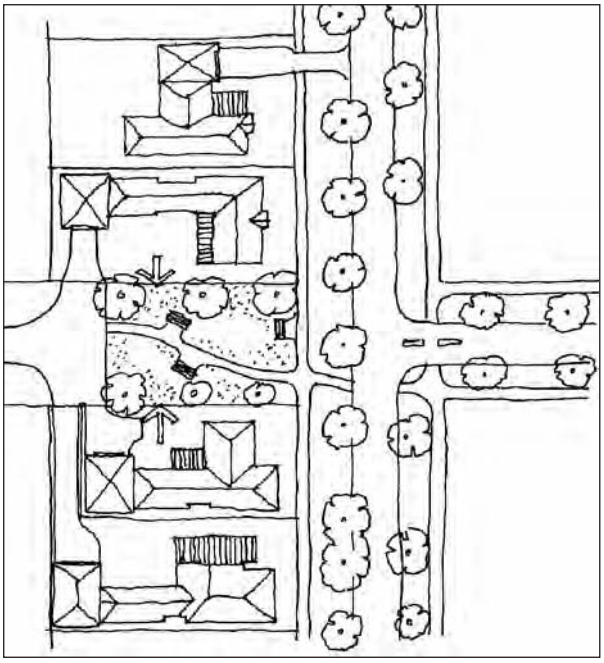


Figure 56: Small park – street terminus 200-600 m². Children's play area on a pedestrian link. Houses are oriented to park, to provide passive surveillance. Portion of boundary to be permeable fencing.

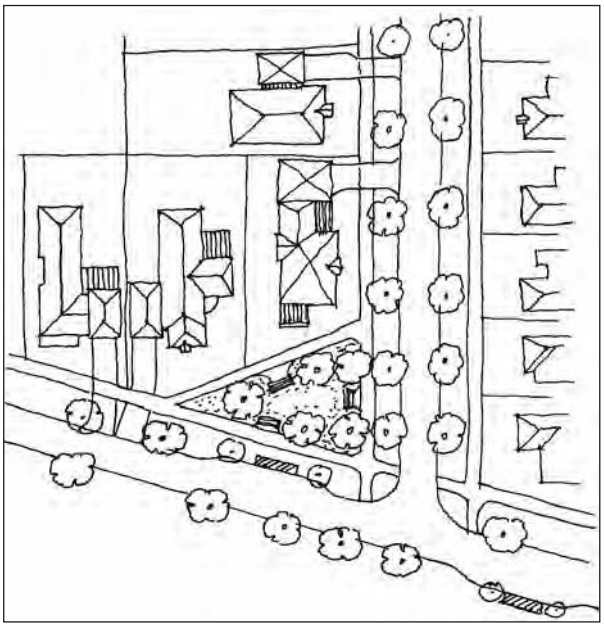


Figure 57: Small corner park at street junction 200-600 m² with bus stops.

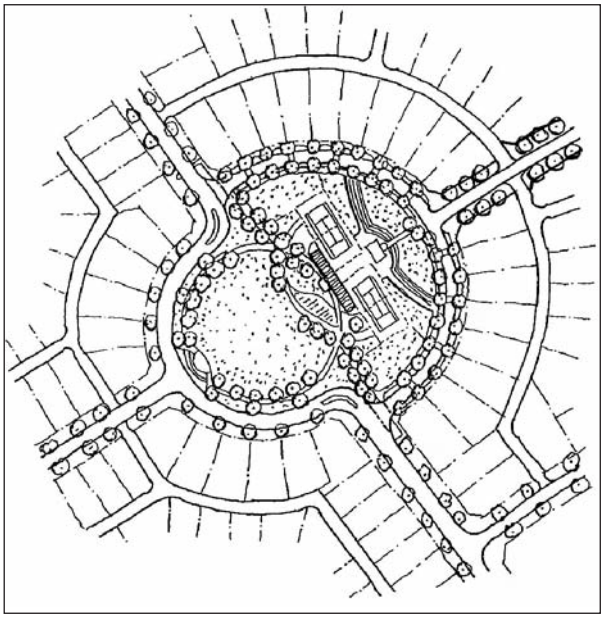


Figure 58: Local park with strong urban focus.

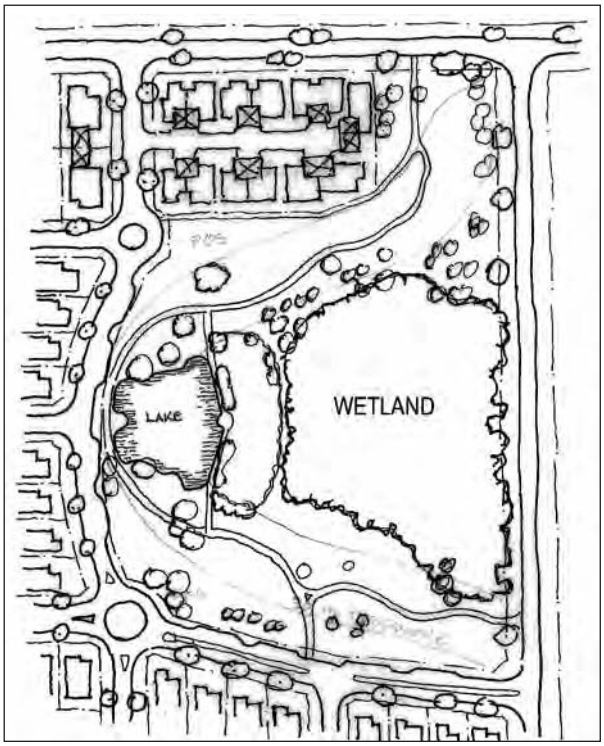


Figure 59: Local park based on wetland retained with core vegetation, artificial lake, and usable public open space.

Neighbourhood parks

R15 Neighbourhood parks of around 3000-5000 m^2 or larger should be provided, each serving about 600-800 dwellings, and be a maximum 400 m walk from most dwellings. These larger parks should be located between or towards the edge of neighbourhoods rather than at the core.

R16 The neighbourhood park should have streets on all sides, but in some instances it may have a portion of its perimeter (generally no more than 25 per cent), with directly abutting development that has only footpath frontage. In such instances the design should provide adequate measures so that nearby buildings overlook the park and provide sufficient road frontage to accommodate visitor parking.

District parks and/or open space

R17 District parks of around 2.5-7 hectares should be provided, notionally serving three neighbourhoods, and should be between a 600 m and 1 km walk from most dwellings. These larger parks should preferably be located between neighbourhoods.

R18 District parks must be of adequate size and shape to accommodate both grassed areas for informal games and for organised sport, and may include hard surfaces for games such as netball and basketball. Natural and human-made differences in elevation need to be considered in this context.

R19 Schools may be located in conjunction with district parks, enabling joint use and maintenance of public open space such as playing fields (Element 8 - schools, R12).

Combining parks with different functions

R20 The size and location of neighbourhood and other parks will vary according to user requirements and site conditions (eg irregular shaped project area, utility easements or multi-use corridors crossing the site, bushland protection requirements). The WAPC, in consultation with the local government, will consider combining some of these park functions where it can be demonstrated that the full range of recreation, leisure and amenity outcomes are in convenient walking distance of most dwellings.

Integrating stormwater and public parkland

R21 The location and design of public open space, where it incorporates urban water management measures, should promote the detention of run-off through the use of swales, depressions, contour banks, rock channels, pebble paths, sedges, reed beds or other suitable measures without compromising the principal function of the public open space.

R22 Sports grounds, passive recreational areas and other moderately flood-sensitive land uses may be included as part of an urban water management system to provide temporary detention areas during storm events.

R23 Where public open space areas include open water bodies for urban water management purposes, the water body may be used as a reservoir for the irrigation of adjacent areas.

R24 The construction of permanent or semi-permanent water features in parks may be permitted for amenity value, recreation, and/or urban water management function, subject to implementation of a suitable management plan agreed to by the local government.

R25 The detention of storm water during and immediately following a greater than five year average recurrence interval may be permitted in public open space.

R26 The detention of stormwater for a greater than one year average recurrence interval may be permitted in restricted use public open space.

Community purposes sites

R27 In consultation with the relevant local government, the WAPC may agree to community purposes sites (eg community centre, meeting halls, branch libraries, kindergartens) being provided as part of the overall public open space contribution. For the purposes of calculating public open space contributions the area of community purposes sites should not be less than 2000 m^2.

R28 Community purposes sites should generally be provided on the basis of one for each group of three neighbourhoods (1500-1800 dwellings located either adjoining public open space or in centres.

R29 Community purposes sites should be identified on an approved structure plan and will be required to be transferred free of cost as a Crown reserve if included as part of the 10 per cent public open space contribution.

Public open space allowances

R30 A full public open space allowance will normally apply to the following restricted use public open space sites as outlined in R5, R31 and R32. The WAPC will accept no more than one-fifth of the 10 per cent contribution being made up of restricted use public open space sites.

Public open space provision and restricted use public open space

R31 An application for subdivision or approval to a structure plan must be accompanied by a public open space schedule similar to **table 11** identifying the total site area, less deductions (eg those land use activities not giving rise for the need for public open space), the gross subdivisible area, the 10 per cent public open space contribution and the restricted use public open space allocation.

R32 The WAPC may support the inclusion of restricted use public open space in the 10 per cent public open space contribution subject to it being satisfied on the usability of the land for recreational purposes.

R33 The WAPC may allow for the following to be included in restricted use public open space:

- buffers to an Environmental Protection Policy, conservation category wetland or wetland of a similar environmental value;
- a resource enhancement wetland, multiple use wetland, or wetland of a similar environmental value;

provided that:

- the area included in public open space is usable for recreational purposes; and
- there is agreement with the local government (or other management authority), referral agencies and the WAPC on a management plan that enhances the wetland.

- urban water management measures including swales and detention areas, where:
  - the area is not subject to inundation more frequently than a one year average recurrence interval rainfall event and does not present a safety hazard;
  - the area of the swale is contoured, unfenced and grassed and/or landscaped; and
  - the area forms part of an appropriate management plan.
- artificial water bodies, where:
  - the water body will contribute to the recreation value and amenity of the public open space;
  - satisfactory arrangements are in place with the local government for the ongoing maintenance of the water body, including an appropriate management plan; and
- the water body forms part of the urban water management system.

Table 11: Example of calculation of gross subdivisible area and public open space provision

Public open space schedule applies to structure plans and subdivisions			
Site area **Less**			200 ha
Environmental protection policy areas Wetlands to be ceded Protected bushland site Unrestricted public open space sites not included in public open space contribution Foreshore reserves to be ceded	3.0 ha 11.0 ha 1.0 ha 5.0 ha		
Total **Net site area**		20.0 ha	 180 ha
Deductions			
Primary school Town centres and commercial Dedicated drainage reserve Transmission corridors Other approved contingencies	4.0 ha 3.5 ha 1.0 ha 1.0 ha 0.5 ha	10.0 ha	
Gross Subdivisible area			170 ha
Public open space @ 10 per cent			17 ha
Public open space contribution			
May comprise: - minimum 80 per cent unrestricted public open space - minimum 20 per cent restricted use public open space (ie one-fifth of 17 ha)		 13.6 ha 3.4 ha	 17 ha
Unrestricted public open space sites			
12 local parks @ 3000 m² each (list and specify) 4 neighbourhood parks @ 8000 m² each 1 district park Community purposes site		3.6 ha 3.0 ha 6.8 ha 0.2 ha	 13.6 ha
Restricted use public open space sites			
Total restricted use public open space contribution (ie 20 per cent of 17 ha = 3.4 ha maximum allowance). eg local bushland eg wetland buffer Total restricted use public open space	 1.0 ha 2.4 ha		 3.4 ha
Public open space provision	3.4 ha		17 ha

Note: Gross subdivisible area includes house lots, access roads, and any land incidental to the subdivision. The gross subdivisible area does not include areas for schools, shopping centres, infrastructure (eg land required for sewer pump stations), dedicated drainage sites not having a recreational function and land set aside for arterial roads and other non-residential uses.

Regional variations

R34 Subject to the support of the local government the WAPC may accept a public open space contribution to a minimum of five per cent of the gross subdivisible area providing:

- the public open space is designed, developed and located for the widest possible use of the community, including meeting, recreation, leisure, entertainment;
- the public open space is developed to a minimum standard including full earthworks, basic reticulation, grassing of key areas, pathways that form part of the overall pedestrian and/or cycle network and maintenance for two summers, in accordance with a landscape plan approved by the local government;
- adequate areas are provided elsewhere for drainage and flooding, particularly overland flow;
- public open space is readily available in the community that can be used at all hours of the day or night; and
- does not include any restricted use public open space.

Cash in lieu and transfers

R35 Under the provisions of Section 153 of the *Planning and Development Act 2005*, the WAPC may agree to cash-in-lieu of public open space where:

- the land area is such that a 10 per cent contribution would be too small to be of practical use; and
- there is already adequate public parkland taking into account the overall objective of parkland provision and distribution.

Guidance on the provision of cash-in-lieu for public open space is provided at Appendix 4.

R36 The WAPC may require the 10 per cent public open space contribution to be transferred as a lot in fee simple to the local government to be held in trust pending its future disposal. The use of funds received from the disposal of such land will be required to be consistent with the cash-in-lieu for public open space procedures. The WAPC will require that a notification be registered on the certificate of title of such land pursuant to section 70A of the *Transfer of Land Act* advising that the land has been ceded for public open space.

Development of public open space

R37 The WAPC will generally require public open space to be developed by a subdivider to a minimum standard that may include full earthworks, basic reticulation, grassing of key areas, pathways that form part of the overall pedestrian and/or cycle network, and maintenance for two summers. Development of public open space should be carried out in accordance with a landscape plan first approved by the local government. The WAPC may not require development of public open space where land is in fragmented ownership, where it is restricted use public open space, and where climatic variations do not require such development.

R38 Where public open space is developed to a standard in excess of the agreed minimum, the WAPC may require the subdivider enter into an agreement with the local government to provide for ongoing management.

Public open space for five lots or less

R39 For subdivision of five lots or less or pre-1956 subdivisions, the WAPC may not always require a public open space contribution providing the contribution is not required under a town planning scheme or approved structure plan where:

- the subdivider demonstrates that land has already been given up for public open space in an earlier subdivision; or
- the subdivider, with advice from the local government, demonstrates that there is sufficient public open space in the locality and the cumulative effect of other potential small subdivisions will not generate the demand for additional public open space.

Implementation procedures

R40 In general, public open space and foreshore management reserves created in a subdivision are to be transferred free of cost to the Crown. Section 152 of the *Planning and Development Act 2005* provides that where a survey deposited plan is approved any land which is shown on the deposited plan as being reserved for recreation or foreshore management automatically vests in the Crown without any conveyance, transfer or assignment or payment

of a fee. As far as possible the provisions of this section should be used to convey proposed recreation areas to the Crown.

R41 Where land for public open space is subsequently vested in a local government, that land is to be used only for public recreational purposes, and remain open to the general public at all times. The WAPC will request the Department for Planning and Infrastructure to ensure that this is done. The WAPC recognises that there may be occasions where the use of some discretion in the operation of this policy is warranted in order to secure better land use and increased public benefit. In such circumstances, the Minister for Lands can, following consultation with the WAPC, exercise that discretion.

Public open space in stages

R42 While the WAPC accepts that the public open space contribution for larger estates may need to be given up in stages, the WAPC may require that the public open space contribution for the entire subdivision application be met entirely from the first stage if:

- the ceding of public open space will become the responsibility of another landowner;
- a public open space staging plan has not been approved;
- the balance of the public open space requirement may place an unreasonable burden on adjoining landowners; and
- an agreement has not been reached with adjoining landowners about the sharing of public open space responsibilities.

Deductions

R43 Deductions from the site area to determine the gross subdivisible area will include those non-residential land uses that do not generate the need for a contribution to public open space and for which a public open space allowance has not been sought. They will include sites for:

- regional roads;
- primary schools;
- high schools;
- town centres other than the residential component (R 44) and commercial uses;
- dedicated drainage reserves (ie sumps);
- regional open space;
- Environmental Protection Policy areas including protected bushland, foreshore reserves and water bodies; and
- transmission corridors.

Where restricted use public open space exceeds the 2 per cent of the 10 per cent minimum public open space contribution, the remaining restricted use public open space can be deducted from the overall site area or other land uses that may with the approval of the WAPC be deducted (**table 11**).

R44 Public open space contribution for mixed uses will be determined by the WAPC on a case by case basis, having regard to:

- the amount of mixed uses proposed and the potential number of residents;
- the amount of public open space available in 300 m of the mixed use area;
- the proportion of the mixed use area likely to be used for non-residential purposes; and
- the level of innovation and quality of the resultant urban form in neighbourhood and town centres.

Liveable Neighbourhoods

a Western Australian Government sustainable cities initiative

Element 5

Urban water management

Introduction

The achievement of appropriate urban water management in a well-structured urban environment is one of the key challenges in Liveable Neighbourhoods. This policy seeks to promote opportunities for linking water management infrastructure with the urban built form and landscape design and aims at achieving a more sustainable development through:

- reducing the amount of water transported between catchments, both in water supply and wastewater export;
- optimising the use of rainwater that falls in urban areas;
- achieving appropriate quality and quantity targets with respect to stormwater run-off; and
- achieving sustainable urban structure and form.

The integration of water supply, wastewater and stormwater is a fundamental principle underpinning urban water management. It may include a range of in catchment techniques applied in the management of the effects of urban developments, in addition to the traditional end of pipe solutions frequently applied.

An integrated approach to urban water management is the key to water-sensitive urban design. This integrated approach regards stormwater as a resource rather than a burden and considers all aspects of run-off in a development, including environmental, social, cultural and economic issues.

This element seeks to encourage water-sensitive urban design through the application of best planning practices and encourage innovative urban water management solutions through the application of best management practices to manage both the quantity and quality of urban stormwater run-off, in a form that adds value to the adjacent land uses. Best management practices provide the technology to facilitate such innovation, but are not detailed in this document (refer to the Stormwater Management Manual for Western Australia (Department of Environment, 2004) and cited references.

Solutions to the management of urban stormwater run-off will be site-specific depending on the local soils, climate, topography, and land uses. The management of urban water in low lying areas will require particular attention and may require larger areas of land to be set aside for water management.

Careful trade-offs will be required to balance the need for urban water management on the one hand with the need to use land efficiently on the other. Minimising development costs, and providing a compact walkable neighbourhood and town structure that is not severely dissected by environmental corridors are important primary design considerations.

Key differences from conventional practice

In the past, the main drivers for stormwater management were that of public safety and mitigating economic effects from flood events. Stormwater management was characterised by the conveyance of stormwater to receiving waters in a hydraulically efficient manner and the detention and retardation of stormwater.

Design for stormwater management has been focused on the collection and channelled removal of stormwater with little opportunity to address the removal of pollutants. Historically, stormwater has not been valued as a resource. Furthermore, this approach provided little or no amenity value.

Increasing levels of public awareness and concern about ongoing sustainability has highlighted the importance of an integrated approach to urban water management and sustainable urban form.

There is now recognition of the importance of water as a resource and managing the quantity and quality of stormwater prior to it reaching a receiving water body (eg waterways, wetlands and groundwater systems). This is necessary to prevent run-off from deteriorating these water bodies and associated environments. Stormwater management objectives have now been widened to include pollution control, re-use, environmental amenity, multiple use and ecological integrity as well as flood control.

The following are the key differences from conventional practice:

- promotes the integration of stormwater management elements into the urban form which results in the provision of a range of social, ecological and economic benefits;
- residential developments need to be planned with an appropriate emphasis on integrating the urban water management and delivery of sustainable urban form such as:
  - treatment of wastewater and reticulation for non-potable use;
  - integration of stormwater treatment measures with public open space;

  - storage of treated stormwater in public water bodies;
  - building urban layouts that are conducive to achieving the objectives of potable mains water conservation, wastewater minimisation and stormwater quality improvement; and
- stormwater requirements for roads are to be designed according to road hierarchy to provide for the level of drainage appropriate for the type of road and that design levels for amenity should be separated from design levels for flood protection.

General principles and background to objectives and requirements

Best planning practices

To accommodate water-sensitive urban design principles in the planning framework, a series of best planning practices have been developed. A best planning practice is defined as the best practical approach for achieving water resource management objectives in an urban framework. This policy seeks to encourage the use of best planning practice s a framework to deliver sustainable urban form.

Best planning practices include:

- retention and integration of natural drainage corridors (eg Belmont Creek, Ascot Waters);
- networked public open space that balance urban structure objectives, the provision of usable and accessible active and passive open space with neighbourhood and district urban water management; and
- road layout and streetscape design that deals with urban water management as a resource and an amenity.

Water-sensitive urban design

Water-sensitive urban design provides emphasis to on-site collection, treatment and use of stormwater flows as part of an integrated treatment train that may be applied in addition to, or in lieu of, conventional stormwater measures. The principles may be applied at the structure plan, subdivision and development level. The opportunities for integrating water-sensitive urban design into urban planning include:

- treating urban stormwater to meet stormwater quality objectives for re-use and/or discharge to surface waters;
- using stormwater in the urban landscape to maximise the visual and recreation amenity;
- reducing potable mains water demand through water efficient appliances, rainwater, stormwater and grey water or wastewater re-use; and
- minimising wastewater generation and treatment of wastewater to a standard suitable for effluent re-use opportunities and/or release to receiving waters.

Elements of a water-sensitive urban design treatment train that can be implemented may include:

- re-use of stormwater run-off or effluent for irrigation, toilet flushing or industrial purposes;
- infiltration of stormwater to underground aquifers;
- specially designed landscaping for conveying and treating run-off including the use of infiltration trenches and grass swales instead of kerb and gutter in roadway designs;
- use of porous paving in appropriate areas to increase infiltration rates;
- minimisation of site disturbance (including cut and fill) to protect native vegetation and conserve habitat;
- protection and restoration of stream corridors for their environmental, recreational and cultural values; and
- re-use of rainwater for toilet flushing, washing machines, garden watering and car washing.

Creating a sustainable urban form

This policy seeks to incorporate urban water management techniques into the overall design approach for urban areas, without compromising the principles of compact, walkable urban structure. Where the land requirement for urban water management and other associated uses is high, the water management system should preferably be located to define the edge of neighbourhoods as opposed to disrupting the neighbourhood structure (**figure 10**, Element 1 - community design).

The amount of space required to provide a water-sensitive urban design response will vary depending on the soil type, climate, and topography. Flat or low-lying land that may be slow to drain is likely to require a greater area for water management. Furthermore, the

spatial requirements will vary along the length of the water management system depending on the type of water management feature and the co-location of recreational areas and other compatible uses.

In areas where there is likely to be a high level of pedestrian movement across an urban water management system, the width of the system should be narrowed to provide for a safe and secure pedestrian route.

Use of other space-efficient technical water quality solutions in lieu of space extensive wetlands and nutrient ponds, should be considered where urban structure or development yield would be unreasonably compromised by space extensive features, such as in the core of neighbourhood or town centres.

Narrow corridors or alternative drainage measures such as pipes should be applied where a corridor passes through the core of a town or neighbourhood. It may not be appropriate to continue wide corridors (50-100 m wide) where a reduction in the volume of urban land may lead to a loss in the efficiency of local facilities or public transport.

In areas already zoned for urban purposes, solutions may require negotiation between the proponent, planning and water management authorities to achieve a balance between urban structuring, efficiency of land use, and urban water management. In new areas, solutions will be expected that optimise the overall objectives of this element through the structure planning process.

Protecting water quality

The quality of stormwater run-off is dependent on the land management activities in the catchment area. Ranges of innovative solutions are available to reduce the pollutant load in stormwater. These solutions differ in their effectiveness at removing particular pollutants. As such, a number of measures may need to be used in sequence to be effective. It is therefore necessary to establish a treatment train approach which includes various solutions in the stormwater management system to enable removal of the whole range of pollutants.

