PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

PINE RIVERS

DESIGN STANDARDS

Part 1	**Design Standards for Roadworks**
Part 2	Design Standards for Stormwater Drainage Works
Part 3	Design Standards for Water Supply Works
Part 4	Design Standards for Sewerage Works

PINE RIVERS SHIRE COUNCIL

DESIGN STANDARDS

PART 1
DESIGN STANDARDS FOR ROADWORKS

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Section 2	The Residential Street
Section 3	**The Street System**
Section 4	The Major Urban Road System
Section 5	Industrial Roads
Section 6	Non-Urban Roads
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3.1.0 THE STREET SYSTEM

Having considered the design requirements of the individual residential street, the next step is to consider the aggregation of a number of streets into a residential area and their connection to the major road system.

A road hierarchy for the road network servicing Pine Rivers Shire has also been established and this is to be followed when development applications are being prepared over individual parcels where applicable.

3.2.0 THE RESIDENTIAL NEIGHBOURHOOD

In areas not covered by a road hierarchy network, the following criteria may be used to establish the size of the neighbourhood and road system that will be required to service it.

3.2.1 DEFINITION

A "residential neighbourhood" may be defined as a homogeneous residential area, with community of interest, which is largely self-contained.

Facilities such as a small shopping centre, primary school and neighbourhood park will generally be provided within the area.

Neighbourhood boundaries are generally clearly defined barriers to movement, such as:-

- major roads
- railways
- rivers or creeks

3.2.2 SIZE OF NEIGHBOURHOODS

The areas and dimensions of individual neighbourhoods will inevitably vary quite considerably due to topography and the location of boundary roads.

One obviously desirable feature, however, is that each neighbourhood be capable of supporting its own primary school, as this means that primary school children (who are among the most vulnerable group for traffic risk) need not cross a major road on their trip between home and school.

The Department of Education criteria for a primary school "catchment" are:-

- maximum catchment - 1800 allotments
- minimum catchment - 1200 allotments

The neighbourhood areas which would result from applying these criteria will vary with the density of residential development but typical figures are:-

		Maximum 1800 Allotments	**Minimum 1200 Allotments**
Conventional Allotments			
Approx. 10 allotments per ha (gross)	-	180 ha (e.g. 1350m x 1350m)	120 ha (e.g. 1100m x 1100m)
Small Allotments (typically 450m - integrated development)			
Approx. 12 allotments per ha (gross)	-	150 ha (e.g. 1225m x 1225m)	100 ha (e.g. 1000m x 1000m)

These dimensions are reasonably consistent with the generally accepted recommendation for the spacing of major roads i.e. 1500m.

If neighbourhoods are sized towards the above **upper** limit this will result in:-

- minimum cost of arterial road infrastructure
- less likelihood of future loss of school viability (from the normal drop in school enrolment as the neighbourhood population ages)

The resultant neighbourhood population, of about 5400 (1800 x 3.0), is also generally considered sufficient to support a local shopping centre.

Hence the criterion of **1800 allotments** is considered a reasonable optimum for determining neighbourhood areas.

3.2.3 OPTIMISING NEIGHBOURHOOD AREAS

While natural barriers and major transport routes such as railways or highways are generally beyond the designer's control, the location of some planned roads may be variable within limits to assist in creating viable neighbourhoods.

Planned Sub-Arterial roads particularly may generally be varied to suit neighbourhood area criteria. For example, to subdivide a larger area an additional Sub-Arterial can be provided.

On the other hand, it is not essential that a neighbourhood has roads on all four sides. Natural features or park strips may form a boundary on one or more sides.

* Insert an extra sub-arterial road * accept roads on three sides only

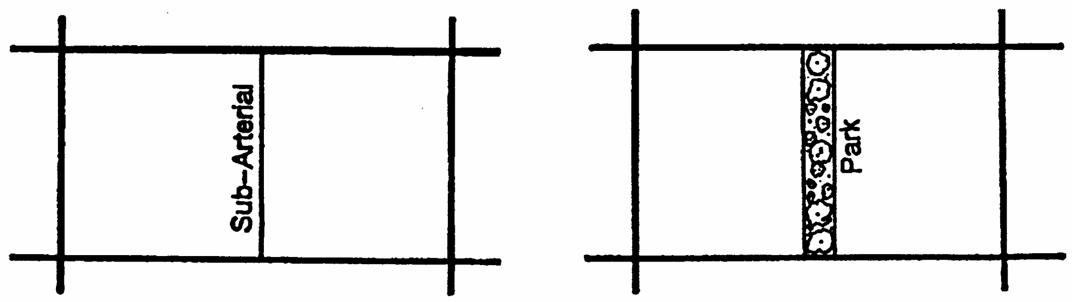


Figure 3.2.A

In the case of an area of less than normal neighbourhood size, it may be necessary to make special provision for residents, especially school children, to cross a major road (desirably one with a relatively low traffic volume) to access facilities in an adjoining neighbourhood.

3.3.0 THE STREET/ROAD INTERFACE

3.3.1 DEALS

The points at which the residential streets intersect with major roads are the **interface** between the two systems.

Not surprisingly then, these intersections are necessarily a compromise between the conflicting ideals of the two systems:-

- Major System – controlled intersections at infrequent intervals to maintain traffic capacity and safety at relatively high speeds

- Residential System – intersections at frequent intervals for driver convenience and to minimise traffic volume on internal streets

3.3.2 ROAD AUTHORITY REQUIREMENTS

Usually the criteria for the location and design of intersections to major roads will be determined by the Road Authority, either the Pine Rivers Shire Council or Department of Transport (Roads Division) depending on the status of the road.

For situations where such criteria are not specified, however, the following guidelines are offered.

3.3.3 SPACING OF INTERSECTIONS

Table 3.3.A indicates the average spacing between intersections to various major road categories and also the minimum spacing for staggered intersections.

Major road categories are defined in Section 4.0 of the Design Standards for Roadworks.

Determining the acceptable number of intersections from an individual neighbourhood to a boundary major road is dependent on:-

- status of the major road
- length of road adjacent to neighbourhood
- location and type of other existing or planned intersections

For example, for a "typical" neighbourhood with lengths of 1350m on four sides, and no constraints from existing or planned intersections, the acceptable number of intersections could be as shown in Figure 3.3.B.

Table 3.3.A
Minimum Intersection Spacing

	Typical Average Intersection Spacing (metres)	*Minimum spacing of Staggered Intersection	
		Left/Right Stagger	Right/Left Stagger
2-lane Sub-Arterial	100 *	60	30
Divided Sub-Arterial	300	150	50
Divided Arterial	500	200	50
Divided Major Arterial	1000	250	50

AMCORD (Modified)

* Minimum spacing governed by geometric design requirements for the specific location.