It is particularly important to select and order treatment measures appropriately to ensure that wetland systems are protected from gross pollutants and coarse sediments.

A treatment train may include, for example, the use of swales and infiltration trenches, a bio-retention system and wetlands. The grassed swale could be applied to the local street, in place of conventional verges. The swale constructed in combination with the infiltration trench beneath the swale, acts as the primary treatment measure removing gross pollutants (eg litter) and coarse sediments. The secondary treatment measure, which for example, may occur in a median strip of a boulevard includes a bio-retention system, which removes fine sediments and filters absorbed pollutants (eg Nitrogen and Phosphorous).

The final component of the treatment train is the tertiary measure. This may include a wetland system which removes very fine particulate matter, in addition to biological uptake of pollutants (eg heavy metals and nutrients).

The pollutant stripping efficiency of constructed wetlands increases with size. The efficiency needs to be balanced with the economic use of land and the impact of large areas of space on providing for an effective and efficient urban structure.

Water-sensitive stormwater systems that meet the objectives of the policy should be designed to promote retention of stormwater pollutants near their source through a combination of flow reduction, peak flow attenuation, detention and filtration of urban stormwater methods.

Managing water quantity

Urban development has the potential to change the hydrology of a catchment, which may lead to an increase in the magnitude of stormwater flow events and the associated effects of flooding and public safety. The volume of run-off generated may also increase as the proportion of impervious surfaces increases.

This element requires that water-sensitive stormwater systems be used to mitigate any increase in the volume of stormwater run-off from frequent events in a catchment through either:

- the use of buffers between impervious surfaces and the receiving waters. Landscaped stormwater detention and quality treatment measures and stormwater storage and re-use systems can be used as buffers;
- the use of landscaped features to direct run-off from impervious areas into vegetated landscaped areas;
- the storage and use of rainwater for in-house and garden use to reduce the volume of run-off discharged to receiving waters; and
- infiltration to provide a stormwater disposal opportunity that can be used to replicate the natural surface hydrology of the receiving waterway.

Stormwater infrastructure requirements as a function of road hierarchy

There is a current perception that some local government standards result in over-designing their stormwater systems, which result in developers constructing systems with larger capacity than is required by Australian Rainfall and Run-off 1997 (Institute of Engineers, Australia). The cost of construction and on-going maintenance of these systems is a significant increase and rises exponentially with size of pipes and distance between road drains.

Installing larger capacity drainage infrastructure and not letting the minor events be contained by the road reserve, results in larger volumes of water being transported to receiving environments. This increase seems to be driven by the design to minimum the nuisance level of water on roads that results in water pooling in gutters and potentially increases road user hazard.

As a result, **figure 60** has been prepared which proposes that the level of drainage is appropriate for the type of road, and that design levels for amenity should be separated from design levels for flood protection.

There are three layers of design criteria identified in **figure 60** which include:

1 pollution control: low level of service and/or amenity required;

2 convenience and/or nuisance control: medium level of service and/or amenity required; and

3 flood control: high level of service and/or amenity required.

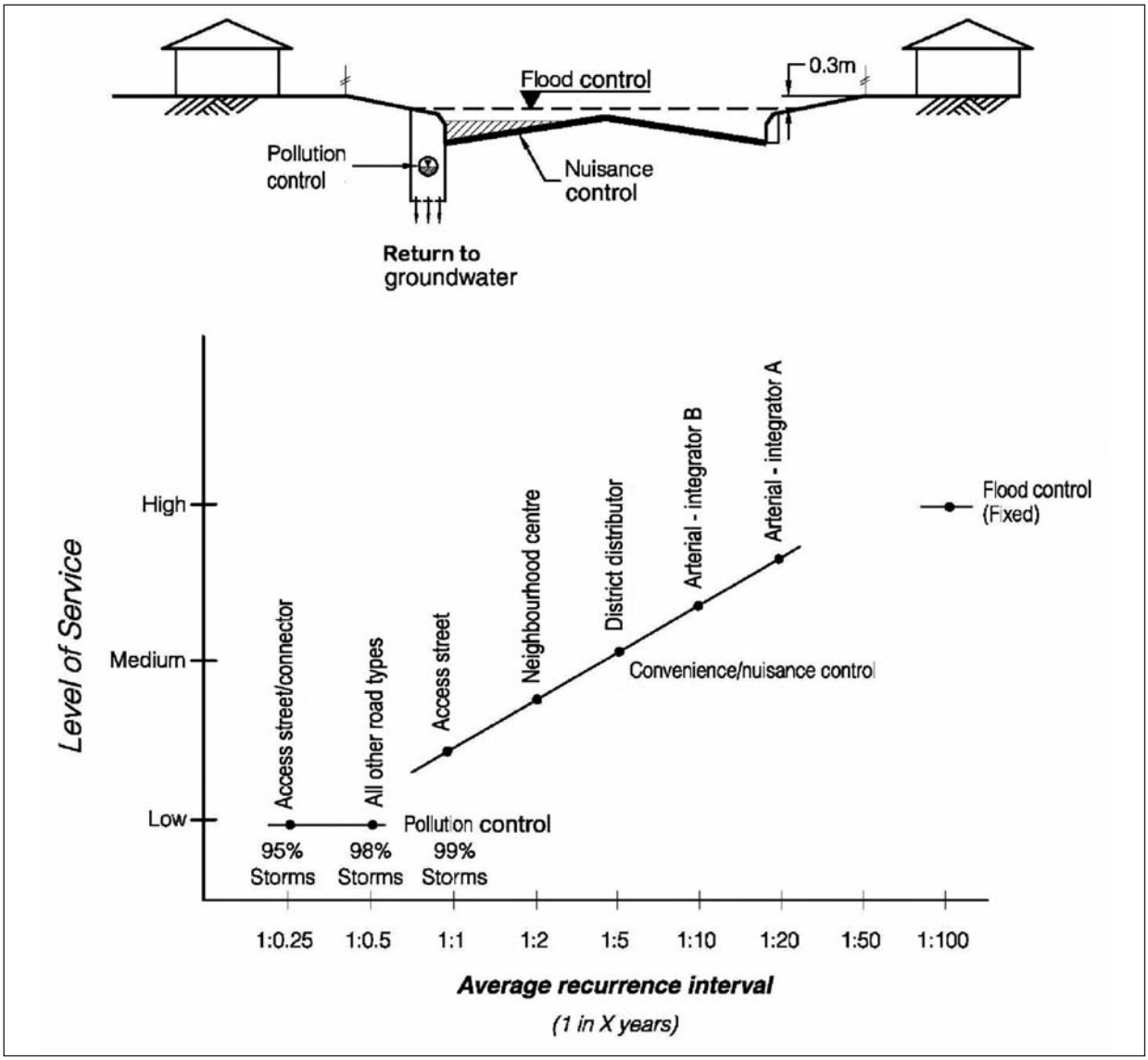


Figure 60: Stormwater infrastructure requirements as a function of road hierarchy.

These layers correspond to the primary aim of the infrastructure and relate to the use of:

1 soak wells in side entry pits for pollution control, so that rainfall from minor events infiltrates into soak wells (side entry pits with pervious bases and walls) to filter out pollutants and infiltrate as close to the source as possible;

2 the width of water on the edges of the road gutters, dictated by the spacing and/or size of the pipe in the side entry pit; and

3 the 1 in 100-year floor line, above which development is located to ensure protection of property and community safety from flooding.

The main point of difference in this approach is the design criteria for amenity. It proposes that instead of automatically designing systems to transport large volumes of water from roads through pipes (irrespective of road hierarchy), that lesser roads such as access streets and neighbourhood connectors be designed to accommodate the more frequent events (up to a 1 in 1-year and 1 in 2-year average recurrence interval event respectively) only.

It should be noted that rainfall up to the 1 in five-year average recurrence interval event represents 99.99 per cent of the total average annual amount of rainfall and therefore there is limited justification to design access streets and neighbourhood connectors to this specification or beyond.

Integrating stormwater treatment into the landscape

The WAPC recognises the potential to combine the spatial requirements of urban water management with the need to provide for recreational open space, habitat for flora and fauna, retention of existing vegetation, and alignments for trunk services. These uses can be successfully integrated using the following mechanisms:

- multiple use corridors
- swales
- bubble up pits
- constructed and/or artificial wetlands

The WAPC may allow urban water management facilities to be accommodated in public open space (Element 4).

Water conservation

Water efficiency measures can be achieved in subdivisions and urban development by:

- minimising the import and use of scheme water;
- promoting the use of rainwater;
- promoting the re-use and recycling of wastewater;
- reducing irrigation requirements; and
- promoting opportunities for localised supply.

The following solutions may also be considered:

- innovative landscaping practices (ie hyrdozoning);
- wastewater re-use systems;
- stormwater tanks; and
- rainwater tanks and water efficient fixtures and appliances (lot level).

Street network and design

The street network should be designed wherever possible to assist in providing for effective urban water management by:

- minimise disturbance to landform, natural watercourses and native vegetation;
- incorporate effective stormwater source controls to minimise stormwater run-off peaks and volumes, reduce pollutants to receiving waters and enhance visual and recreational amenity; and
- facilitate overflow paths.

Interface between urban water management areas and adjacent land uses

Urban water management areas should be treated in the same way as parkland for the purposes of determining the relationship between the open space and the surrounding development. The objectives and requirements contained in Element 3 - lot layout, and Element 4 - public parkland, in regard to the provision of frontage onto parkland, apply equally to urban water management areas to be overlooked from nearby buildings.

Maintenance costs and management arrangements

The success of water-sensitive urban design is heavily dependent on the implementation of an on-going maintenance program. The costs and skills required to manage wetlands and other water treatment devices are likely to be significant. This element seeks to include maintenance costs as an important design consideration, and that on-going maintenance is included as part of the approval process.

Balancing the requirements for urban development and urban water management

The requirements of this element for urban water management may in places, result in land being made unsuitable for efficient and well-structured urban development. The WAPC will take this into consideration when determining proposals for the zoning of land. In areas already zoned urban, solutions may require negotiation between the proponent, planning and water management authorities to achieve a balance between urban structuring, efficiency of land use, and urban water management. In new areas, solutions are expected to optimise the urban water management objectives of this policy.

Application of element

In making decisions involving urban water management and urban structuring the WAPC will have regard to advice from:

- the Water Corporation and the Department of Water in respect of the application of the element on the proposed or existing arterial drainage system as determined in consultation with local authorities, on the desirability of such drainage systems and their impact on the water balance of wetlands, and on the likely impact of land use proposals on the quality and quantity of water resources;
- the Environmental Protection Authority, the Department of Environment and Conservation and Department of Water in respect to the application of the element, the identification of important wetlands and river systems and provisions to minimise their nutrient enrichment, and any additional environmental assessment requirements; and
- the local government in respect to the design, development and management of urban water management areas (ie open space), consideration to matters such as minimising water usage, preserving and enhancing natural wetland values and facilitating conservation of stormwater.

The WAPC will apply this element when considering regional, district or local structure plans, planning schemes and/or scheme amendments and in determining and imposing conditions on subdivision applications. The WAPC may require information such as an urban water management strategy, drainage and nutrient management plan, wetland management plan incorporating consideration of stormwater drainage, water quality as a means of addressing the impact of development on water and environmental resources.

Objectives

O1 To encourage best practice in the use and management of land and water resources, reduce reliance on potable water wherever practicable and improve at source protection of water quality.

O2 To encourage water conservation by maximising the retention, detention and re-use of stormwater, by maximising local recharge of groundwater and by wastewater re-use and water harvesting.

O3 To protect the built environment from flooding, inundation and stormwater damage.

O4 To maintain and where possible improve the surface and groundwater quality.

O5 To prevent adverse affect upon natural environments that may be sensitive to changes in the natural water cycle.

O6 To integrate appropriate water management measures in an efficient urban structure and range of parkland types.

O7 To enable minor adjustments to streams, gullies, wetlands and marginal flood plains to provide for a compact, walkable and efficient urban form.

O8 To provide an urban water management system that is sustainable and that arrangements are in place for on-going maintenance and management.

Requirements

Application requirements

R1 Subdivision and development should have regard to an urban water management strategy that forms part of regional, district and/or local structure plans which should address the following matters:

- an analysis of the proposed urban water management network including major and minor systems;
- maintenance of natural urban water management networks, ground water and aquifer systems;
- ground water recharge;
- run-off water quality;
- environmental values and physical characteristics of receiving domains or watercourses;
- protection of people, property and built environment from stormwater and flooding;
- developer cost contribution arrangements; and
- on-going management arrangements (including maintenance costs) and responsibilities.

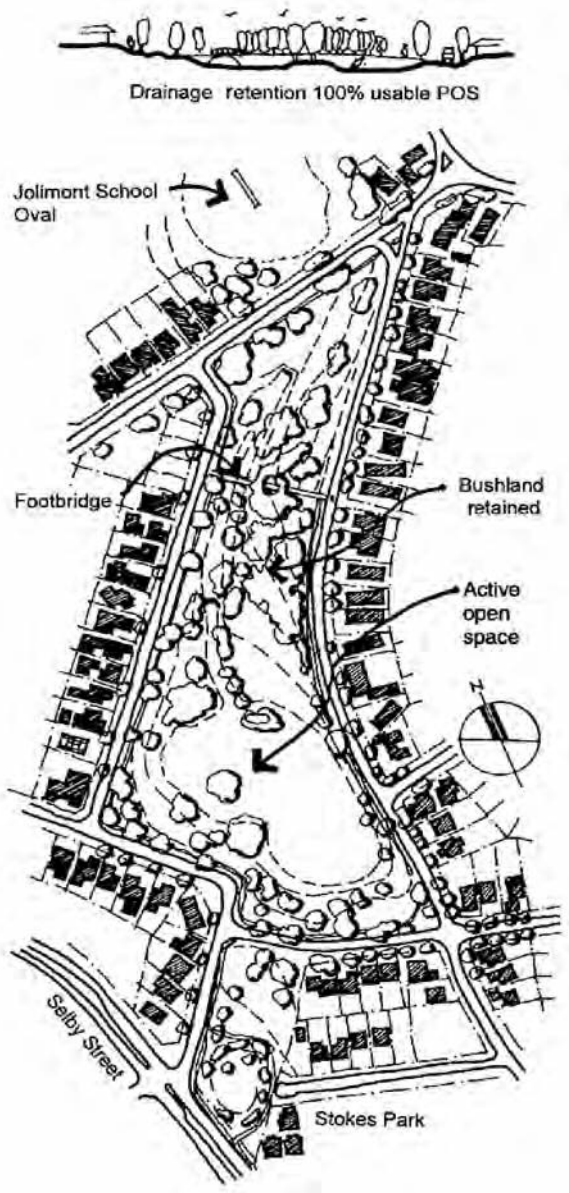
Urban structuring

R2 Urban water management measures should aim to provide protection from stormwater and maintain natural drainage networks and water quality with a site responsive approach, while balancing the need for efficient, walkable and compact urban development.

R3 Efficient, sustainable urban form as defined in Element 1 - community design, should not be compromised by large continuous areas of open space for the purposes of urban stormwater management.

R4 Integration of urban water management measures should be achieved by:

- areas of open space established for urban stormwater management that do not compromise efficient urban structure;
- linear parks along drainage lines;
- retaining and enhancing natural watercourses, wetlands and their riparian vegetation, while also recognising that minor alignment modifications may be appropriate;
- flood ways taking the form of a natural waterway, an augmenting parallel channel, a constructed open channel, a roadway reserve or public open space;
- streets and road reserves acting as flood ways or elements of the overland flow route taken by floodwaters. Flood depths and velocities should be limited in the interests of safety, and floodwaters should be diverted from streets and road reserves as soon as practically possible;



An example of public open space and drainage (bubble up/low flow) combined with bushland retention, nutrient stripping and visual surveillance from perimeter roads, footpaths and nearby houses.

Figure 61: Example of integrated urban water management and public open space – Cliff Sadlier Memorial Park, Daglish.

- detention and retention basins being incorporated to reduce on-flow flood peaks and provide increased flood protection for downstream areas;
- retaining and enhancing natural streams and vegetation where practicable;
- incorporating sports grounds and other less flood-sensitive areas; and
- placing detention and retention basins and swales in public open space and selected streets for amenity and function.

Water quality

R5 The design of urban water management systems should include a range of solutions and measures to manage water quality through the provisions contained in Australian Rainfall Quality (IE Aust, 2004) and the Stormwater Management Manual for Western Australia (Department of Environment, 2004) (as amended) and cited references.

R6 The design of the urban stormwater management system should provide for the removal of the full range of pollutants using the treatment train from the urban stormwater run-off and may include the following techniques:

- filtration and bio-retention devices;
- vegetated swales;
- infiltration devices and areas;
- site infrastructure maintenance practices;
- ponds and wetlands; and
- education and training.

R7 Non-structural management measures should be used to reduce the amount of pollutants entering the stormwater system, with structural controls used to reduce the pollutants entering the groundwater and to treat pollutants that may have already entered the system.

Water quantity

R8 The design of urban water management systems should be based on recognised and locally accepted hydrological, hydro-geological, geological, hydraulic and residential parameter data, and water demand data, including the provisions contained in Australian Rainfall and Run-off (IE Australia, 2001) (as amended) and cited references.

R9 In areas where stormwater is to be managed for re-use, the design of the urban water management system should minimise run-off and maximise local infiltration, where appropriate, by the use of techniques such as soak wells, vegetated swales and filter strips and by minimising impermeable areas.

R10 The design of urban water management systems should avoid overland flow paths that increase the potential risk to adjoining property or to public safety.

Water conservation

R11 Stormwater and wastewater re-use systems should be considered as a secondary water source, and provision for their infrastructure included in the street design.

Protecting and enhancing valued native vegetation and habitats

R12 Where development includes or is adjacent to an existing wetland, stream or gully, the design of the urban water management systems should:

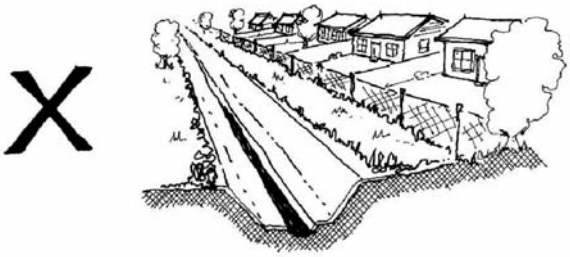
- include appropriate measures to maintain the natural water cycle of that system; and
- manage stormwater run-off to protect and enhance the environmental values and physical characteristics of the receiving environment.

Integrating stormwater into the landscape

R13 The location and design of public open space where it incorporates urban water management measures should promote the detention and retention of run-off through the use of swales, depressions, contour banks, rock channels, pebble paths, sedges, reed beds or other suitable measures without compromising the principal function of the public open space (**figure 62**).

R14 Sports grounds, passive recreational areas, car parks and other moderately flood-sensitive land uses may be included as part of an urban water management system to provide temporary detention areas during storm events.

- Safe street providing housing overlooking parkland.
- Attractive and manageable parkland for recreation, wildlife habitat, and visual amenity.



- Concrete-lined high velocity channel.
- Space unusable, often poorly maintained and dangerous.

Figure 62: Integrating stormwater into the landscape.

R15 Where open space areas include open water bodies for urban water management purposes, the water body may be used as a reservoir for the irrigation of adjacent areas.

R16 The construction of permanent or semi-permanent water features into parks, for amenity, recreation, and/or urban water management function, may be permitted subject to implementation of a suitable management plan.

Street network and design

R17 Stormwater infrastructure for roads should be dependent on the road hierarchy and catchment characteristics as defined in **figure 60** and **figure 63**.

R18 Streets may be designed as temporary flood-ways during storm events, provided that vehicular access to adjoining land is possible at slow speeds and that the depth and rate of water flow is not hazardous to public safety.

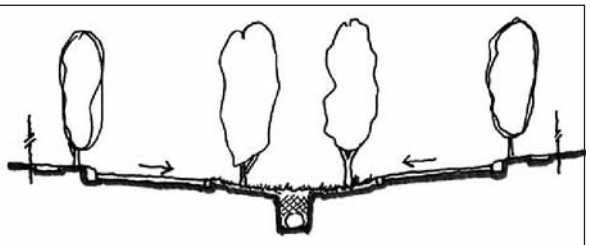
R19 The design of streets should make provision for the retention, detention, low velocity flows and treatment of stormwater through the use of landscaping, swales, sand and/or gravel filters, vegetated filter strips, retention devices or other appropriate source controls.

R20 The design of the street network should consider opportunities to incorporate water-sensitive urban design techniques, which may include:

- use of drainage swales in the central median of access street A; and
- minimising the average length of street blocks so as to reduce run-off lengths.

R21 Drainage swales in road reservations may be located in one of the verges, where:

- vehicle access can be managed or is not required; and
- alternative parking arrangements on one verge side are possible.



Median swale boulevard with gravel-filled trench and perforated drainage pipe.

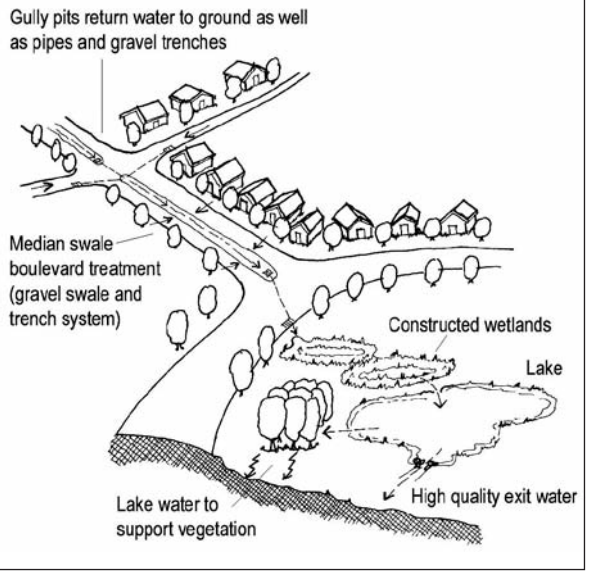


Figure 63: Street network and design: street network and open space should be designed to facilitate natural stormwater flows.

Maintenance and management

R22 Where appropriate the WAPC shall require the preparation of a management plan in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000) that addresses the following:

- an ongoing maintenance and monitoring program;
- drainage and nutrient management; and
- funding arrangements as required.

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Element 6

Utilities

Introduction

This element covers contemporary subdivision servicing requirements and emphasises the need to predetermine, through design, the most appropriate way in which to provide utility services in a sustainable and land-efficient manner.

General principles and background to objectives and requirements

Utility services

This element requires that each new lot be provided with a standard of utility services appropriate for its intended use. The required level of services for a subdivision needs to account for the proposed use and lot size, land and servicing capability and the provisions of the town planning scheme, Government Sewerage Policy and any other relevant published policy.

Reductions in street widths

It is recognised that in addition to the transportation function of streets for vehicles and pedestrians, road reservations are also important for the distribution and protection of public utilities. Reductions in street widths are encouraged under this policy, provided that the essential requirements of the road pavement width, street trees, parking, footpaths, bike lanes and services can all be accommodated. Therefore, reductions may best be achieved through the design process and by careful placement of trunk services and some services underneath footpaths, road pavements and in rear laneways.

Reticulated sewerage

It is recognised that the provision of reticulated sewerage to development has numerous environmental and public health benefits. This policy stipulates mandatory sewer requirements, where sewerage is available, and circumstances where on-site effluent disposal systems may be accepted in accordance with Water Corporation and Health Department requirements.

Underground power

This element also recognises that considerable advantages are to be gained from underground power reticulation in residential subdivision. Benefits include improved aesthetics, a safer and more reliable power supply, greater flexibility in road design and potentially lower maintenance costs. Requirements for the mandatory provision of underground power and the circumstances where exceptions can be made to these requirements form part of this policy in accordance with the service provider's requirements.

Provision of street trees and street lighting

This element also recognises that the street is the main vehicle for promoting walkable communities, and as such needs to provide an environment that is conducive to pedestrians. As such, street trees in road reserves are an essential part of the urban environment, and to ensure the requirement for such space is not reduced to make way for servicing, street widening requirements or future servicing upgrades.

Current street lighting standards need to be reviewed to ensure adequate lighting of footpaths occurs on all streets.

Utility alignments and common trenching

The utility alignments and cross-sections included in this policy reflect minor variations to the current Utility Providers Code of Practice released by the Public Utility Services Committee in order to ensure all facilities are included in a minimum 4.1 m verge width, and the overall objectives of safety and lower traffic speeds are not compromised by increased verge widths. Where trunk services are provided, widened verges may be required.

De-regulation of some service providers has made it difficult to achieve common trenching. The WAPC strongly supports a more coordinated and efficient approach to infrastructure planning, by adopting measures such as common trenching.

Wastewater re-use

This element recognises the opportunity to reduce the potable water demands through wastewater re-use in the form of a second pipe system in the future. As such, the provision of a service alignment for the second pipe has been identified in cross-sections included in this element.

Services in rear laneways

This element acknowledges the requirement to maximise community safety and security in rear laneways and as such, the provision of metered services in rear laneways must occur in a manner that does not compromise this safety. Metered services will not be permitted where indented easements are required in the lot, unless safety and surveillance in the laneway can be adequately addressed.

Servicing authorities should be consulted at an early stage in the planning design process so that servicing requirements can be accommodated in the detailed road layout and subdivision design.

Objectives

O1 To provide new urban lots with adequate services including sewerage, water, fire fighting equipment and services, electricity, gas, street lighting and communication services in a timely, cost-effective, coordinated, efficient and aesthetically appropriate manner that supports sustainable development practices.

O2 To maximise the efficient location of utilities while providing sufficient space to accommodate large canopy street trees in all road reservations, except rear laneways.

O3 To accommodate a sewerage system that is adequate for the maintenance of public health and the disposal of effluent to maximise environmental protection.

O4 To accommodate the delivery of an adequate, reliable, safe, efficient and potable supply of water.

O5 To increase the potential for wastewater recycling in accordance with the objectives of the State Water Strategy.

O6 To provide public lighting in streets and public spaces for the safety of pedestrians, cyclists and vehicles.

O7 To accommodate services that will reduce the affect on public amenity, provide flexibility in road design and minimise maintenance costs.

O8 To encourage suitable provision of utilities in rear laneways.

Requirements

Application requirements

R1 Structure plans should where necessary be accompanied by a servicing report that identifies and documents the following matters:

- existing main/trunk services (including easements) and their proximity to the subject land;
- major sewerage and water supply infrastructure requirements, including proposed and existing sites for sewage treatment plants, pump stations, sewer mains, water towers, production bores and any associated buffers;
- major power requirements, including proposed and existing high tension transmission lines, substations and gas pipelines;
- cross-sections through typical streets demonstrating that road reserve widths can adequately accommodate essential services, street trees, footpaths, shared paths, on-street parking, road pavement widths and on-street cycling;
- an outline of the capability of and requirements for adequately servicing the subject land; and
- details relating to the objectives and management envisaged for any shared development contributions arrangement for the provision of headworks and other infrastructure, where the structure plan covers an area held in multiple ownership.

Lifecycle impacts

R2 The design and provision of public utilities, including sewerage, water, electricity, gas, street lighting and communication services should be cost effective over the lifecycle and should seek to minimise adverse environmental impact in the short and long term.

R3 The selection of materials and technologies used in the construction of service networks should be determined by suitability, durability, ease of maintenance and cost effectiveness, whole of lifecycle costing, energy savings and reduction in greenhouse gas emissions over the lifecycle of infrastructures.

Service alignments

R4 Services in streets should be provided in accordance with the service alignments identified in **figure 64 and figure 65**, which is also subject to approval by the utility service providers.

R5 In specific cases, wider shared paths and the provision of trunk services may be required, and the verge width will need to be widened accordingly.

R6 Where a shared path is not required to be provided in a street, the street tree may be located closer to the property boundary, as identified in **figure 64**.

R7 Where the common trenching of services can be achieved, the width of road verges can be narrowed by reducing by the width of the utilities corridor shown in **figure 64**.

Existing service easement

R8 Before lodging an application for subdivision for land affected by an existing public utility easement, the subdivider should negotiate with the service provider to either surrender of the existing easements; or relocation and/or realignment and protection of the utility so as to minimise affect on the delivery of an efficient and sustainable urban form.

Service locations

R9 Street verges must be of sufficient width to contain all of the anticipated services, including provision for street lighting, adequate space for large canopy street trees of an appropriate species and, where appropriate, embayed car parking, landscaping and footpaths.

R10 Rear laneways should be used to accommodate drainage and sewer services to individual lots. Laneways should not include the placement of trunk services or metered services, where the meter imposes an easement on the lot which will result in a recessed metering facility and compromised community safety, except where:

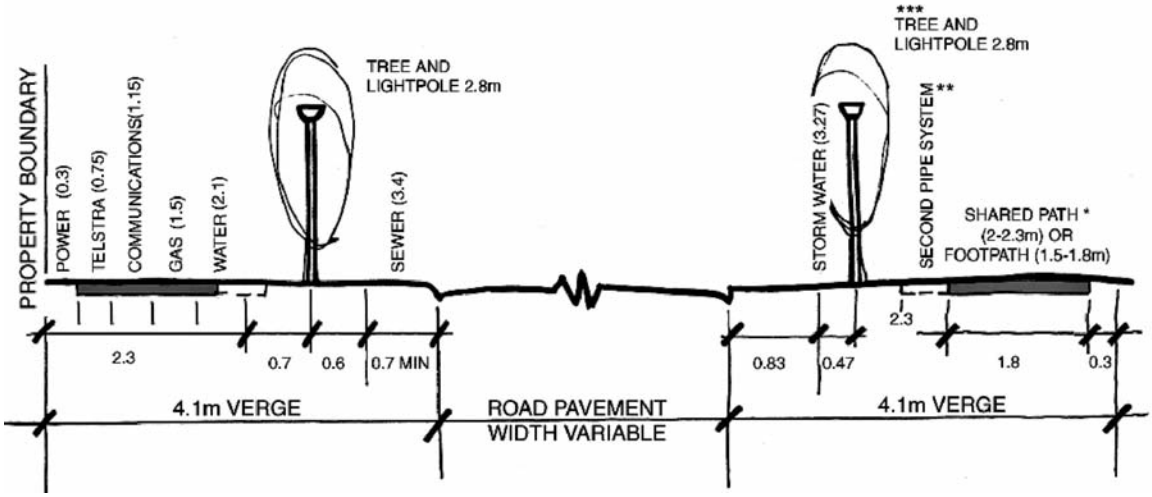
- zero setbacks to development require alternative arrangements;
- topography constrains the provision of services in primary streets; and

- development fronts public open space with laneway access only and services cannot be located in the public open space and/or under footpaths.

R11 Where metered services are required to be provided in the laneway, the following community safety issues should be addressed:

- easements associated with metered services should be located so as to minimise the affect on the lot and located so as to not compromise laneway security, surveillance and safety;
- measures to maintain the visual amenity of the laneway; and
- laneway lighting located to maximise passive surveillance and increase community safety adjacent an easement.

R12 Sewer mains may be positioned under the road pavement where maintenance is likely to be very infrequent, provided that maintenance can be carried out in a manner that will not present a public hazard or significant inconvenience during maintenance periods.

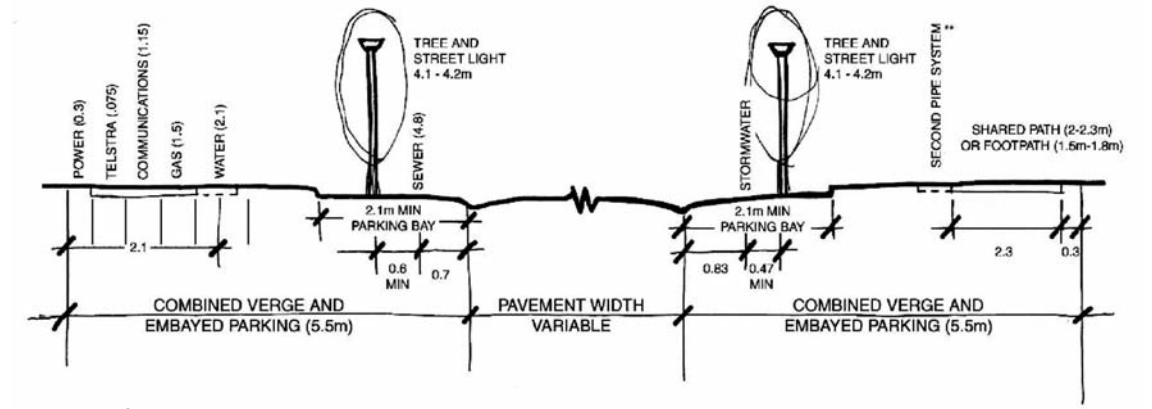


* In specific cases, wider shared paths may be required, and the verge width will need to be widened accordingly.

** Possible second pipe alignment

*** Trees may be located at 2.6 m from property boundary where there is no shared path.

Figure 64: Typical services, tree and path locations in 4.1 m verge.



* In specific cases, wider shared paths may be required, and the verge width will need to be widened accordingly.

** Possible second pipe alignment

Figure 65: Typical services, tree and path locations in 5.5 m verge incorporating indented parking.

Service provision

Underground power

R13 Provide electricity to each lot in a timely, efficient and cost effective manner.

R14 Underground power will be a mandatory requirement in areas where:

- the location is such that development is accessible to, and can be readily connected to, the existing distribution system; and
- the proposed reticulation is technically and economically acceptable to the service provider.

Gas

R15 In areas where a reticulated gas network is available provide each lot with access to a reticulated gas supply.

Sewer

R16 The WAPC will apply the requirements of the Government Sewerage Policy(s). All new lots shall be connected to a reticulated sewerage system where:

- there are extensive broad acre subdivisions, involving the creation of lots in areas not currently developed for urban purposes; and
- subdivision or density development in areas served by reticulated sewerage or which the responsible authorities determine can reasonably be connected to sewer.

R17 In areas identified as unsuitable for on-site wastewater disposal, subdivision and/or density development may not be permitted where the absence of sewerage is considered by the responsible authorities to:

- endanger public health, the environment or the quality of underground and surface water supplies; and
- prejudice, physically or financially, the ability to provide sewerage to adjoining areas.

R18 The Government Sewerage Policy Perth Metropolitan Region sets out special conditions which could provide possible exceptions to the mandatory provisions. These relate to areas where sewerage facilities are not available nor in reasonable prospect, and subject to ground conditions being suitable for the long-term, efficient, on-site disposal of effluent. The exceptions are:

a) In the inner metropolitan area where residential developments do not exceed R12.5, no individual lot on which wastewater is to be disposed is less that 700 m^2 in area and where in constrained areas the on-site wastewater disposal system is approved by the Executive Director, Public Health.

b) In the outer metropolitan area for:

- small infill subdivision or development which does not have potential for the creation of more than four additional lots, dwellings or single residential equivalents respectively in the immediate vicinity, and where the proposal completes rather than extends the existing pattern of subdivision and development;
- large lot subdivision which does not involve the creation of lots less than 2000 m^2, or density development exceeding R5, providing the responsible authorities are satisfied that no significant detriment to the environment is likely and there is no further opportunity for subdivision without sewerage;
- remote and isolated subdivisions or density developments which do not involve the potential for the creation of more than 25 lots, dwellings or single residential equivalents and the applicant can demonstrate that site conditions are suitable for effective long-term on-site disposal, residential developments do not exceed R12.5 and no individual lot containing on-site disposal is less than 700 m^2, and sewerage services are unavailable and impractical in the foreseeable future; and
- aged or dependent persons' accommodation which does not exceed a density of R12.5 and meets tests of need and site suitability.

R19 Similarly, outside the Metropolitan region, the WAPC will have regard to the Government Sewerage Policy: Country which specifies those towns, or parts of towns, where the provision of sewerage is mandatory for new subdivisions, together with any exceptions.

R20 Residential lots without sewerage will need to include a minimum unencumbered area of 150 m^2 of a suitable shape for each dwelling for the installation of an on-site effluent disposal

system. Transportation, treatment and disposal of sewage wastes must be to the satisfaction of the relevant servicing authority or local government (as appropriate), and the relevant State health and environmental regulators.

Water supply

R21 Subdivision for urban purposes must only occur in locations where there is access to an adequate reticulated water supply for domestic use and fire fighting purposes.

Public lighting

R22 Public lighting should be designed in accordance with Australian Standard 1158 and should be provided to adequately illuminate streets, footpaths, public telephones, public transport stops and major pedestrian and bicycle links including open spaces that are likely to be well-used at night to assist in providing safe passage for pedestrians, cyclists and vehicles.

R23 Public lighting should be designed with regard to energy efficient practices and technologies. Obtrusive and upwards waste lighting should be minimised in accordance with AS 4282 (1997).

Other

R24 Payphones and public mailboxes should be located together wherever possible. Ideally they should be located at major activity centres, at neighbourhood centres and on neighbourhood connector roads, taking into account visibility, lighting, parking and effects on nearby residential properties.

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Element 7

Activity centres and employment

Introduction

Element 1 - community design covers the key principles behind the structuring of an urban area to provide for an appropriately distributed range of mixed-use activity centres. Most retail, civic, institutional, commercial and service businesses can potentially be provided in these centres. In addition, some larger scale and less urban-compatible forms of employment activity (eg large scale or heavy industry) will need to be provided in strategically located and relatively single-use precincts.

Regional and district structure plans should show the location and size of centres and other employment areas. These plans should also normally include employment targets and strategies for their achievement.

This element provides requirements at a greater level of detail than element 1 on both activity centres and employment. Local structure plans, subdivision plans and/or detailed area plans should provide indicative layouts and massing for centres and other employment generating areas. Typical types of mixed-use activity centres occurring under Liveable Neighbourhoods are shown in **table 12**.

Key changes from conventional practice

- The establishment of well-located activity centres is necessary to serve the requirements of local populations and facilitate employment creation. The role of retail in this context is to create a public domain environment that attracts employment from the non-retail sector. Providing a mixed-use centre delivers improved environmental, economic and social outcomes.
- Main street-fronting retail layouts should predominate, instead of enclosed or parking lot-dominant retail formats.
- The key focus of centre planning is the quality of the public realm with the street being the main organising element for centre design (not the land use).
- All centres are to be planned as activity centres, not just shopping centres.
- Centres capitalise on, relate to and address arterial roads rather than just using them for access.
- Local centres are located on busier streets, not hidden away in residential cells.
- Small local neighbourhood centres of various sizes with (as a minimum) some retail and a public transport stop should be provided in a 400-500 m walk of most residents.
- Neighbourhood centres are not usually closely integrated with primary schools (see also Element 8 - schools) unless they are interim schools in shops, offices or houses.
- Centres are designed to facilitate and encourage walking, cycling and public transport access, and not just car access.
- Parking requirements may be reduced where the mix of uses, the parking management and the availability of other access modes justify reduction.
- On-street parking is important, and is incorporated on most streets and counted towards the overall parking requirements.
- Off-street parking is located behind and sleeved by buildings, and is shared between different centre uses.
- Centres are planned with, and provide support for railway stations and/or significant bus services.
- Mixed-use centres and other employment generating activity areas are located to become strong destinations' in the public transport network.
- Planning for new residential areas is accompanied by planning for appropriate businesses and other employment generating activities in order to encourage as many locally based jobs as possible.
- An employment strategy may be required, especially for larger development areas, town and district centres or for strategically located sites and where required under a regional structure plan or other State or local government policy.
- Most commercial and business uses are integrated into mixed-use centres, rather than segregated in single-use business parks.
- Centres have an appropriate range of higher density housing both in and immediately around them.
- Sites suited for various types of home-based businesses are identified and provided.
- Large institutional uses such as universities, TAFEs and hospitals are designed as urban complexes, and should be located in or adjoining activity centres, rather than in campus-style, car-based stand-alone precincts.

- Most centre plans will show indicative streets and blocks, building layout plans and built form criteria, to ensure that they can be detailed up to create high quality streetscapes and public places that will form an appropriate focus for their communities.
- Building typologies that generate good street frontage become an important component of the centre planning process.
- To achieve good streetscapes, appropriate building types or forms are needed, that a particular focus on the ground floor, to support adaptability, economic change, and amenity over time.

General principles and background to objectives and requirements

Why mixed-use main street centres instead of enclosed retail complexes?

There are many benefits associated with the traditional street-based mixed-use retail centres, compared with the conventional enclosed mall format. These include:

- better urban and streetscape amenity, with ability to create a public realm with a sense of place and community ownership;
- better support of sustainable transport modes;
- better catalyst of mixed-use, jobs, service businesses, commercial and other complementary uses;
- much better capacity to incrementally evolve and adapt to changing economic and social conditions over time; and
- more support of higher density housing in close proximity.

In the post-industrial economy, fewer jobs are concentrated in industrial estates. Most are now focused into service businesses and small businesses, or in larger businesses that require a high amenity urban setting to attract both managers and staff. Recent research by Patrick Partners in Perth and Auckland shows that main street retail centres supported up to five times the number of non-retail jobs compared with enclosed retail centres or hybrid centres.

Main street mixed-use centres can also attract greater densities of both workers and residents. They are critical in the transition from a car-dominant community to one that supports public transport, walking and cycling.

Mall-based big box retail can deliver the benefits of good management of common areas and security. These management techniques could also be applied to main street models.

Relationship of this element to other wapc policies and guidelines

This element has been prepared to complement, support and extend the State Planning Policy 4.2: Metropolitan Centres Policy Statement for the Perth Metropolitan Region and to realise the objectives of Network city.

State Planning Policy 4.2, Policy 4.2.6 states, *"As far as practicable, centres at all levels should be developed or redeveloped in accordance with the traditional 'main street' principles as integrated, attractive, safe and vibrant places to provide a focus for community activities."*

This policy promotes main street mixed-use centres, with street-frontage retail, significant levels of employment provision, higher density housing, high amenity environments and facilitation of non-car transport modes. State Planning Policy 4.2 is to be revised to strengthen these and other requirements in response to the State Sustainability Strategy and Network City. This element will be supported by forthcoming WAPC Planning Guidance on Activity Centres and Employment Provision.

Liveable Neighbourhoods plans for town centres, rather than district centres, as a key element in the delivery of well-structured urban areas and the creation of a context for viable public transport, density housing, employment creation and a focus for a vibrant community. The differences between Liveable Neighbourhoods and State Planning Policy 4.2 will be addressed in the review of State Planning Policy 4.2.

Typical town centre main street retail locations relative to arterials

Pedestrian-scale retail main streets work best on streets that have traffic volumes in the range of 10 000-18 000 vehicles per day, but only have two lanes of slow moving traffic (ie 30 km/h), and on-street parking. To activate these streets, the anchor stores (supermarkets, discount department stores and mini-majors) need to be strategically located to support pedestrian flow past the smaller specialty shops, and should have the anchor stores opening onto the main street.

The core of a typical retail main street will be only 200-400 metres long, but will often transition into lower rent businesses on the edges of the centre. The latter play an important role in building robustness into the commerce, and providing more jobs in centres.

To best capitalise on the movement economy of passing trade, these town centres are usually best located adjoining and visible from (but not on) integrator A arterials. There are several typical relationships between integrator A arterials and successful retail main street centres (**figure 66**).

Other influences on the main street location will include climate (eg often north-south orientations are preferable), key views, or its relationship to a railway station, university or other major destination facility.

Local streets should be arranged to feed strongly into the main street, so that most nearby residents do not need to travel along a larger arterial to reach the main street. The strategic location of lights-controlled cross-roads (rather than roundabouts) on the arterials can facilitate both vehicle and pedestrian access into the centre.

Typical street and block layouts for main street retail and related anchor stores

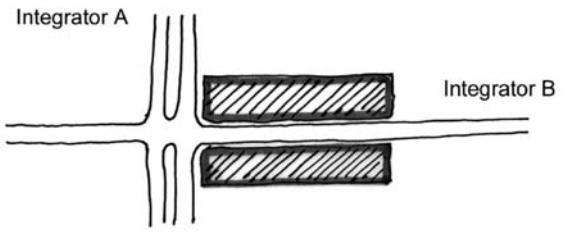
Town centre street super-blocks of around 180 m x 200 m have been found to typically provide sufficient space for an anchor store (supermarket or discount department store), plus its related main-street specialty shops, and sufficient off-street parking, while also allowing for a row of smaller non-retail buildings, including residential, on the other street frontages. The anchor stores will normally open out onto the main street.

Thus, a typical town centre might be provided for with three or four such street super-blocks, which total around 15-18 hectares for the mixed-use retail-dominant core. **Figure 67** shows a typical layout of four town or district centre super-blocks, and **figure 68** a detail of how a supermarket can be designed to front onto a main street.

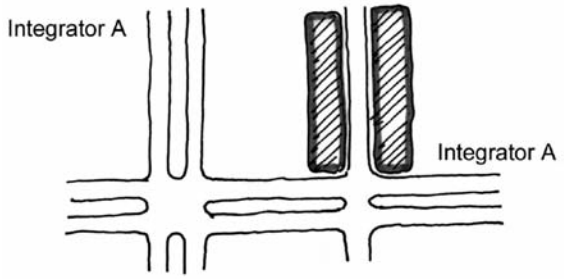
Buildings in centres will be laid out to front streets, and generally be located on or very close to the street frontage line. Off-street parking areas will be sleeved behind buildings in intra-block parking areas.

Table 12: Typical mixed-use activity centre types.

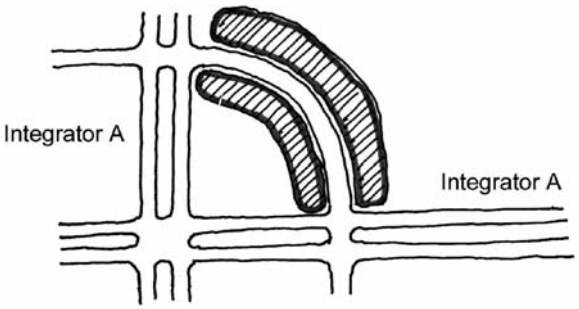
Strategic regional and regional centres
Strategic regional and regional centres provide for the widest range of activities and employment, and serve a population of typically 80 000-130 000+ in larger metropolitan centres such as Perth.
Typically they will contain a substantial amount of commercial, government, civic, entertainment and community-based businesses and employment, and medium and high density housing. They will often include major institutional uses (eg university, hospital, council offices, courts).
The role of retail is to attract regional employment by delivering an active and vibrant public domain, whilst satisfying the higher order retail demands of the catchment. Typically retail floor space ranges from 40 000 to 80 000 m^2 for these centres, with three or more anchor stores, many specialty shops and closely associated mixed business areas containing bulky goods outlets and other car-based retail forms.
Town (district) centres
Town (district) centres provide a community focus with a compatible mix of uses that satisfy weekly needs and have a wide range of employment generating non-retail commercial, service businesses, smaller light industries, medical centres, and community service employment. There may also be some institutional anchors such as TAFE and council offices.
This type of centre should be supported by six to nine walkable neighbourhoods clustered together, with a denser mixed-use core, to provide a base population of around 18 000 to 25 000 people. For smaller town centres this may be less, but for larger town (district) centres may be up to 30 000 people.
Typically these centres have retail floor space of 15 000 m^2, to 25 000 m^2, with two or three anchor stores (usually including two competing supermarkets), and diverse specialties, arranged to front streets forming the urban core of the mixed use centre
Neighbourhood and local centres
These will need to vary in size, depending on a wide range of case specific factors. The majority will be quite small, with many local centres only comprising a corner store of 100-250 m^2as the only shop and/or retail component. Some neighbourhood centres may be quite large, of around 4500 m^2.
On sites with more than a local residential catchment (such as coastal nodes or centres on major traffic routes), several shops and restaurants may also be supported in neighbourhood centres. Each neighbourhood centre should also provide opportunities for an appropriate range of other business uses, such as small business spaces or home-based business sites and often may include a private child-care centre.



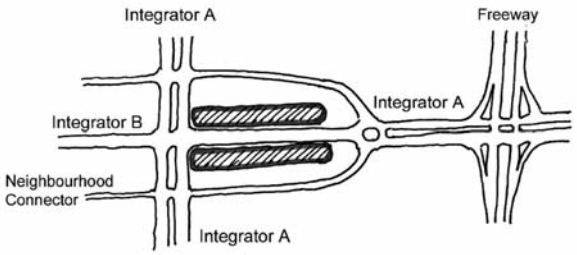
1.1 Main street on an integrator B, perpendicular to an integrator A



1.2 Main street parallel to one integrator A and perpendicular to another integrator A.

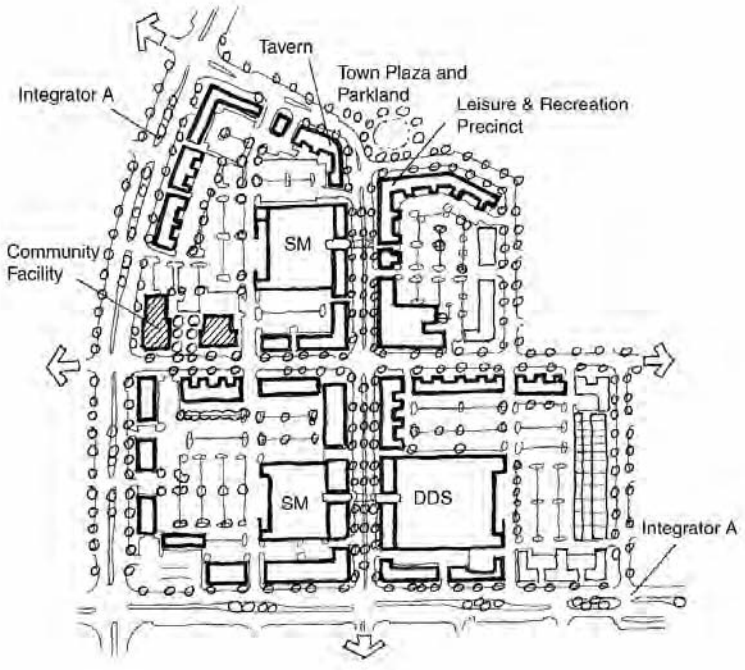


1.3 Main street diagonally linking between two Integrator A arterials



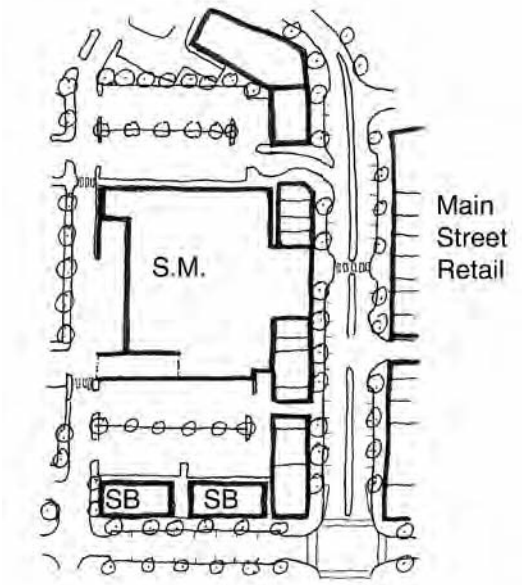
1.4 Main street on an integrator B that is achieved by using parallel routes to reduce traffic volumes on an integrator A as it passes through a town or district centre. (Suited to streets connected to freeway junctions).

Figure 66: Typical main street relationships to larger integrator arterials.



This centre comprises four town centre super blocks (with three of around 180 m x 180 m suited to accommodating anchor stores, and one smaller block containing a mini-major). The three larger centres have a rear lane providing access to the intra-block parking areas and loading docks (adapted from Point Cook Town Centre Concept Plan).

Figure 67: Example of a main street-based town or district centre structured as four street blocks.



The supermarket is central to the street segment, and has on-street parking, plus parking lots distributed either side of it and opposite it (additional parking may be provided on the roof or below the supermarket). The supermarket entry is around 25 m long, onto the main street and is flanked on each side by specialty shops that benefit from the movement of customers moving from the car parks along the street to the supermarket adapted from the Point Cook Town Centre Concept Plan).

Figure 68: Supermarket designed to front onto a main street.

Hybrid centre layouts incorporating some enclosed mall retail in a main street centre

This Liveable Neighbourhoods policy is not generally supportive of enclosed retail formats, principally because they do not activate the centre's streets, and are poor catalysers of non-retail jobs. There may be situations where a limited amount of the total retail floorspace in a main street centre can be provided in an enclosed format.

Where this occurs, the amount and location of the enclosed mall retail floorspace should comprise only a small proportion of the centre's total floorspace, and it should be located so it does not significantly reduce the effectiveness of any associated anchor stores to activate the main street retail.

Figure 69 shows an example of a main street retail layout with a small amount of enclosed mall associated with each anchor. Hybrids such as these should ideally be limited to situations where there is strong catchment for all the retail, and where the important smaller retail drawcards (such as chemists, post offices and newsagents) are located on the main street, not in the enclosed mall.

In larger regional centres, there may also be a limited amount of retail floorspace provided in enclosed formats or in pedestrian arcades, particularly comparison retail, provided as part of the overall retail mix. Again, the key is to ensure that the amount and layout of the enclosed component complements and reinforces the street-based retail, rather than weakening it. The exterior of any enclosed mall component or large anchor store should be lined with active frontages, unless that wall is flanking an intra-block car park. No blank walls or major loading and/or service areas should front or face streets.

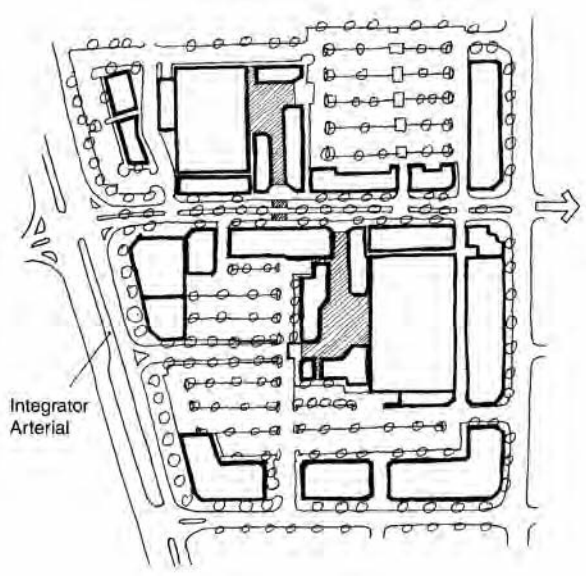
Larger neighbourhood centres

Larger neighbourhood centres (sometimes called village centres) are a model that has been used in limited situations, and comprise a centre (say 6000 –10 000 m^2 of retail), with a single full-sized supermarket anchor and limited non-retail businesses.

Under Liveable Neighbourhoods urban structuring, this scale of centre is likely to have limited application, as it is generally too small to catalyse substantial non-retail businesses, and it depletes the potential for stronger district and town centres to be supported in the vicinity. It may also reduce the potential for smaller neighbourhood centres to survive nearby, resulting in extensive residential areas with no local retail.

One-way arterial couplets in centres

A one-way couplet is produced when a four-lane or six-lane arterial is split into two streets, with development occurring between the one-way pair. Couplets in centres have both benefits and limitations, and require site-specific justification. They reduce the scale of the arterial, and can improve pedestrian crossing conditions and vehicle turning capacity, but they also require more traffic lights and can generate



This layout locates two anchors well apart, at either end of the main street so that movement between them activates main street retail. Car park accesses are also located to encourage pedestrian movement along the main street. Some drawcard convenience retailers (chemist and newsagent) would be strategically located along the main street. In addition, the proportion of specialty retail floor space that is in the enclosed format is relatively small.

Note: This layout will not support the main street shops as strongly as one where the anchors directly connect out onto the main street. This model should only be used in situations where it is not practical to front the anchors onto the main street and where there is strong retail demand for the total floorspace provided.

Figure 69: Hybrid centre: an example which mixes main street retail with small enclosed mall segments.

increased vehicle travel distances and turning movements. They often create a stronger outside and weaker inside business side, as parking on the inside can be less easy for people to use.

One-way couplets are generally not supported for main street retail streets, as it is preferable to have two-way traffic to support the retail frontage. There are usually alternative ways for couplets to reduce traffic volumes to around 15 000 vehicles per day through a retail main street.

Street types and parking in activity centres

In Element 2 - movement network there are three street sections specifically provided for town centres. These are **Figure 14** - integrator A (centres), **Figure 15** - integrator B (centres), and **Figure 23** - small town centre street. All these street sections have on-street parallel parking. In addition, other street sections provided (**Figure 20** - access street B) may be used or modified to suit a range of typical secondary streets in a town or district centre.

On-street parking on virtually all streets is an important component of mixed-use main street centres. It can be managed for maximum efficiency, and it provides an important buffer between moving vehicles and pedestrians.

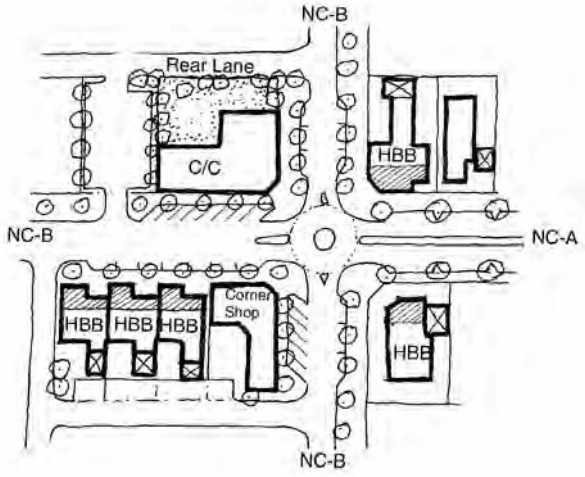
Some town centre streets may provide angle (or sometimes right-angle) parking. As a general rule, streets with volumes less than 7000 vehicles per day may incorporate angle parking. Typically, angle parking could occur in several of the secondary streets around a main street town or district centre, as it is a very efficient form of parking.

When a neighbourhood connector or low-volume integrator B passes through a neighbourhood centre, or small town centre, it may be able to be modified for short lengths to provide a reasonable amount of angle parking. Often the on-street parking alone can provide the majority of customer spaces required for smaller neighbourhood centres. **Figure 70** shows some typical angle parking layouts provided to serve a small neighbourhood centre at the intersection of two neighbourhood connectors.

Where angle parking is introduced on short segments of neighbourhood connectors or low-volume integrator B's, the street speed should be constrained as drivers approach the angle-parking segment. In many cases, a traffic safety audit may be required to support the angle parking location and layout proposed.

Where service roads are used on integrator arterials in centres, these service roads may provide angle parking.

Off-street parking is to be provided in areas behind buildings, totally or partially screened from the street. Preference is given to parking areas that are shared between many uses and managed as public parking, rather than separate parking lots being attached to each building. This shared parking approach usually enables a reduced amount of parking to be provided overall, and ensures that it is used to maximum efficiency. It is also able to better adapt to changing uses and demands over time.



A limited length of angle parking serving a corner store and related neighbourhood centre uses may often provide for customer needs, and thus limit the need for off-street car parking to staff requirements only. The on-street parking helps support the street-frontage location of the businesses, and stimulates support of the businesses.

Figure 70: Typical angle parking layout for neighbourhood centre.

In larger off-street parking areas, it may often be appropriate to designate a dimensioned area as a future multi-deck car park site. The access points to this site should be designed with this future in mind. The designation of these sites can accommodate the intensification of centres over time.

Key location and design parameters for neighbourhood and local centres

The small neighbourhood and local centres located to provide local retail, and possibly other services, in walking distance of most dwellings is a key element of Liveable Neighbourhoods. These centres not only provide a focus for the neighbourhood, but extensive research has shown that local mixed-use destinations are vitally important to generating walking trips and supporting physical activity.

A small retail store with a bus stop and post box, with some associated home-based business opportunities supported by higher density housing is a minimum component of a neighbourhood centre under Liveable Neighbourhoods.

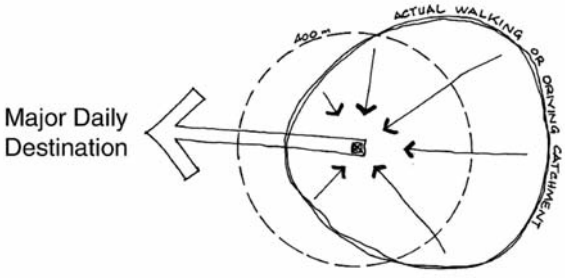
Neighbourhood and local centres cannot comprise just schools or parks, as these do not provide a sufficiently useful walkable node or regular destination for the majority of the population.

Achieving successful neighbourhood centres requires careful consideration of many factors. To support neighbourhood centre retail, it is not just a matter of identifying 400-metre radius circles across an entire residential area.

It is better to have fewer centres with better viability. Too few will result in many residents not being in walking distance of any centre. The design and spacing of the arterial and neighbourhood connector street network will influence the location and frequency of successful neighbourhood centres.

Key factors for a potentially successful neighbourhood centre with the minimum corner store include:

- a minimum local residential population of approximately 2000 people (60-70 ha at >13 dwellings per site hectare) in a 400-450 m radius, and including small areas beyond where lower density residential development might be located;
- central location in a good walkable catchments for local residents (**Appendix 2**);
- location on an intersection of relatively busy streets with good through traffic levels (eg total traffic of 5000 to 10 000+ vehicles per day);
- location generally towards the downstream end of the daily movement pattern out of the area (**figure 71**);
- location on the going home side of the road, or if not, then provision of easy vehicle turning movement (eg roundabout or median);



A typical retail catchment may be skewed, not circular, with the larger part of the catchment on the side remote from the major destination. This is particularly critical to the successful location of corner stores, but also applies to larger centres.

More custom will come from behind the centre, than in front, relative to the main travel direction. The good walkability of a central location needs to be balanced against skewing the location to benefit from this gravitational pull factor.

Figure 71: Typical shape of a retail catchment.

- good on-street parking in front and across the street, a bike rack and a bus stop;
- prominent and attractive building located on the street frontage, with some sun access, small plaza, landscaping and a veranda for shade;
- preferably a two-storey building, and often incorporating a dwelling;
- slight under-provision (rather than over-provision) of retail floor space, in order to maximise vitality and to minimise under-trading; and
- associated with several other small business premises, a post box, often a child-care centre, and/or several home-based businesses, perhaps in purpose-built live and work units.

Typical parking ratios for retail are often inappropriate for the corner stores in these centres. On-street parking is usually sufficient for customers, because demand is spread over long hours, visits are of relatively short duration and because many customers will walk or cycle to the store.

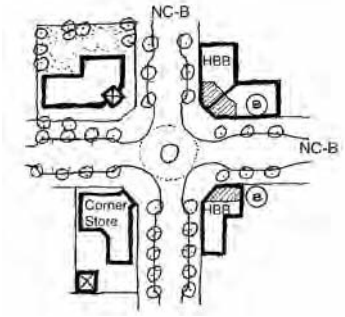
Figures 72 and 73 illustrate a range of typical layouts for neighbourhood centres. **Figure 74** shows in more detail an example of a corner store and/or cafe with a double-storey dwelling and a bed-sit or small business space.

In limited circumstances neighbourhood centres on busy arterials may include a service station with convenience store. To provide some local walking and urban amenity, these complexes can be designed to locate the convenience store as a corner building, with the petrol pumps tucked in behind (**figure 75**).

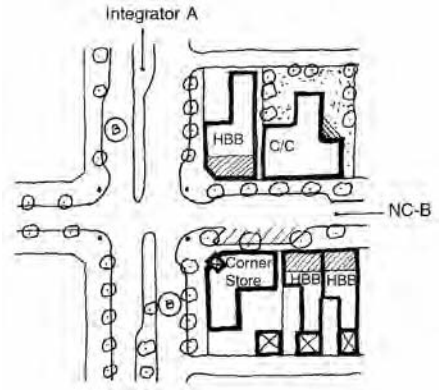
In other circumstances, neighbourhood centres can be located on the edge of a local industrial estate. This provides lunchtime worker trade and broadens the merchandise available, as well as providing a retail outlet in walking distance of the workers.

Schools and neighbourhood centres

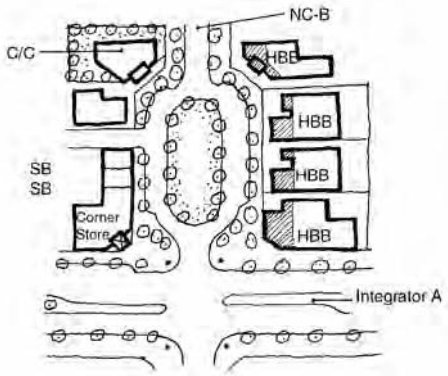
In general, schools are preferably located outside the neighbourhood centre walkable catchment. This is for three key reasons: firstly, a school normally serves a wider catchment than just one neighbourhood. Secondly, schools are relatively large (over three ha) and occupy a large amount of the core of a walkable neighbourhood. Thirdly, schools are a focus for only a limited number of households in a neighbourhood given today's smaller and more diverse households. Schools should usually be located midway between two or three neighbourhoods.



72.1 Intersection of two neighbourhood connector streets (adapted from The Strand, Point Cook Concept).



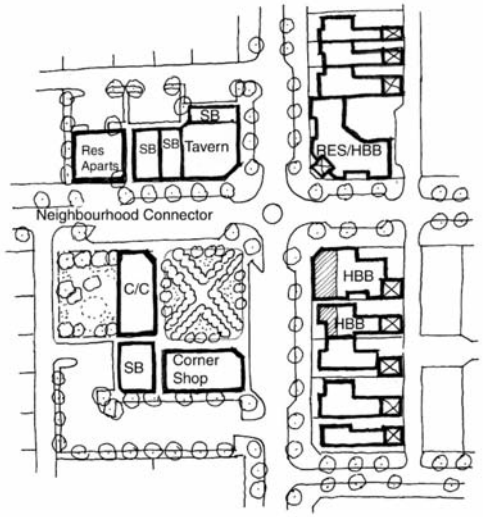
72.2 Intersection of two-lane street and major arterial.



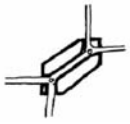
72.3 Neighbourhood centre at junction of major arterial with feature median and traffic lights

72.4 Turbine plaza feature intersection (adapted from Vermillion, USA, concept).

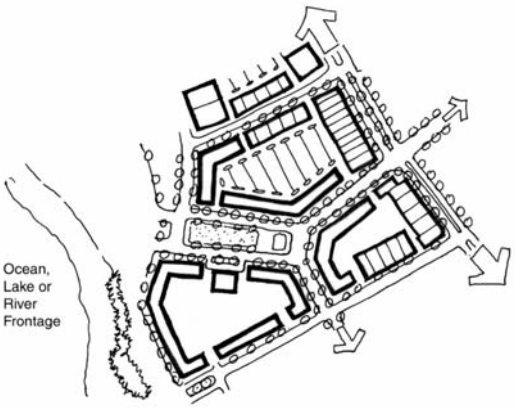
Figure 72: Typical small neighbourhood centre layouts.



73.1 Centre focused around a small park or plaza.

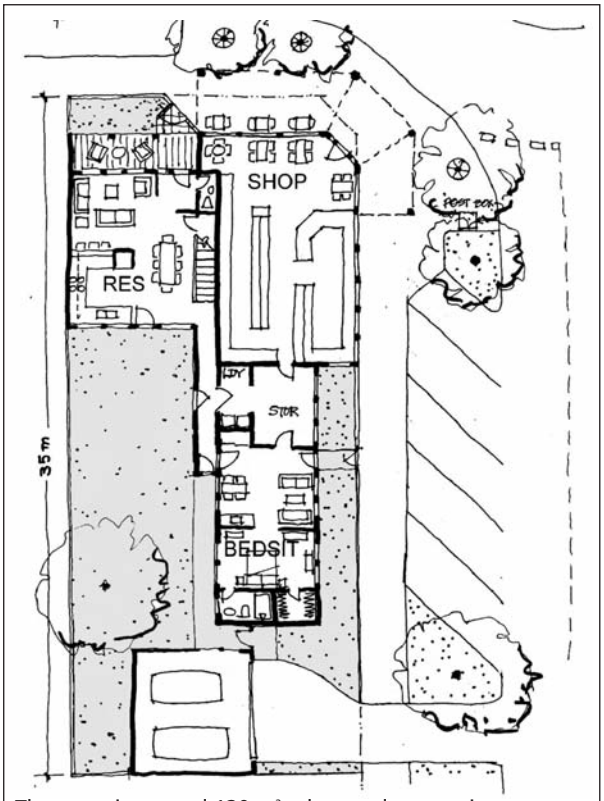


73.2 Centre on a street segment where two streets come together as one, to focus sufficient traffic movement and activity (adapted from Tullimbah Village, NSW).



73.3 Centre suited to framing views, such as the ocean (adapted from Jindee preliminary concept).

Figure 73: Typical larger neighbourhood centre layouts.



The store is around 120 m², plus outdoor seating area, and the lot is around 550 m²(approx 16 x 35 m).

Figure 74: Ground floor plan of a typical neighbourhood corner store and/or café with attached double-storey residence and bed-sitter small business space.

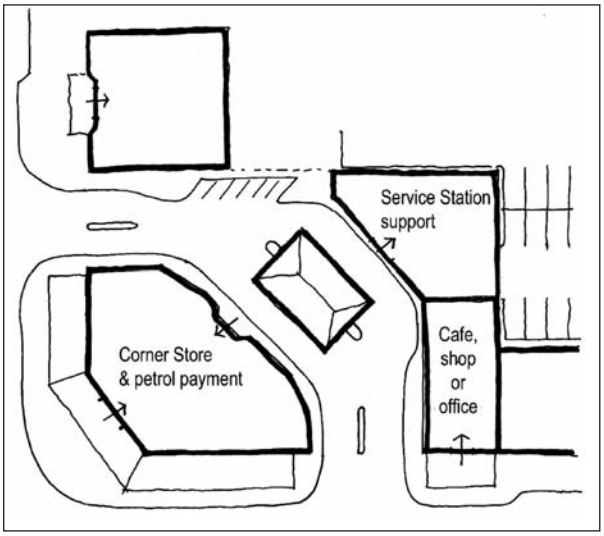


Figure 75: Combining a service station and neighbourhood centre retail to create an urban corner.

There will be occasions where schools can be located towards the edge of a neighbourhood, in a way that creates a good relationship with the neighbourhood centre. In limited circumstances, schools may be located in the core of a neighbourhood centre. This is where the school is small, and/or has a separate sports field. Where this does occur, the school administration building should be located so as to contribute to the form and function of a neighbourhood centre. Element 8-schools addresses the location and layout of schools in detail.

Interim school buildings occupying shops, offices or houses in a neighbourhood centre help activate the centre in the early stages of a development. These interim arrangements also occupy and help fund buildings that can later be used for shops and offices as demand increases.

Integrating large-format stores or car-based big box uses into a walkable urban activity centre

Large-format bulky goods or factory outlet-type stores are a major challenge to walkable mixed-use centres, as the buildings are often out-of scale and the parking areas required are substantial. As these uses draw on a regional, rather than a town (district) or neighbourhood catchment they require high visibility and high levels of accessibility to large residential catchments. These uses should be located in proximity to high volume transit corridors, on fringes of activity corridors, or in business areas associated with regional centres and have accessibility to the regional road network. They should not be located in the walkable catchment of neighbourhood centres and should not consume more than a very small portion of the catchment of a district centre.

These uses frequently draw on a regional, rather than a town (district) or neighbourhood catchment. Where such retail formats are permitted, careful location and design is imperative to ensure they contribute positively to the centre and do not create low quality strip retail areas.

There are now several examples of large-format stores or complexes that do integrate reasonably well in centres. These include:

- stores that front to streets and sleeve most parking in behind;
- stores that use rows of long, narrow store formats rather than stand-alone square buildings;
- stores arranged as urban squares;
- stores that provide smaller-scale liner buildings and uses along otherwise blank walls facing streets; and
- double-storey complexes, or up-escalator store formats on the first floor of multi-storey mixed-use buildings, with pedestrian-scale retail at the ground floor.

Providing denser housing in activity centres

Medium or high density housing should be located in and nearby all mixed-use centres. Mixed-use centres should include both commercial and residential uses and preferably also include office uses. Centres that do not include residential uses do not meet the definition of a mixed-use centre. These centres should provide a range of housing types, sizes and affordability choices. Housing in upper storeys of mixed-use buildings is strongly encouraged. This not only provides centrally located housing, but also helps to create a sense of urban scale and intensity along the streets. In addition, residential activity provides improved community safety to the centre.

Housing in these centres are important for providing adequate walkable custom and for supporting public transport services.

Planning for employment and business

In WA at present, each household, on average, requires around 1.3 jobs. A new 1000-lot residential subdivision will, therefore, require a total of around 1300 jobs. It is desirable that as many of these jobs as possible are provided in the local area.

Locally available employment is vital to creating relatively self-contained and vibrant communities with diverse employment choices. It also helps limit car travel, and reduces pressure to expand major roads to distant employment nodes. It also improves equity, especially for those needing low income part-time jobs, and helps support inward or destination custom on public transport.

Targets for local employment self-sufficiency may be set for new growth areas, and these typically range from a minimum of 30 per cent to over 60 per cent of the total jobs required. A figure of 60 per cent is suggested as a starting point for district structure plans where no alternative target has been set. An employment strategy may be required, especially for larger development areas, town (district) centres or for strategically located sites.

Achieving high levels of local employment requires planning for a diverse range of business and employment generating activities as part of the planning of new residential areas.

Most jobs in the 21st century economy do not occur primarily in the typical large-scale industrial estates of the past. Instead they are diverse in nature, and are often in small businesses and other activities in the service economy. Increasing numbers of jobs are part-time and relatively low-paid, and opportunities for this type of employment should be provided a short travel distance from residents.

These new jobs are best generated by vibrant, attractive mixed-use street-based centres, with appropriate sites and precincts provided to suit different needs, and a development form that is responsive to change.

Many types of business require or benefit from sites with particular characteristics. Liveable Neighbourhoods encourages strategic sites be identified for potential business uses. Interim development on these sites should not prejudice the option of later adaptation as the demand for employment generating activities increases.

The form in which commercial and business land is provided under this element will be quite different from past practices. Commercial and business uses are now to be integrated into mixed use, main street activity centres rather than being provided in single-use purpose built business parks. In addition, large institutional uses such as universities, TAFEs and hospitals should be designed as urban complexes, located on efficient sites in activity centres, rather than built as campus-style, car-based stand-alone precincts.

Spatially efficient, multi-storey buildings are encouraged in centres, so that these business and employment precincts are walkable and supportive of public transport.

In addition, there will be requirements for areas of light industry, warehousing and storage, and possibly for heavy or noxious industry. These uses are important and require appropriate and large sites with good highway access. These uses cannot normally be expected to generate many of the required jobs and should not be located in neighbourhood catchments.

Home-based business

Many jobs are now generated in home-based businesses. Up to 16 per cent of dwellings now have a home-based business. Sites suited for various types of home-based businesses should be identified and provided in all new urban areas. Some key types of home-based business sites include:

- sites with arterial road or service road frontage for home businesses needing high visibility, traffic exposure and good access;
- sites needing pedestrian exposure in centres, or seeking active environments with high amenity (eg for professional offices on the ground floor of, say, three-storey live-work dwellings);
- sites for service trades operators (eg plumbers, landscape gardeners) to be based, and to store goods and vehicles. These may include rear-lane based home workshops in enlarged garages;
- sites in neighbourhood centres for local services (eg hairdressers) and other uses; and
- other sites with no specific locational features but capable of providing adequate on-street parking for outside workers or occasional clients.

Definitions of employment self-sufficiency and employment self-containment

There are two main measures of the ratio of jobs in an area relative to the population. These are:

- **employment self-sufficiency:** the proportion of total jobs in an area to the total number of jobs required by the resident workforce (eg 1200 jobs for 2000 workers = 60 per cent employment self-sufficiency). This is usually the first factor to consider in planning for business and employment, to ensure that sufficient and appropriate land and urban context is provided; and
- **employment self-containment:** the number of jobs occupied by the resident workforce of an area, relative to the total number of jobs needed by a population (eg if 600 of the local jobs available are occupied by the 2000 local workers, then the employment self-containment is 30 per cent). This factor is important to providing local jobs for local people, and planning for good employment self-containment involves matching the type of jobs available (or to be provided) to the type of local workforce.

Public transport and overall density in activity centres

Under this policy the concept of concentrating employment, retail, major community and government services, and significant residential into mixed-use activity centres is not only to generate the many synergies between these uses, but also to enable these centres to function as key hubs and strong destinations on the public transport network.

Public transport use, the level of mixed-use and the style or method of retail and entertainment development are inextricably linked, as summarised below.

- In order to promote higher public transport use, intensification of land use is required in close proximity to transit stops.
- Retail stores facing streets inspire intensification and mixed-use activity in centres. Intensification and levels of mixed use are a major factor in generating transit trips and walking, and are heavily reliant on public domain quality (amenity).
- Public domain quality in centres is a function of the relationship between retail stores or ground floor activity and the public domain.

The structuring of centres to ensure higher intensity activities and key public transport generators are located in 400 m, and preferably 250 m, of major public transport stops is vital.

Provision of transport interchanges or hubs may be appropriate in many larger centres, particularly where bus and/or rail transfer is likely to be significant. In many centres, bus stops may best be provided on-street rather than in dedicated bus stations.

Achievement of adequate overall densities of residents and workers, and an appropriate balance between residents and workers is critical to the success of both centres and public transport. **Table 13** provides a guide to calculating resident and worker densities for different centre types.

Table 13: Urban intensity and typical residents and workers per hectare targets for different types of centres.

To estimate the urban intensity (combined density) of a mixed-use area, a useful measure is the total number of residents (R) and workers (W) in a given area.

For town (district) centres, this might involve an assessment of the area in 400 m of the core 15-20 ha of the centre. This is typically about 200 hectares. For typical residentially dominant neighbourhoods, it can be calculated for the 400 m radius around the centre and is 50 hectares.

For different types of centres, the proposed ratio of residents to workers can also be assessed, to ensure that the larger centres will be sufficiently jobs-dominant. Some broad rules of thumb for planning target resident and worker densities and ratios in different types of centres are given below.

Regional centres	90 - 150 R+W/ha; (1R: 2-3W)
Town (district) centres	65 - 90 R+W/ha; (2-3R: 1W)
Neighbourhood centres	40 - 65 R+W/ha; (5+R: 1W)

(derived from Victorian Urban Villages Project, Energy Victoria, 1996)

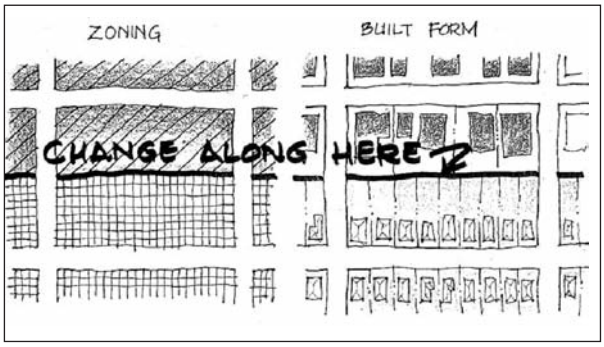


Figure 76: Changing uses at the mid-line of a street block.

Objectives

O1 That new residential areas are provided with sufficient and appropriately located land for activity centres and other employment and business needs.

O2 That activity centres, more intensive integrated employment areas and tertiary education facilities are located in walking distance of existing or proposed public transport nodes, and that adequate development intensity and land use mix can be provided to support public transport services.

O3 To facilitate activity centres that are structured as mixed-use centres in a predominantly main street based format, and are detailed to provide a high quality public realm supportive of public transport, walking and cycling in addition to good car and service vehicle access.

O4 To facilitate well-distributed town (district) and neighbourhood centres throughout the urban area, such that a substantial majority of dwellings are in a 400 to 500 metre radius of a centre, such centres can support, at a minimum, daily local retail, a post box and a public transport stop.

O5 That mixed uses centres are located and designed to encourage a broad mix of land uses that includes residential, commercial and office uses.

O6 To provide adequate areas for low intensity industrial development and car-dependent service businesses in locations that are appropriate in terms of heavy vehicle access, client exposure, compatibility with surrounding uses, and that are not in core public transport nodes or in the walkable catchment of a neighbourhood.

O7 To provide for appropriate industrial and low intensity non-retail business in strategically-located land adjoining freeway intersections and major arterial roads to take advantage of the accessibility and exposure.

O8 To identify a variety of appropriate locations for live and work dwellings and home-based businesses, and to ensure that detailed design and planning provisions can encourage their use for workplaces.

09 To promote the restructuring of existing urban areas to improve the distribution of centres in walking distance of residences, and to upgrade the quality and function of existing centres to support mixed uses, public transport, walkability, intensification, sense of community, amenity, and reduced car travel.

O10 To encourage major civic, cultural and community facilities (such as council offices, performing arts centres, tertiary institutions, hospitals) to be located in centres, and are designed as well-integrated, land-efficient urban buildings, rather than in campus layouts.

O11 To recognise that centres and employment areas often develop later than their surrounding residential areas, and to put in place mechanisms to facilitate appropriate interim uses, together with a strategy that easily facilitates gradual intensification over time.

O12 To facilitate the identification of, and the achievement of appropriate employment and jobs targets in association with new residential areas.

O13 That an appropriate amount and variety of medium density housing is provided in and around activity centres.

O14 That appropriate employment and business development strategies be required as a component of structure plans.

Requirements

Application requirements

R1 Locations, sizes and indicative layouts of activity centres and other non-centre employment areas are to be shown on district and local structure plans. Information on the estimated number of retail and non-retail jobs should be provided. Where required under a regional structure plan or other state or local government policy, an employment strategy is to be submitted.

R2 Adequate and appropriate sites for businesses are to be provided on subdivision plans. Super lots may be created, provided that a detailed area plan is submitted to demonstrate proposed massing and layout.

R3 Detailed area plans may be required as part of a structure plan approval to accompany or follow subdivision applications for activity centres, other employment areas or super lots.

Provision and location of activity centres

R4 Provide appropriate and adequate distribution of regional, town and neighbourhood centres. Consideration must be given to the influence of, and affect on, existing centres in the catchment.

R5 Centres are to be located on and integrated with the arterial road and neighbourhood connector street network, to optimise the benefits from the movement economy. No centre should be located in an area isolated from major streets.

R6 When a centre is to be located on an intersection of multiple property owners, the allocation of each component of the centre should be clarified between the different properties.

R7 Wherever practical, new development should support and enhance existing centres that are appropriately located to serve the new area.

Regional centres

R8 New regional-scale centres should be structured to facilitate development of predominantly multi-storey street frontage-based, mixed-use layout buildings, with on-street parking, and additional parking at the rear of buildings.

R9 Regional-scale centres should be structured to be jobs dominant, with sufficient capacity for non-retail employment to be at least five times the anticipated retail employment.

Town (district) centres

R10 New town or district centres should be structured in a predominantly main street mixed-use layout, preferably multi-storey, with on-street parking, and additional parking at the rear of buildings. All secondary streets should also be fronted by development.

R11 Sufficient retail should be provided, and be located and designed to act as a strong catalyst to help generate other (non-retail) employment generating activity.

Large neighbourhood centres

R12 Large single supermarket-scale neighbourhood centres (generally over 6000 m^2) should not be provided unless it can be demonstrated that such centres will not adversely affect the provision and location of successful larger town centres, or constrain the distribution of neighbourhood centres in walking distance of most residents.

R13 Where large neighbourhood centres are proposed, they should be in a main street layout with on-street parking, additional parking at the rear of buildings, and built frontage to secondary streets (**figure 68**).

Neighbourhood and local centres

R14 Neighbourhood centres should be located and distributed to provide a centre for most residents in a 400-500 m walk. Centres should be on sites that have adequate surrounding custom, sufficient traffic, and appropriate exposure and amenity to provide for the successful operation of the centre.

R15 Neighbourhood centres should seek to include local office and higher density residential.

R16 Some neighbourhood centres may need to be as large as 4500 m^2 of retail floorspace; however, the significant majority will be smaller local centres. The minimum requirements of a neighbourhood centre are to be a small convenience shop, a public transport stop and a post box. Land for several additional uses (such

as a child-care centre, home-based businesses, small businesses or other local activities) should be provided, together with some medium density housing and possibly a small plaza or park.

R17 In most circumstances, schools will not be located in the core of neighbourhood centres. Sites between two or three neighbourhood centres are preferred (Element 8-schools). Small interim schools (schools in shops or offices or houses) should be located in neighbourhood centres.

R18 Buildings are to be located to abut and address streets or public plazas and/or parks. The core of the centre should be greater than one storey in height. Buildings are to be located and detailed to create a strong and identifiable sense of place, with public space detailing appropriate to pedestrian scale.

R19 Customer parking is to be provided mainly off-site and preferably on the street. On-site parking should primarily be limited for staff and residential use, located either to the side or rear of a building. No parking is to be located on-site between the building frontage and the street.

R20 Where service stations and related convenience stores are to form a key part of neighbourhood centre, the layout of the development should be modified to create an urban street edge and frontage, with the petrol pumps located behind the convenience store or other retail components.

Provision of land for employment and business

R21 In new urban development areas, that in the opinion of the WAPC or local government are remote from employment areas, sufficient and appropriate sites should be identified in structure plans for employment and business opportunities to provide adequate jobs for the new residential population. These may take the form of sites available for short-term development of business uses, as well as residential areas that might be capable of adaptation and/or business uses in the longer term.

R22 The layout and location of land for employment and business uses should seek to be integrated into mixed-use centres, and located in walking distance of public transport stops.

R23 Land fronting arterial roads in and close to regional town and district centres is to be predominantly designated for business uses or be suitable for later adaptation for business or other employment generating uses.

R24 Land designated for future business use may, if demand does not exist in the short term, be used for suitable interim uses. Where such interim use includes housing, a detailed area plan may be required to facilitate the orderly conversion of the area from residential to business uses.

Industrial and warehousing precincts

R25 Land for smaller-scale light industrial, warehousing and storage, and service industries may need to be provided to serve a local population, in relatively close proximity to the residents. These areas should be served by public transport and be in close proximity to a neighbourhood or larger centre.

R26 Where required, and where suitable sites exist, land should be identified for heavy industries or large-scale warehousing or distribution uses. Such areas should have good highway access, and should usually not be in walkable catchment of a neighbourhood, town or regional centre.

R27 Where existing or proposed uses are required to be separated from other uses, the use of a buffer may result in compatible business, recreation or other uses.

Strategic business sites

R28 Potential strategic business sites should be excluded from residential use. These sites may include freeway interchanges, frontages to freeways, many arterial road intersections, or sites with strategic suitability related to local resources.

R29 Sites along the coast or other high amenity areas that are suited to development should be considered for mixed-use tourist or recreation nodes.

R30 Outside centres, service roads should be provided, wherever practical, to major arterial roads. Lot layouts should be designed to be adaptable to a range of uses over time. Closed loop roads or other forms of development

frontage to the arterial road that cannot be accessed easily from the arterial road should be minimised.

Home-based businesses

R31 In local structure plans, a range of sites should be identified as suitable for home-based business. Methods to promote the take-up of these sites for home-based businesses should be described. A detailed area plan may be required to assist with the establishment of home-based businesses.

R32 A wide variety of different types of sites, including sites with good traffic exposure on arterials and neighbourhood connectors, sites in neighbourhood centres, suited to home workshops and trades businesses, and live and work opportunities in centres and/or in areas with high amenity.

R33 A minimum of five per cent of all residential lots should be identified for home-based businesses requiring specifically targeted sites as listed in R32 above.

Mixed use compatibility

R34 The street and building layout and interface treatment should provide for compatibility between different uses. Urban land should be used efficiently so that compatibility is achieved without relying on spatial separations between uses.

R35 In most situations, changes of use or of significant development intensity should be made at the mid-line of a street block, rather than at a street frontage. Similar forms of development should front each other across a street to provide compatibility and legible streetscapes.

Street layout and parking in activity centres

R36 Centres should comprise a network of streets that encourage pedestrian activity, facilitate crossing of busy arterials, enable ease of local vehicle movement, provide extensive frontage for development, and define blocks that can accommodate mixed-use development and off-street parking.

R37 In centres, the spacing of local streets connecting to integrator A and B arterials should be close enough to create relatively small pedestrian-scale street blocks. In most centres, the design of the street network will require a site-specific study to balance the traffic aspects of intersection spacing with the requirements for creating an appropriate street network for a successful urban centre.

R38 In the retail core of town or district centres, adequate larger street blocks (typically around 180 m x 200 m) are provided to enable the anticipated anchor retail stores to be incorporated into a main street layout.

R39 In centres, most streets should be designed to provide on-street parking. Some streets, particularly secondary streets in larger centres, and streets at neighbourhood centres, may be designed to including angle parking.

R40 In new centres, the number of on-street spaces provided is to count towards required parking provision for non-residential development in the centre.

R41 In centres, off-street parking is to be located in intra-block car parks and usually located behind buildings. In some circumstances, parking may be located beside buildings, particularly if this is an interim situation, and future development will occur on the street frontage. Car parks should not be placed between the front of buildings and the street.

R42 As far as practical, off-street parking should be located, designed and managed to maximise efficient use of spaces, and thus to minimise the total area of land provided for parking. This may be achieved by ensuring car parks serve multiple businesses and different uses, which have peak demand requirements at different times. Parking dedicated to single uses should be minimised.

R43 Land may be required to be set aside as public car parking, especially where shared use is intended.

R44 To enable future intensification of larger centres, some off-street surface car park areas should be designated, dimensioned and provided with appropriate access to facilitate future insertion of efficient multi-deck car parks.

R45 Multi-deck car parks should be located and designed to minimise affect on the street through the use of innovative architectural features and where possible through the sleeving of the bulk of the car park behind other buildings.

Urban locations and formats for universities, TAFEs, hospitals and other institutional uses

R46 Major institutional uses should be located in or adjoining centres. They should be well connected by streets into the core of the centres, and to the main public transport services serving the centre.

R47 Institutional uses should be designed in an efficient urban layout rather than in land-extensive campus-style layouts. Buildings are to front streets, be multi-storey wherever practical, and parking is to be screened behind buildings.

R48 State and local government offices, civic and community facilities should, be located in centres. They should be designed as urban buildings with good street frontage, and be located and detailed as landmark buildings where appropriate.

Integration of activity centres and other employment areas with public transport

R49 Centres are to be located and designed to support public transport. In walkable catchments of rail stations or major bus stops, uses should be of sufficient density and diversity to generate passenger inward and outward movements. Larger centres should specifically establish uses that provide strong destinations for public transport users.

R50 Centres should provide well-located bus stops in approximately 250 m of all parts of the centre. Bus stops should be safely accessible from both sides of the street, particularly on arterial roads. This may be achieved by careful treatment of intersections and by locating bus stops at traffic-lighted intersections wherever practical.

Design for community safety in centres

R51 The detailed layout and design of centres should ensure that a safe, well-defined public realm will be produced.

R52 In achieving safer communities, consideration should be given to the WAPC Designing Out Crime Planning Guidelines which should be incorporated into all design and development components of a centre.

Creating attractive, high amenity urban centres

R53 The detailed design of all centres should seek to achieve a strong and unique sense of place and local identity, and this should be derived from the local natural and cultural context. The street layout and broad structure of the centre should be an integral part of achieving these outcomes.

R54 Centres should be provided with an appropriate range and distribution of public spaces, including urban squares, plazas, parks and other incidental public spaces.

R55 Centres should be detailed to create a high quality street environment with shade, shelter, trees, pavement treatment, street furniture, landscaping, and urban art.

R56 The planning and design of a centre should be informed by the community it is intended to serve. Pro-active methods for community participation should be incorporated into the design development phase.

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Element 8

Schools

Introduction

School sites are an important element in designing and establishing communities. It is especially important that the location and size of school sites, including the design of the surrounding road network and parking, is carefully considered to enable the community design objectives of this policy to be achieved.

This element has been prepared to facilitate site responsive design to allow flexibility for a number of design scenarios and locations for school sites, and to protect surrounding residential amenity.

Experience has shown that there is a correlation between the number of single residential lots created by subdivision and the need for school sites. Although that correlation is useful in determining a broad need for new school sites, it is necessary in each particular case to assess that need against allocated school sites, established schools, rate and type of development (including the consideration of demographic profiles and lot pricing policies), and the opportunities for co-location of other human services. In this regard, it is important that consideration for the provision of school sites is undertaken at the sub-regional and district structure planning stage and in consultation with both government and non-government education providers.

Key differences from conventional practice

Primary schools

In 1998, the WAPC amended its policy on primary schools from one school per 1200-1500 lots to one school per 1500-1800 lots. More recently, this has resulted in larger than anticipated student populations on sites. There is therefore, the need to reduce the ratio to an average of one primary school per 1500 lots.

Traditionally, primary schools were seen to be ideally located in the centre of one neighbourhood adjacent to shopping, sporting, recreational and cultural and/or community facilities.

The planning for primary school sites promoted in this element allows for a number of design scenarios. For example the WAPC considers there is a close association between the planning of neighbourhoods and primary schools. Importantly, it is the social value of primary schools that has a vital role in the development of urban areas. In particular, the role of the primary school as a key place making element needs to be respected in the design of new urban areas.

The preferred location for primary schools is not necessarily on the edge of three neighbourhoods or at the centre of one neighbourhood, but located on a neighbourhood connector with good accessibility for walking, cycling and public transport together with vehicular access.

As a result, this element allows for primary schools to be located in one of three locations depending on the characteristics of the existing and planned neighbourhoods. This may be:

- at the edge outside of the 400 m radius neighbourhood centre catchment, serving in the order of three neighbourhoods;
- on the neighbourhood connector road between two neighbourhoods; and
- at the centre of one neighbourhood (with reduced size and separate sports field).

It is the responsibility of the developers in association with the relevant agencies to determine the preferred location of primary schools. The objectives and requirements in this element then provide guidance and direction as to the design requirements under each scenario.

Secondary schools

Secondary school sites are acquired by the State government at the rate of approximately one secondary school per 6500 - 7000 lots.

The Department of Education and Training provides a range of models for high schools including senior high schools (years 7/8 - 12), senior schools, (years 10 - 12), middle schools (years 6/7 - 9) and K12 (kindergarten to year 12).

General principles and background to objectives and requirements

Provision of school sites

Government secondary school sites and Tafes are acquired by the State government ideally in advance of urban development in the surrounding community. Primary school sites are to be given up free of cost by the landowner supporting the school site and pro-rata contributions provided by the landowners in the catchment of the primary school site. Non-government school sites are to be acquired by their providers.

TAFE (technical colleges)

Tafes should ideally be located in urban centres as discussed in element 1 and not in campuses which has traditionally been the case.

Facilities will range in size depending on the range of programs, style of facility and likely future growth. The general TAFE requirement is one facility per 60 000 to 70 000 people, but in closely populated areas, could be as high as 1 per 250 000 people.

Location

School sites should be located to maximise accessibility, as well as managing traffic congestion at peak periods, including drop-off times and more particularly, pick-up at the end of the school day.

Primary schools should be positioned with access to a neighbourhood connector and surrounding access streets. Secondary schools and TAFEs should be located on neighbourhood connectors in 800 metres of a transport node.

The location of school sites should be identified in district or local structure plans. Subsequent more detailed planning process, may identify the need for school sites to be relocated or reconfigured to better meet the needs of students and education providers, which may in turn require a modification to the approved structure plan.

A fundamental issue for the design and layout of schools is the WAPC preference for schools to form part of the community, and to discourage the need for high fencing of school buildings and the school site, while still maintaining an appropriate level of security too. It is essential that the surrounding uses and buildings overlook schools and that the internal layout of the school promotes view corridors to maximise visibility. Low open fencing is also encouraged to delineate public and private spaces.

Recreational areas and open spaces are an important component in the delivery of education. It is appropriate that these areas are also accessible by the general community after school hours.

Shared ovals with local government and school sites are encouraged to improve land efficiency, and allow the provision of smaller school sites. This arrangement will generally require a maintenance agreement with the local government to guarantee exclusive use rights particularly for primary schools during school hours, and that the ovals will remain available to the public in the long term.

Interim school buildings

Interim school buildings are an ideal way in which to achieve the early delivery of education in a community and/or accommodate peak student numbers. More recently, these have been in the form of schools-in-shop' and schools-in-houses. Schools-in-shops have the added advantage of contributing to the early establishment of the neighbourhood centre through guaranteed rental returns for the first few years. Schools-in-shops or houses, can be used where there are not sufficient student numbers to support the establishment of a new school, or where existing school sites are at capacity.

The WAPC supports the concept of interim school buildings as they have the advantage of improving land efficiency and can generate early activity in activity centres.

Demand for school sites

The Department of Education and Training, Catholic Education Office or other non-government school system providers require the following provision of school sites as outlined below in **table 14**.

In some circumstances, particularly in country areas, the provision of separate primary and secondary schools cannot always be justified. The provision of a shared site with other education providers may be required.

Table 14: School site provision.

	Primary schools	Secondary schools
Government	One site per 1500 housing units	One site per 6500 - 7000 lots
Non-government	One non-government site to three government primary schools	One non-government site to two government secondary schools

Consultation

Those involved in structure planning at both the sub-regional and district level together with more detailed planning at the local structure plan and subdivisional stages should confer regularly with the Department of Education and Training, WAPC, Catholic Education Office and other non-government school system providers in the early stages of the design process to determine the preferred location, size, acceptability and design for school sites.

Consultation with the Department for Community Development may also be able to assist in determining the need for, and correct location of, any sites for children's services facilities.

Objectives

O1 To set aside adequate and appropriate government and non-government school sites to accommodate the educational needs of existing and future communities.

O2 To establish the requirements for the number and location of school sites at the sub-regional and district structure planning stage.

O3 To encourage consultation with the government and non-government school providers at the structure plan, subdivision and detailed design phases.

O4 To provide a surrounding street network system that is appropriately designed to accommodate safe access and on-street parking.

O5 To encourage public buildings to have an appropriate interface with adjoining land uses.

O6 To enable schools sites to be located and designed to promote safe walkability, cycling and access by public transport consistent with the requirements of this element.

O7 To encourage efficient use of land for schools, including co-location of schools and open space (in consultation with the local government) for access by the general community.

O8 To support the concept of schools-in-shops and schools-in-houses to facilitate the early establishment of schools in communities and accommodate peak demands in student numbers.

O9 To provide flexibility in the size, location and design of schools such as those in regional areas, and to support children's service facilities on school sites including out-of-school care, special education and health facilities.

O10 To provide school sites with developable level land, and without encumbrances such as high tension power lines, regionally significant urban bushland or easements.

Requirements

Application information requirements

R1 Written confirmation of acceptance by the appropriate school provider as to the location and configuration of a school site should be provided when submitting a structure plan with the local government.

Provision of school sites

R2 School sites shall be identified in district structure plans, local structure plans and plans of subdivision. They should generally be provided in accordance with **table 14**.

R3 TAFE sites should be determined based on the specific needs of the region in consultation with the Department for Education and Training as outlined in Element 1 - community design.

R4 The number and location of school sites required shall be determined in consultation with WAPC, Department of Education and Training, Catholic Education Office and other non-government school system providers as appropriate.

Location of school sites

R5 A government or non-government primary school site should be located in one of three locations as outlined below:

- at the edge or outside of the 400 m radius neighbourhood centre catchments, serving approximately three neighbourhoods (**figure 77**);
- on the neighbourhood connector road between two neighbourhoods (**figure 78**); and
- near the centre of one neighbourhood (**figure 79**).

R6 A secondary school site should be located on public transport routes and major road frontage with good walking and cycling access.

Size of school sites

R7 The size of school sites, whether for a government or non-government school, may vary depending on the context, location and characteristics of the site.

R8 Variations to the size of school sites may occur where:

- they are located in an urban centre to accommodate land efficiency;
- there is only a portion of a school catchment; and
- an interim school is provided.

R9 The size of government secondary school sites should generally be as follows:

- 10 ha for a senior high school site (years 7/8-12);
- 8-10 ha for a senior school (years 10-12);
- 8 ha for a middle school (years 6/7-9) and
- 12 ha for a kindergarten to year 12 school.

R10 The size of a non-government secondary school should generally be as follows:

- 8-10 ha for a secondary school;
- 6 ha for a district high school; and
- 10-12 ha for a combined primary and secondary school.

R11 The size of a government and non-government primary school site in urban areas should generally be as follows:

- four ha for a school site with self-contained designated playing fields and other recreational facilities; and
- a minimum of 3.5 ha where there is co-location with adjoining public open space (R12).

R12 Where there is a reduction in the primary school site below four hectares (R11) and there is co-location with public open space:

- the public open space is to be designed and able to be developed as playing fields;
- the subdivider is to earthwork the primary school site and public open space so that site levels are suitably integrated with surrounding development; and
- a formal agreement is to be entered into between the local government and education provider to provide a long term commitment to shared recreation facilities.

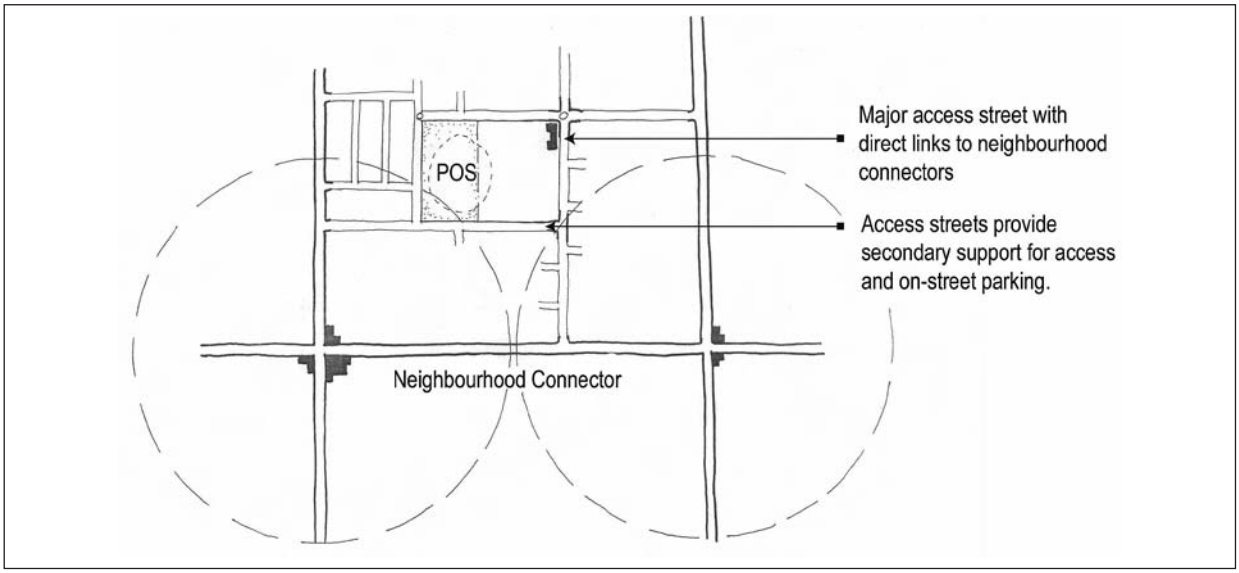

Figure 77: School located at edge of neighbourhoods.

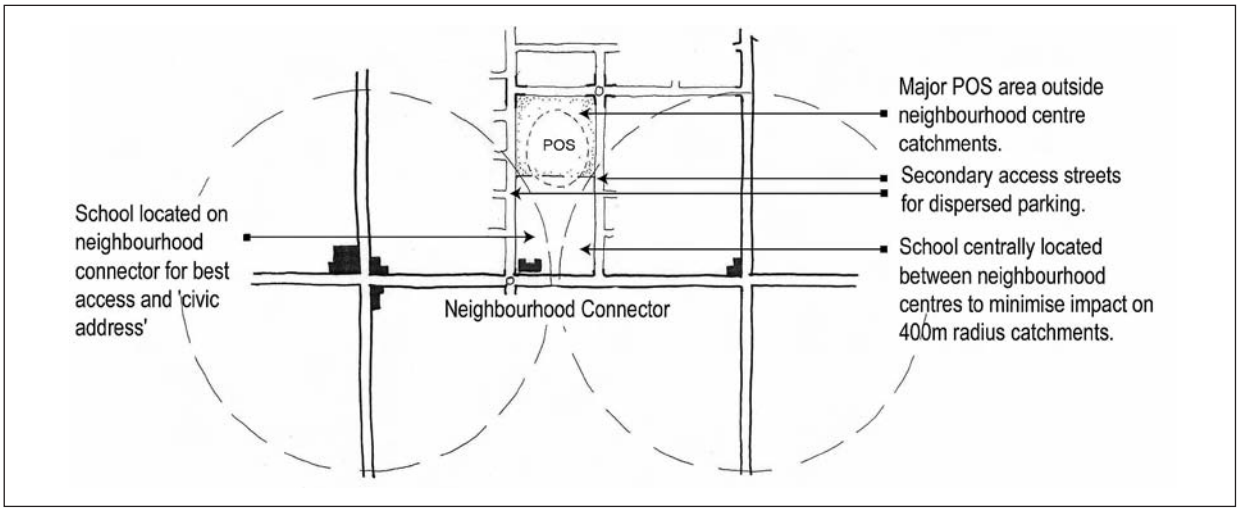

Figure 78: School located at edge of two neighbourhoods on neighbourhood connector.

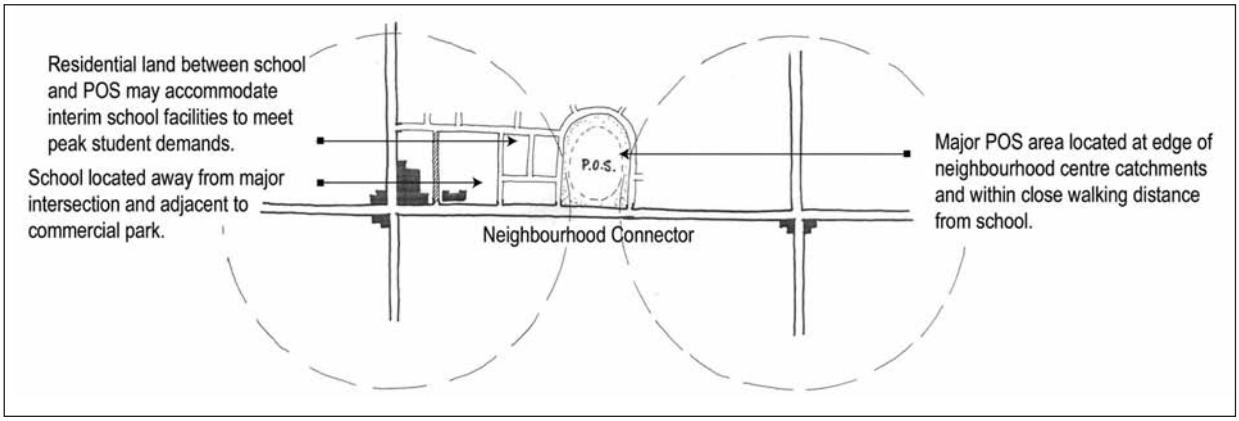

Figure 79: School located in the neighbourhood centre.

R13 In some circumstances larger school sites may be required to service a larger than normal catchment area. This will be subject to negotiations with the Department of Education and Training, or non-government school system provider as appropriate.

R14 In country areas, special sites may be required for shared facilities.

Ceding and acquisition of land

R15 In broad acre subdivisions where the subdivision generates or contributes to the need for a primary school, the subdivider shall cede or contribute to the provision of the government primary school site free of cost. Where land is in multiple ownerships, the subdividing landowners are to provide a pro-rata contribution towards the acquisition of the primary school site.

R16 The WAPC will require as a condition of subdivision that arrangements are made to transfer the land to the Department of Education and Training possibly in a defined period of subdivision approval.

Infrastructure costs and recovery

R17 Road pavements, traffic management devices and on-street parking should be provided by the subdivider to the satisfaction of the local government and the relevant school provider. The cost of on-street embayments and raised pedestrian crossings should be shared equally by the subdivider and the school provider.

R18 The sharing of costs by subdividers at R17 may be spread across the catchment area of the school.

Topography and physical features

R19 All of the school site should be usable, having regard to the:

- desirability of a site slope no greater than 1 in 20;
- impact of any areas of the site that may require retention for conservation areas (eg wetlands, flora and fauna);
- impact of any services easements; and
- requirements for noise buffers to primary or integrator arterial routes.

If the site topography or vegetation characteristics prohibit full use of the site, the site must be enlarged to achieve the necessary usable area.

Street network and design

R20 A school should be surrounded by a minimum of three streets, including a neighbourhood connector and a wider access street.

R21 Schools should not abut more than one neighbourhood connector. Where a school is adjacent to two neighbourhood connectors, the school should also be bounded by two access streets.

R22 All streets bordering a school should be through streets. Culs-de-sac create congestion at set-down and pick-up times, and should only be considered as an interim measure.

R23 The longest boundaries of the school should be along access streets to maximise the length of the street that can accommodate on-street parking and access to on-site parking.

R24 Where a neighbourhood connector abuts a school, the street environment should be specially designed to slow vehicle speeds and accentuate a pedestrian-oriented environment along the school. This includes elements such as: threshold paving; median island, vertical elements such as trees and bollards to enclose the vehicle environment, on-street parking and bus bays and formal and informal pedestrian crossings.

R25 Parking in the surrounding streets should be designed for pedestrian-priority to maximise safety.

R26 Streets surrounding schools should accommodate on-street parking, and may need to be designed as special streets (Element 2 - movement network) to safely accommodate traffic movement and on-street parking.

R27 As a minimum, on-street parking should be provided adjacent to the proposed location of school site buildings, including administration and K-2 (kindergarten to year 2).

R28 The street network surrounding the school should facilitate short, safe and direct trips for pedestrians and cyclists. Specific safe routes to schools should be identified and detailed to encourage non-car journeys to schools.

Surrounding land uses

R29 Adjoining commercial and/or community facilities should be designed to enable sharing of car parking and services, such as libraries, performing arts centres and sporting facilities.

R30 Surrounding residential development should be designed to overlook the school. Side and rear fences abutting school sites will generally not be acceptable.

R31 School sites, particularly primary and/or middle schools sites, should generally not be located in larger neighbourhood (ie 4000m^2 nla of retail floorspace) or district and regional centres.

Interim school buildings

R32 Where possible, interim schools buildings should be used as an alternative to transportable buildings. Interim government schools, in the form of schools-in-shops and/or offices or schools-in-houses, are the preferred mechanism for accommodating peak student numbers or the early provision of a school site.

R33 Where interim school buildings are likely to be needed on a long term basis, these should be located adjacent to the main campus.

R34 Interim schools buildings should be located so that they abut, or are in 150 m of, an active recreation area.

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Appendices

Site and context analysis

Importance of context and site analysis

The success of an individual subdivision in achieving a distinct identity and sense of place is a function of how well the design relates to the specific site and its wider urban context.

Context and site analysis provides a means by which to inform a design to achieve these outcomes, facilitates the efficient provision of infrastructure through good design, and can also identify any features which will add value to a development by improving amenity.

The value-adding flow-on from considered analysis can directly benefit developers and future residents through better quality design.

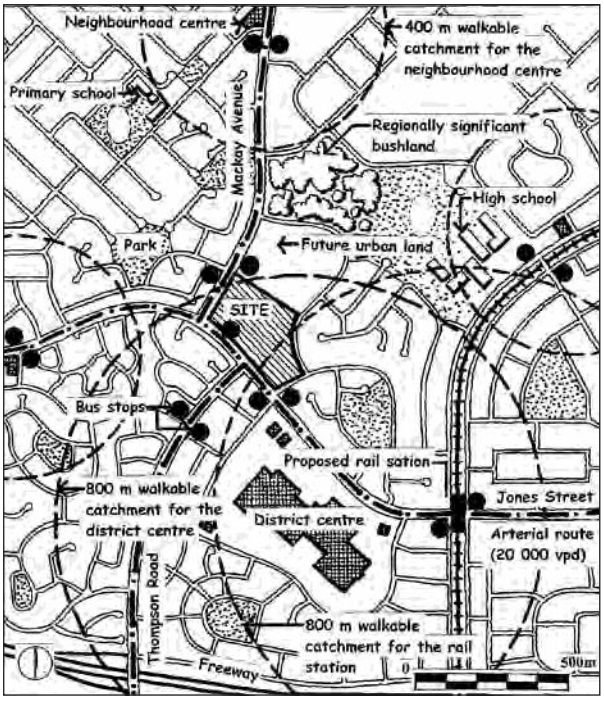


Figure 80: Example of context analysis.

Context analysis

The purpose of context analysis is to connect and integrate new subdivision and development with surrounding natural and developed areas, including planned and committed development for adjacent sites.

Context analysis should identify key opportunities and constraints presented by the context of the site. New opportunities for the improvement of existing local and district planning frameworks can be identified and tested.

Any likely conflict with existing plans should be identified at an early stage, and discussed with the relevant local government or Department for Planning and Infrastructure.

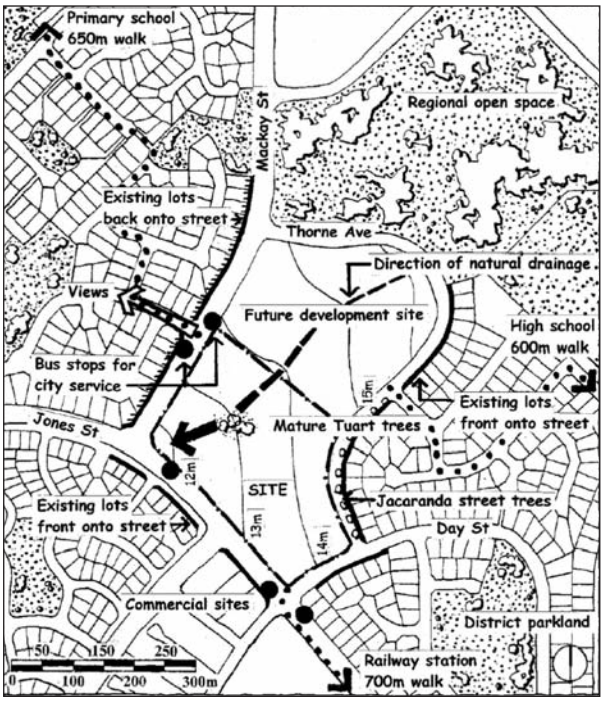


Figure 81: Example of site analysis.

Site analysis

A sufficiently detailed assessment of the site and its immediate surrounds facilitates planning and urban design decisions for subdivision. Site analysis enables:

- a cost effective and environmentally responsive design in respect of site features and constraints;
- natural and cultural assets on and around the site to be taken advantage of to build a positive sense of place and unique identity into the design; and
- design to be integrated with its immediate surrounds and provide compatible interfaces between the development site and neighbouring development.

Mapping and information requirements

For context and site analysis mapping, describe and analyse (as appropriate) the following information:

- existing and planned neighbourhood, town and regional centres, and major employment areas;
- neighbourhoods around existing and planned neighbourhood, town and regional centres, indicated by circles of 400-450 m radius centred on the neighbourhood or town centre;
- transport routes, including freeways, arterial route and neighbourhood connector alignments, public transport routes, bus stops and rail stations;
- walkable catchments of existing and planned rail stations via circles of 800 m radius centred on the rail stations;
- surrounding subdivision (indicating fronts and backs of lots) for a reasonable and useful distance beyond the site boundary;
- existing and proposed land use distribution and densities; and
- site characteristics, such as landform, areas of environmental significance, Environmental Protection Policy areas, bushland, wetlands, damp lands and foreshore reserves.

The north point, visual bar scale, key street names and a drawing title should be standard information on all drawings.

Context and site mapping may be undertaken together or separately, and a brief written report may also be provided to explain the mapping.

Design process for a district structure plan and consequent subdivision

The figures at Phases 1 to 12 inclusive are examples of district level context and site analysis, concept design and detailed design for a district structure plan of some 450 ha. When accompanied by report(s) outlining the elements of the plan and management details (as described in the Results from the Jindalee Enquiry-by-Design Workshop Report, Ministry for Planning, August 1996), the phase figures would generally meet the requirements for information stated in the applications section under Liveable Neighbourhoods for a district structure plan or large scale subdivision.

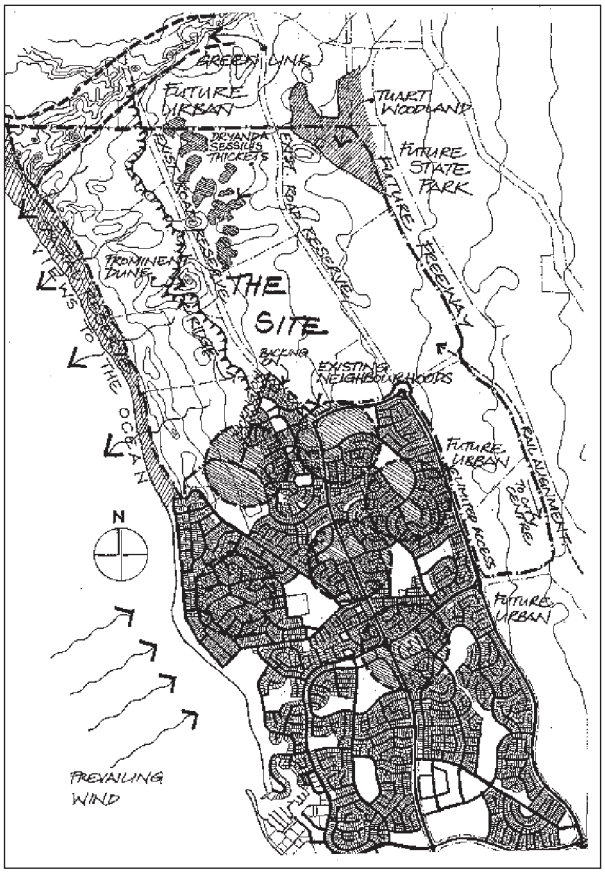
Phase 1 – *Context and site analysis, to identify key opportunities and constraints presented by the site and its context. This takes into account all constraints to development such as regional open space networks, landform, topography, urban water management and infrastructure easements. This should include an analysis of the regional structure and neighbourhood form in existing surrounding areas. The full range of requirements for the context and site analysis is shown in the applications section under Liveable Neighbourhoods.*

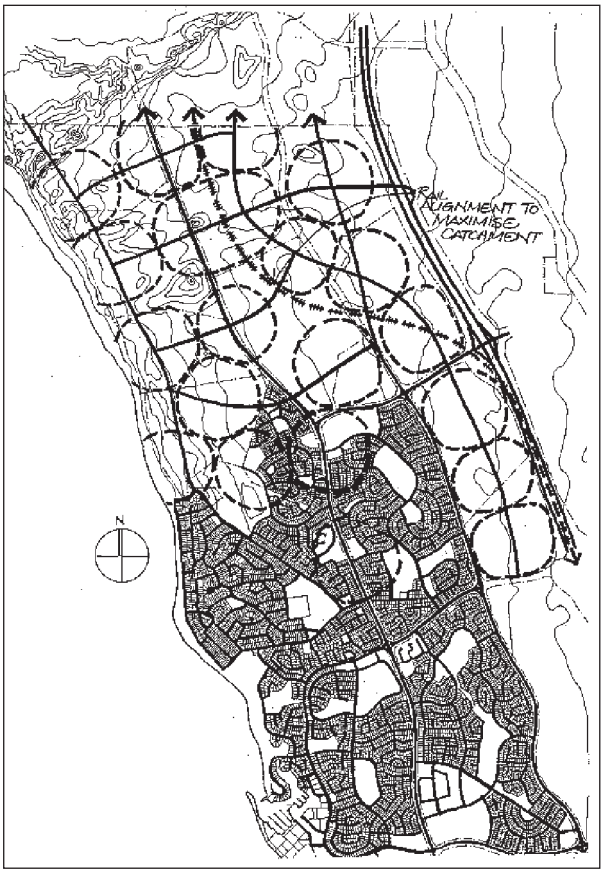
Phase 2 – *Freeways, arterial routes, and public transport routes are linked from the existing areas through the site.*

Walkable catchments, represented as circles of about 400-450 m radius and showing the theoretical distance pedestrians reasonably cover in five minutes, are placed in appropriate relationship to each other, and the already identified constrained areas.

Arterial routes and neighbourhood connectors are drawn through the neighbourhoods so that points of intersection are potential new neighbourhood and town centres. The design of these arterial routes should avoid the division of communities, and ensure integration.

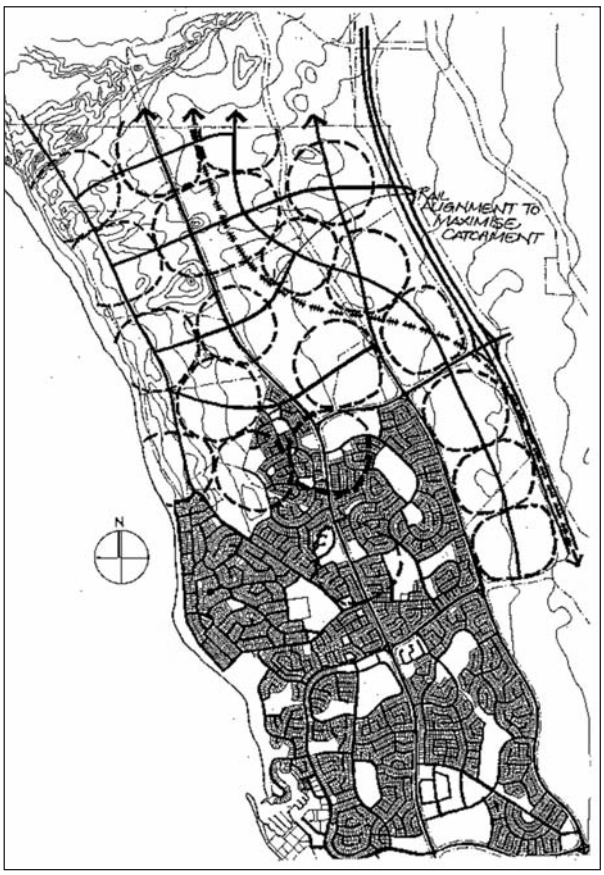
Neighbourhood and town positions are adjusted to avoid extensive overlap of walkable catchment areas.



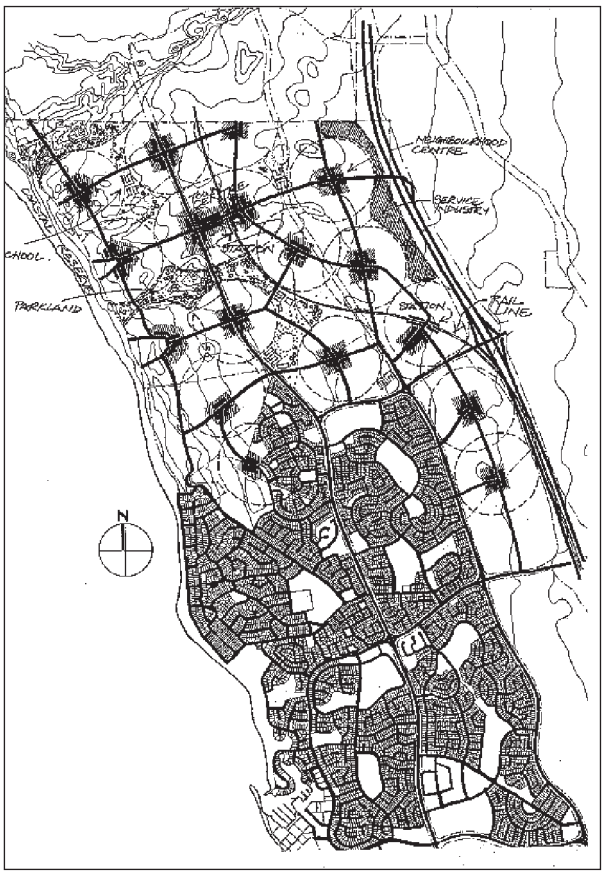


Appendix 2

Phase 3 – *In an iterative design process, neighbourhoods formed around arterial routes are realigned and adjusted so that neighbourhoods are clustered to form and support towns and town centres. Neighbourhoods are linked to town centres in the most direct way possible, in the constraints of local site and environmental conditions.*



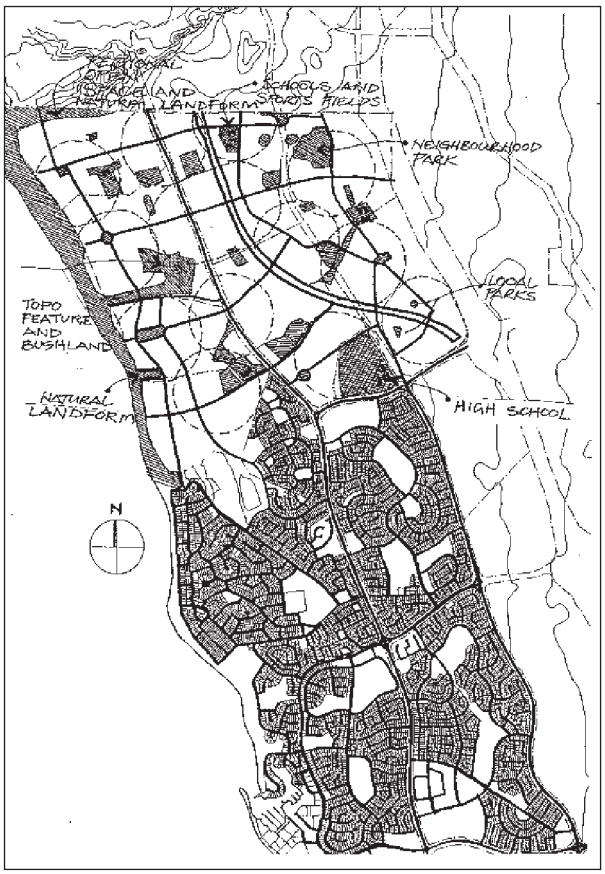
Phase 4 – *Focal places and centres are identified for later design and detailed development. At this stage rough land use allocations are made. Neighbourhood and town centres are located at the intersection of major streets, to provide for additional retail patronage. Schools, large parks and industrial areas are better located at the edge or between neighbourhoods because they are large land users, and tend to disrupt walking access to neighbourhood centres.*

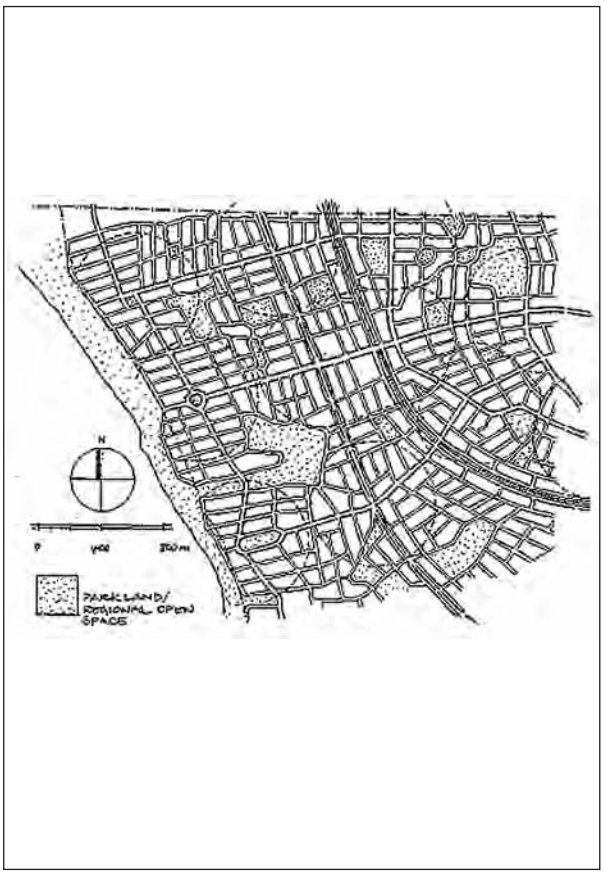


Appendix 2

Phase 5 – *Plan in and design parks, recreation areas, and public open spaces. Where possible these should incorporate urban water management devices. Parks should be fronted by streets and adjoining development on at least three sides to facilitate surveillance.*

Phase 6 – *A network of local streets is developed. This network must have a high level of interconnection to facilitate choice of movement and dispersal of traffic. The street network should be designed to accommodate the needs of all users. At this stage and at this scale, urban water management and traffic management strategies are developed.*

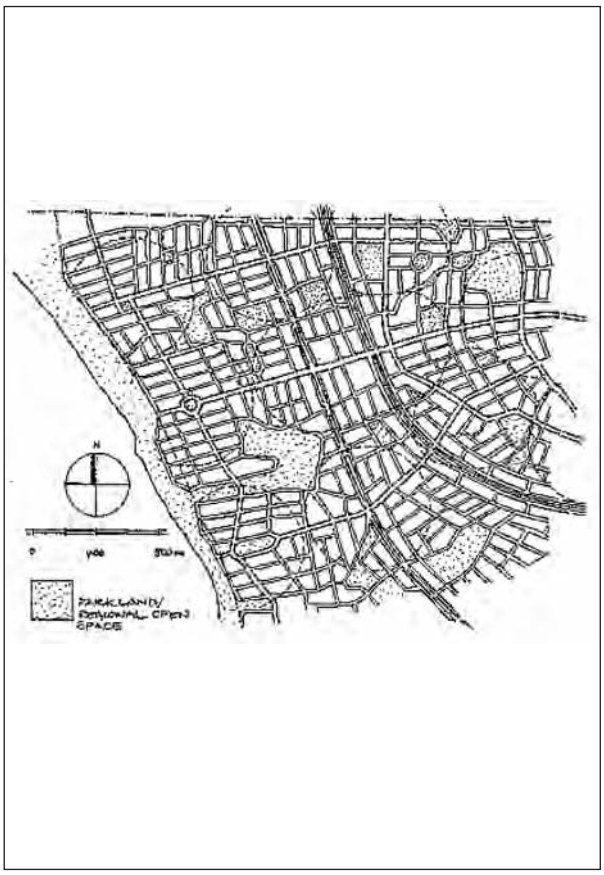


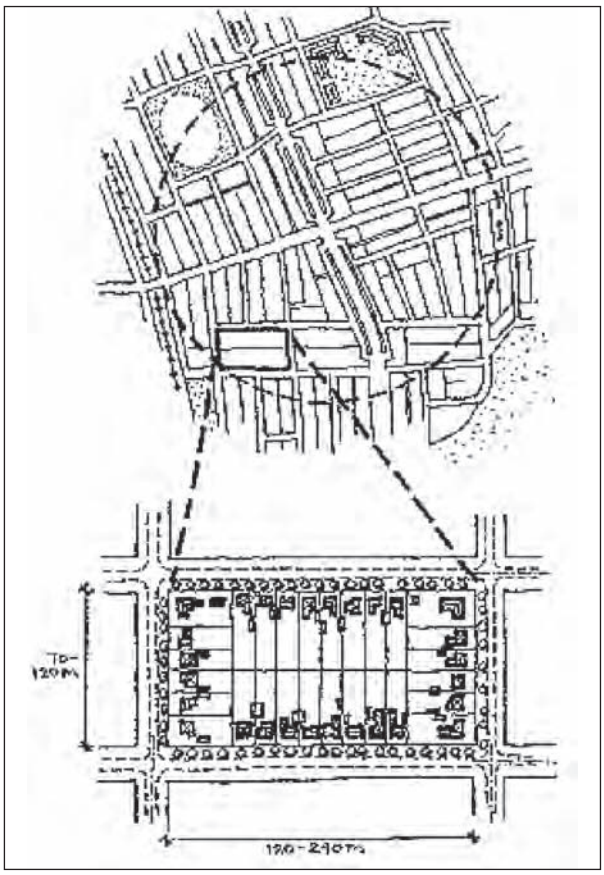


Appendix 2

Phase 7 – *The accessibility to facilities at the centre of the neighbourhood or town is tested, and adjusted to maximise access, especially pedestrian access. This is done using the walkable catchment calculation technique, or ped-shed calculation. (appendix 3)*

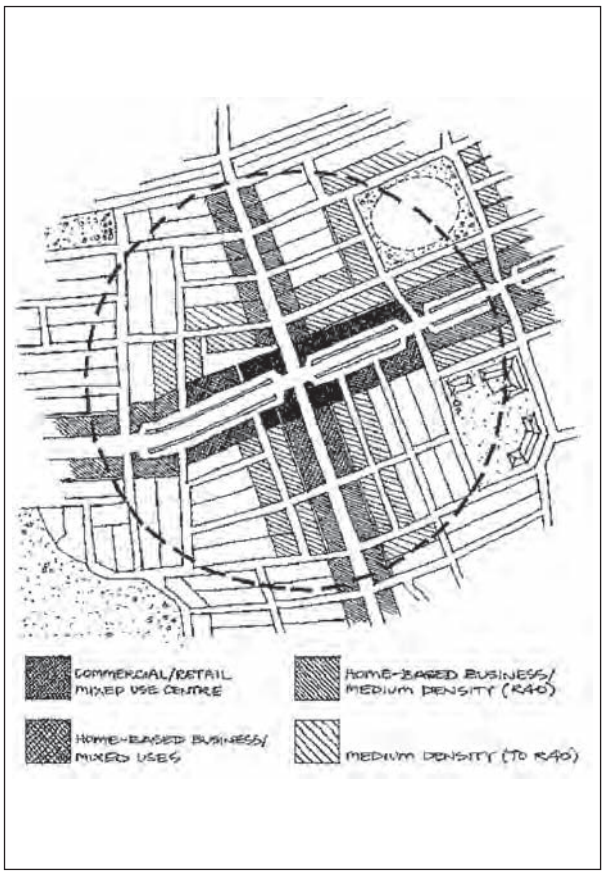
Phase 8 – *Achieve street blocks generally in a range of 70-120 m by 120-240 m with smaller blocks located towards the neighbourhood centre, to balance permeability in developed areas with the provision of sufficient developable land for a wide range of land uses over time. A clear and unambiguous definition of private and public space should be achieved through perimeter block development where development faces streets, while creating safe and secure private backs.*



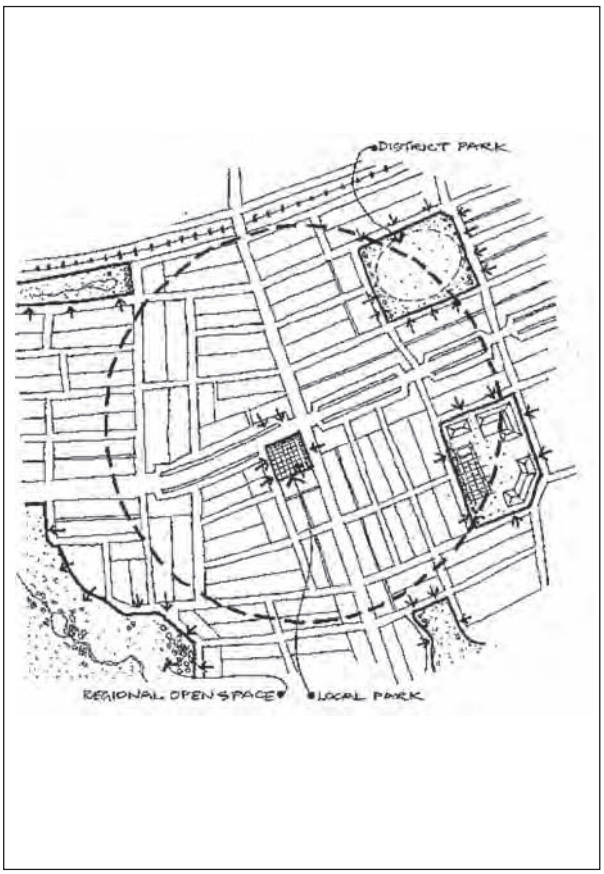


Appendix 2

Phase 9 – *Work for the highest residential densities and create a mix of land use including home-based businesses along major connection streets, concentrated towards the centre of the neighbourhood, and around rail stations. Medium-density residential or small lot development should be focused around parks, while larger land users should be located at the edge of or between neighbourhoods. Liveable Neighbourhoods provides a spatial logic for the compatible mixing of land uses at a fine grain, including home-based businesses.*



Phase 10 – *Plan for a variety of parks and recreation areas. Front development onto these areas.*



Appendix 2

Phase 11 – *In order to accommodate changing residential needs in Western Australia, a wide range of residential opportunities should be facilitated by providing a variety of lot sizes.*

Phase 12 – *Add quality to improve legibility and a sense of place in urban areas through refinement of the urban form. For example, vary street widths as part of a traffic and urban water management strategy, close vistas with prominent architectural features, and adjust streets to align with local natural and built landmarks.*

The walkable catchment technique

Walkable catchments, sometimes referred to as ped-sheds, are maps showing the actual area in a five-minute walking distance from any centre, or ten minutes from any major transport stop such as a railway station. The centre could be a neighbourhood or town centre. The walkable catchment is simply a technique for comparative evaluation of how easy it is to move through an urban area in order to get to and from these centres or facilities. These maps are the best estimates of walkability, and as such are an indication of energy efficiency.

Walkable catchment calculations are expressed as the actual area in a five-minute walking distance as a percentage of the theoretical area in a five-minute walking distance. The theoretical five-minute walking distance is shown as a circle with a radius of about 400 m drawn around any particular centre. This is an area of 50 ha. When calculating a ten-minute walking distance, the radius used is about 800 m, resulting in a circle area with an area of 200 ha.

The higher the percentage the better the walkability and hence the likely energy efficiency of any urban area. A good target for a walkable catchment is to have 60 per cent of the area in a five-minute walking distance, or ten minutes in the case of stations.

Process for calculating walkable catchments

1. On a scaled map draw a circle of 400 m radius around a neighbourhood or town centre, and an 800 m radius circle around a rail station. When drawing the circles around a station, draw the inner 400 m radius circle as a thick solid black line, and the 800 m radius circle as a broken black line.
2. Starting from the centre, measure along the centre line of all available streets, to a distance of 400 m.
3. Estimate the boundary of the lots in a 400 m walk, and colour this area. The convention is to colour this area purple. This is the actual area from which a pedestrian would be able to access a centre along the available streets in a five-minute walk.
4. In the case of stations, complete the task outlined in number 3, and complete the task for a ten-minute walking distance, using 800 m as the distance measure. This will result in a map showing the actual distance in both a five-minute walk, and a ten-minute walk from the railway station. The convention is to colour the ten-minute walking distance area light blue.
5. Using a grid of scaled hectares, (ie 100 x 100 m squares at the appropriate scale), calculate the approximate area in hectares of the land coloured purple, and express this as a percentage of 50 ha. This shows the actual area in 400 m of the centre as a percentage of the 50 ha circle. In **figure 82**, in the example of a conventional subdivision around a neighbourhood centre, this is 38 per cent, while in **figure 83**, for a walkable neighbourhood around a neighbourhood centre and transit station the figure is 60 per cent.
6. Repeat the exercise for rail stations, using the hectare grid, and calculate the area accessible in a ten-minute walk (800 m) of the 200 ha area. In **figure 83** for a walkable neighbourhood the figure is 58 per cent.

Note that the walkable catchment should always count the area of land used for dwellings but not include public open space contained in the accessible area.

Fine tuning the calculation

There are practical influences on walkable catchments such as short cuts through parks or along pedestrian paths. These should only be included where there is a high degree of surveillance, during evenings and at weekends, from adjoining development that fronts the parks and where there is good lighting. Similarly, the walkable catchment may need to be reduced where there is poor surveillance and routes are perceived to be unsafe.

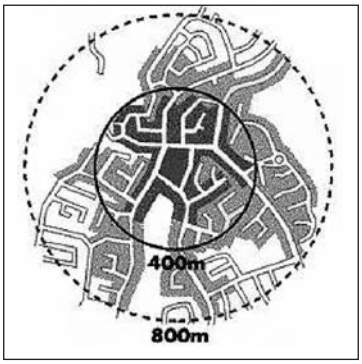


Figure 82: Conventional subdivision around a neighbourhood centre.

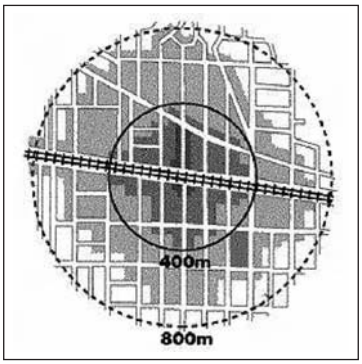


Figure 83: A walkable neighbourhood around a neighbourhood centre and transit station.

Cash in lieu for public open space

A1 Under the provisions of 153 of the *Planning and Development Act 2005*, the WAPC may agree to cash in lieu of public open space if the land area is such that a 10 per cent contribution would be too small to be of practical use, and there is already adequate public parkland taking into account the overall objective of parkland provision and distribution.

A2 Having regard to A1, the WAPC may impose a condition seeking the provision of a cash-in-lieu equivalent of the public open space, where:

- the local government has requested the condition and identified an existing or potential surplus of public open space; or
- the local government has an adopted strategy to provide open space by land acquisition in the locality of the subdivision; or
- the otherwise required 10 per cent area of open space would yield an area of unsuitable size/s and dimension/s to be of practicable use.

A3 The Act requires that the use of cash-in-lieu must either:

- be initiated by the owner of the land concerned, and requires approval of the relevant local government and the WAPC; or
- required by the WAPC after consultation with the local government. In cases where the WAPC considers that it may be appropriate to use these provisions, the applicant will be so advised in the WAPC's letter of approval.

A4 All money received by the local government in this way is required by the Act to be paid into a separate account of that authority, which under the Local Government Financial Management Regulations, 1996, should clearly set out the purposes for which the money is held, the landholding from which it was obtained and the date on which it was paid to the local government. The money should be applied:

a) for the purchase of land by the local government for parks, recreation grounds or open spaces generally, in the locality in which the land included in the plan of subdivision is situated;

b) in repaying any loans raised by the local government for the purchase of any such land; and

c) with the approval of the Minister for Planning and Infrastructure, for the improvement or development of land as parks, recreation grounds or open spaces; generally of any land in the said locality vested in or administered by the local government for any of those purposes.

A5 In each such instance, the WAPC should be advised of the location of the land in respect of which the money is to be expended, the nature and the timing of the expenditure, and the amount of money held by the local government concerned for acquisition or improvement of public open space in the locality concerned. In addition, when it has recommended to the Minister that approval be given to the use of cash-in-lieu funds as provided for above, it will also recommend that the local government indicate when those improvement works have been completed.

A6 The WAPC also requires that local governments provide an annual statement of the separate cash-in-lieu account, in order that it may be appraised of the position in each local government area with respect to the use of cash-in-lieu funds.

A7 Expenditure of cash-in-lieu funds must be directly related to the use or development of land for public open space purposes. The land must be vested or administered for recreation purposes with unrestricted public access. Land held in fee simple by the local government should, as a prerequisite, be reserved for public recreation in the council's town planning scheme.

A8 The use of cash-in-lieu would not normally be acceptable for indoor recreation centres, enclosed tennis courts, bowling greens for clubs, facilities for private clubs or similar facilities where access by the general public is restricted. Acceptable expenditure for cash-in-lieu funds may be for:

- clearing of vegetation
- seating
- earthworks
- spectator cover and/or shelters
- grass planting
- toilets

- landscaping
- change rooms
- community hall, readily available for public use
- reticulation
- lighting
- play equipment
- pathways
- fencing
- walk trails
- car parking
- signs relating to recreational pursuits

A9 Requests to the Minister for Planning and Infrastructure for approval of the expenditure of cash-in-lieu should be submitted to the WAPC accompanied by a map and schedule showing:

- the location and WAPC reference number of the subdivision(s) from which the funds were obtained;
- the dollar value of the funds obtained;
- the location of the proposed reserve where the funds are proposed to be expended;
- the nature of the proposed expenditure; and
- the program for the expenditure.

The following section school site layouts is provided for guidance.

School site layouts

Where a primary school is proposed to be reduced to less than 4.0 hectares including where it is co-located with public open space or where it is located in the centre of a neighbourhood adjacent to a centre, a detailed area plan providing the following information may be required:

- the general building layout;
- the type and location of surrounding streets;
- the location and type of on-street, on-site, and co-shared car parking;
- the relationship of key school buildings with the abutting streets; and
- the relationship with adjoining uses.

The detailed area plan should address the following design issues and general principles:

- the primary school located one street and/or block away from the main neighbourhood centre intersection - not at the junction of two neighbourhood connectors;
- off-site kindergarten and pre-primary facilities adjacent to the school, on designated 40 kph streets;
- the provision of a nearby interim school, sharing a common street with the school, to accommodate peak student numbers;
- off-site support and ancillary facilities such as health clinic, out of school care etc;
- the administration building located so as to be easily identifiable and accessible. Other buildings and facilities that are public facilities should be located with the same objectives;
- the preferred location for transportable buildings which have truck access but with limited visual impact on adjacent streets;
- opportunity for major view corridors preserved;
- buildings addressing street frontages;
- two-storey buildings if the school is located in the centre of a neighbourhood on a reduced site area of around 3.5 hectares;
- fencing if required that should address amenity, security and safety;
- on-site parking dispersed throughout the primary school site; including a minimum of two separate parking areas;
- each parking area accessed from a separate access street;
- at least one car park located adjacent to the lower primary (ie kindergarten to year three) classrooms;
- maximum use of shared parking facilities; and
- provision of a grassed recreation area of a minimum of 3000 m^2 in area with a minimum dimension of 100 m for non-government schools or provision of a grassed recreation area of minimum dimensions 118 m x 84 m for government schools.

The following site layouts (**figures 84 and 85**) indicate how these general principles might be addressed in the design of primary school sites on 3.5ha with shared public open space or in the centre of a neighbourhood and integrated with a local centre, and shown on a school sites detailed area plan.

Appendix 5

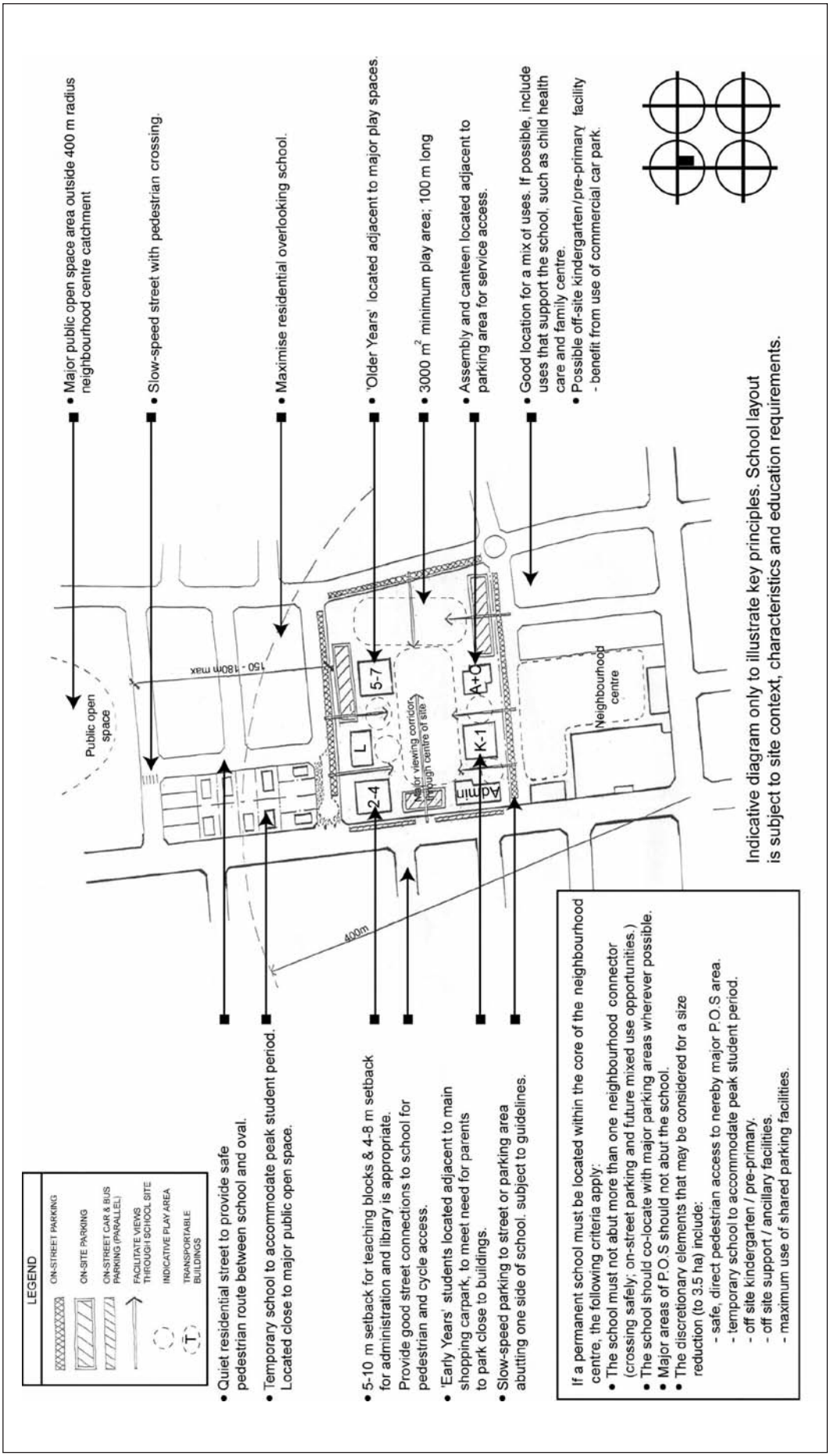


Figure 84: School sites detailed area plan - 3.5 ha school site in centre of neighbourhood and adjacent to neighbouring centre.

Appendix 5

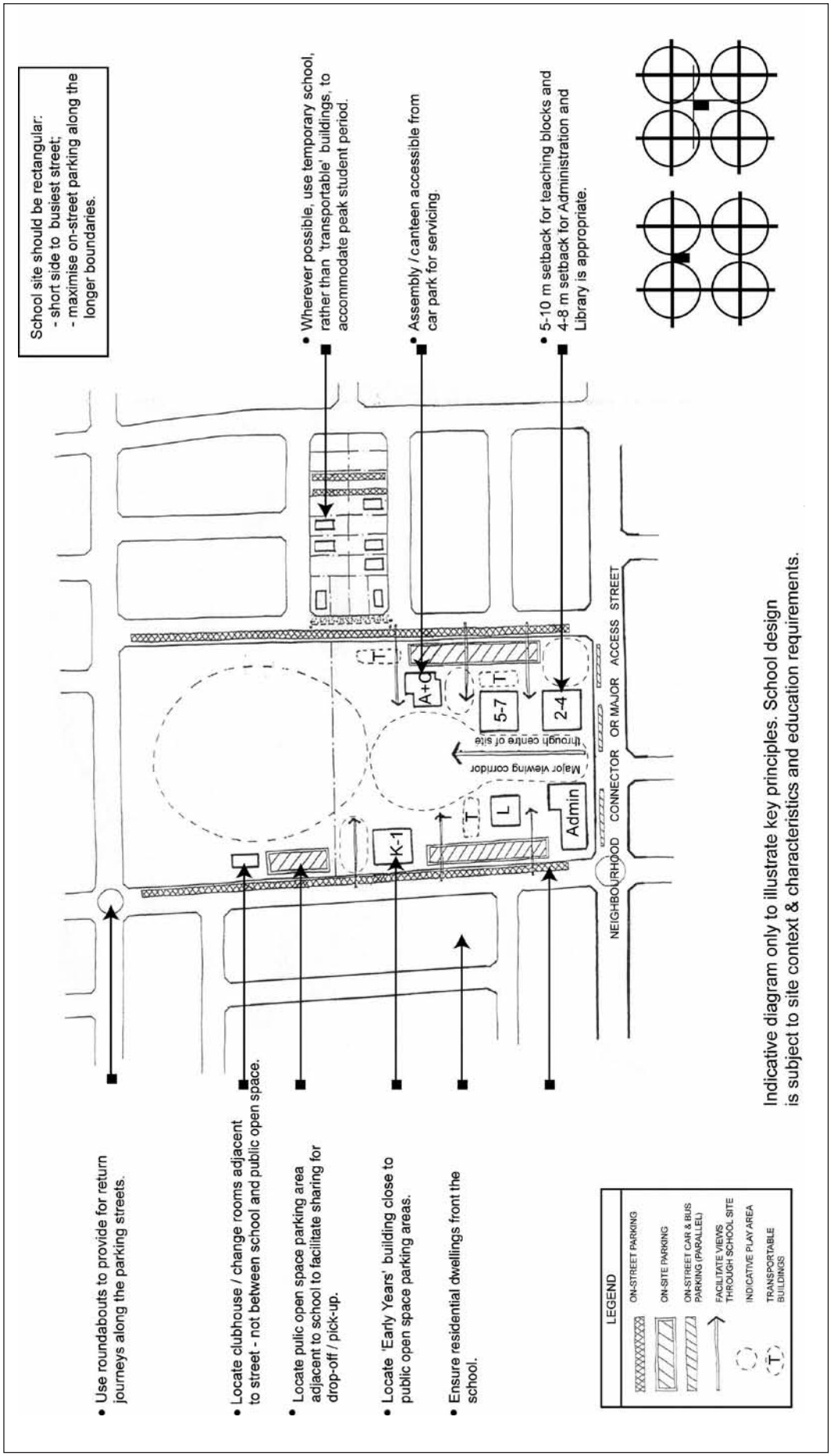


Figure 85: 3.5 ha school site with shared open space.

Appendix 5

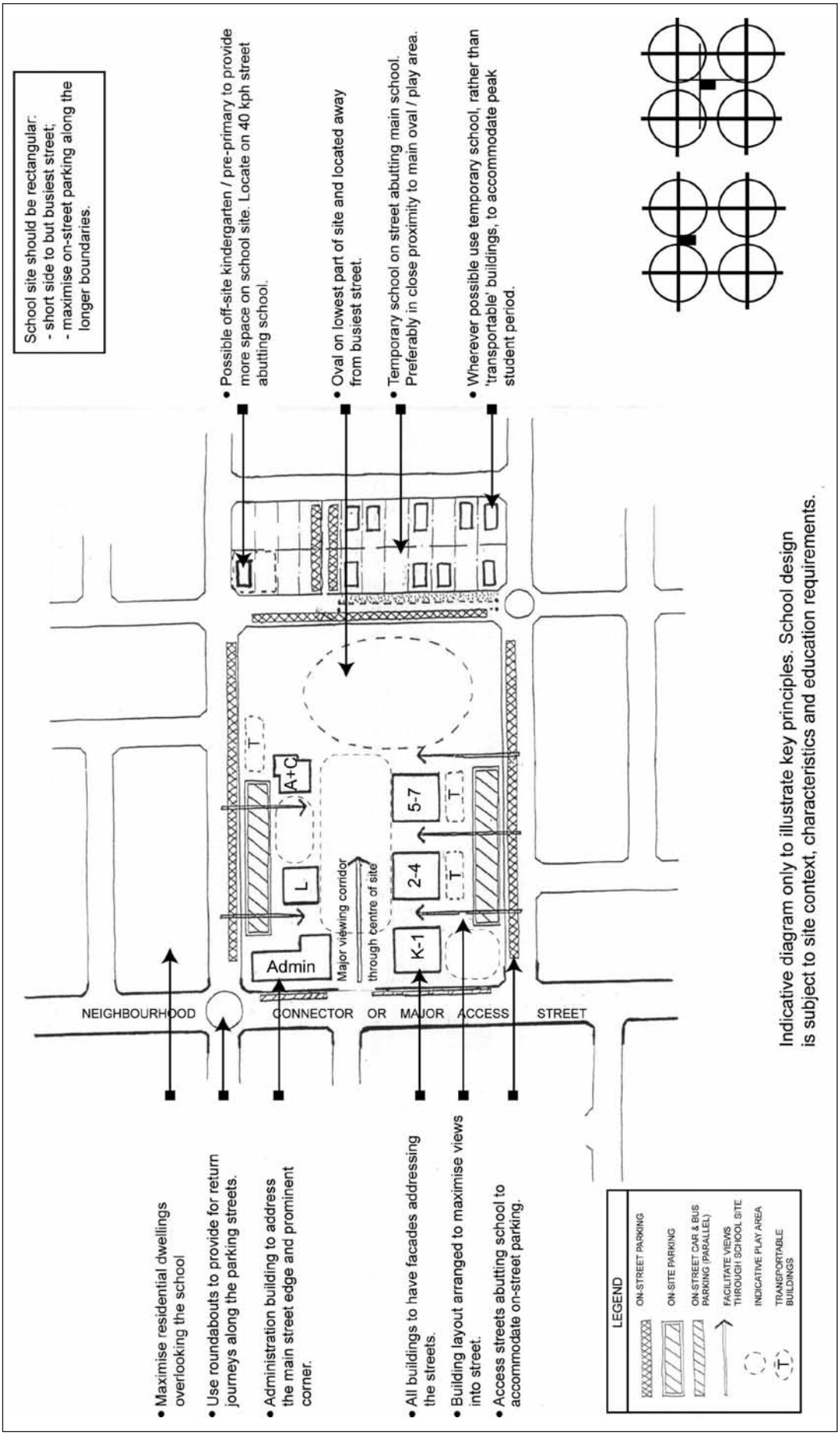


Figure 86: 4.0 ha school site with self-contained open space.

Shortened terms

ARRB	Australian Road Research Board
BMP	best management practices
BPP	best planning practices
CCA	Cement and Concrete Association of Australia
CPTED	Crime prevention through environmental design
DAP	detailed area plans
DC	development control
DET	Department of Education and Training
DOW	Department of Water
DCE	Department of Conservation and Environment
DPI	Department for Planning and Infrastructure
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
LN	Liveable Neighbourhoods
MRS	Metropolitan Region Scheme
MRWA	Main Roads Western Australia
POS	public open space
SPP	State planning policy
WAPC	Western Australian Planning Commission
WSUD	water-sensitive urban design

Glossary

Access street means a street providing predominantly residential access where the local environment is dominant, traffic speeds and volumes are low, and pedestrian and cycle movements are facilitated.

Approved construction standard means any specification document adopted by the responsible authority that outlines the standards of construction for streets, bicycle paths and pedestrian paths.

Arterial routes are the urban grid of transport routes that range from freeways (up to 80 000 vehicles per day) to district distributor integrators (down to 7000 vehicles per day).

Building envelope means a diagram on a lot on a subdivision plan to the requirements of Liveable Neighbourhoods defining the limits for the siting and wall heights of any dwelling and/or outbuildings.

Building line - see setback.

Compatible use transition means locating the interface between incompatible uses at the rear boundary of the lots, where the impact is minimal, compared to locating the incompatible use interface along the street which has a greater affect on the streetscape and building fronts.

Deflection angle is the angle between two straight sections of road.

Design speed is used to determine geometric standards for the road.

Detailed Area Plan means design guidelines that are prepared by subdivision proponents for all lots below 350 m^2 and for other lots as appropriate, and which address matters raised in the relevant requirements of Element 3 - lot layout. Approval may be given to the subdivision subject to approval of the detailed area plan(s).

Development contribution is a fee or contribution charged against a development for the provision of infrastructure.

District distributor integrator A means an arterial route that has frequent connections to local streets, development frontage along its length, and, typically, has service roads with on street parking for mixed-use, with direct vehicle access limited where there are no service roads. Indicative maximum traffic capacity is 35 000 vehicles per day.

District distributor integrator B means an arterial route that has frequent connections to local streets, development frontage along its length, and typically, has one clear lane for each direction with on street parking. Indicative maximum traffic capacity is 20 000 vehicles per day.

Dual use path means a pathway that is constructed and detailed in such a way as to allow for its shared use by pedestrians, bikes, wheelchairs etc.

Elements means the group of eight items in Liveable Neighbourhoods in which objectives and requirements are specified.

Frontage means the street alignment at the front of a lot and, in the case of a lot that abuts two or more streets, the boundary of which, when chosen, would enable the site to comply with Liveable Neighbourhoods.

Green fields area means a large area of land zoned for urban development and located on the fringe of an urban area.

Gross subdivisible area means the total site area of a subdivision proposal less deductions for non residential uses such as school sites, drainage sites, retail and related land uses, community facilities etc. (**table 11**)

Home based business is where the resident of a dwelling operates a business on the premises.

Interconnected streets are where the street system possesses numerous intersections and junctions providing many alternative vehicle and pedestrian routes which disperse traffic.

K-2 means kindergarten to year 2.

Kerb means the road verge interface of a street which may also serve to channel stormwater run off.

Laneway means a narrow local street type without a verge located along the rear and/or side property boundary, typically used in more dense residential areas when smaller lot layouts justify rear garaging, and where alternative vehicle access is needed for lots fronting busy streets or parks.

Legibility is where the design of the street system provides a sense of direction and connection, giving clear signals regarding the spatial layout and geography of an area.

Glossary

Local identity means recognising and responding to the natural, cultural and historic characteristics and features of an area so that they are preserved and enhanced for people to experience the essential personality and character of that area.

Local self containment is where there is a sufficient level of goods and services, facilities and employment opportunity to meet the daily needs of local residents in a mixed-use neighbourhood so that the need to travel to other areas for daily requirements is minimised.

Local streets mean the local network of laneways, access streets and neighbourhood connectors that serve the neighbourhood.

Lot means an area of topographical space shown on a plan of subdivision.

Mixed use means the compatible mixing of a range of uses, integrated in close proximity to each other to improve the efficiency and amenity of neighbourhoods, reduce travel demand, increase walkability, and make more efficient use of available space and buildings.

Neighbourhood connector means a local street that provides the lower order sub arterial network, servicing and linking neighbourhoods and towns. They spread local traffic loads, act as a bus route, have a predominantly residential frontage, have frequent connection points to local streets and are typically traffic-calmed to limit noise and facilitate pedestrian use.

Net subdivisible area means the gross subdivisible area less the area to be provided for public open space.

Objectives or element objectives mean the statements of desired outcomes to be achieved in the completed development.

Outline development plan - refer to structure plan.

Peak loading means schools that will accommodate students from in excess of 1500 lots (generally more than 600 students) for a prolonged period of time.

Pedshed - refer to walkable catchment.

Primary distributor means those arterial routes that are highly connective, with service roads wherever possible, limited intersections. They are often signal controlled. Indicative maximum traffic capacity is 35 000 vehicles per day for four lanes and 50 000 vehicles per day for six lanes.

Private open space means an area of land which is suitable for private outdoor living activities.

Public open space means land used or intended for use for recreational purposes by the public and includes parks, public gardens, foreshore reserves, playgrounds, and sports fields but does not include regional open space and foreshore reserves.

Requirements means the criteria to be used in the preparation, submission and assessment of structure plans and subdivision proposals for measuring the performance of such proposals against element objectives.

Residential density means dwellings per hectare of a development site or aggregation of sites. It is designated on plans as dwellings per site hectare.

Road means the area of a street reserve which is provided for the movement or parking of vehicles and bikes.

Setback means the minimum distance which a wall face or window is required to be from a property boundary or another window to a habitable room. It is measured as the horizontal distance between the proposed wall or window and the boundary or other window.

Shared space is where pedestrians, cyclists and vehicular traffic have equal rights to access.

Slow points means sections of a street which have geometric features which limit the travel speed of vehicles. These include bends, constrictions to road widths, surface obstructions etc, and include junctions or intersections which are designed to slow traffic.

Special Residential refers to lots as defined by Development Control Policy 2.5 Special Residential Zones. The purpose of special residential zones is to allow for lots of a size which will offer a style of spacious living at densities lower than those characteristic of traditional single residential developments but higher than those found in special rural zones.

SPP means a state planning policy.

Street alignment means the horizontal shape of the street reserve boundary.

Street leg length means the distance between intersections or junctions, or points and locations where vehicles must slow down, usually to a maximum of 20 km/h.

Glossary

Street network means a system of connected streets where multiple routes are available for a given trip.

Street reserve means the land set aside for a street and verge and usually vested in a public authority.

Streetscape means the visible components in a street between the facing buildings, including the form of the buildings, garages, setbacks, fencing, landscaping, driveway and street surfaces, utility services and street furniture such as lighting, signs, barriers and bus shelters.

Structure plan means a plan showing in outline the overall development intentions for an area, including land use, major transport and utility networks, drainage and/or urban water management, open space systems and indicative built form. Also known as an outline development plan and that addresses the elements of Liveable Neighbourhoods.

Subdivision means the division of a cadastral parcel of land into two or more lots which can be disposed of separately.

Target speed is the intended maximum vehicular speed in the subject section of street, and is used to determine the combination of road geometry and spacing and form of slow points.

Urban Density is the dwelling yield from a hectare of residential land comprising 10 per cent public open space, 25 per cent streets and 65 per cent lots.

Verge means that part of the street reserve between the road and the boundary of adjacent lots (or other limit to street reserve). It may accommodate public utilities, footpaths, stormwater flows, street lighting poles, street trees and other landscaping.

Walkable catchment means the actual area served in a 400 m (five-minute) or 800 m (10-minute) walking distance along the street system from a public transport stop, town or neighbourhood centre.

Walkable neighbourhood means the area defined by a 400 m or five-minute walk from the neighbourhood centre having an interconnected and safe walkable street network where shops, schools, public transport, community facilities and other buildings front the streets.

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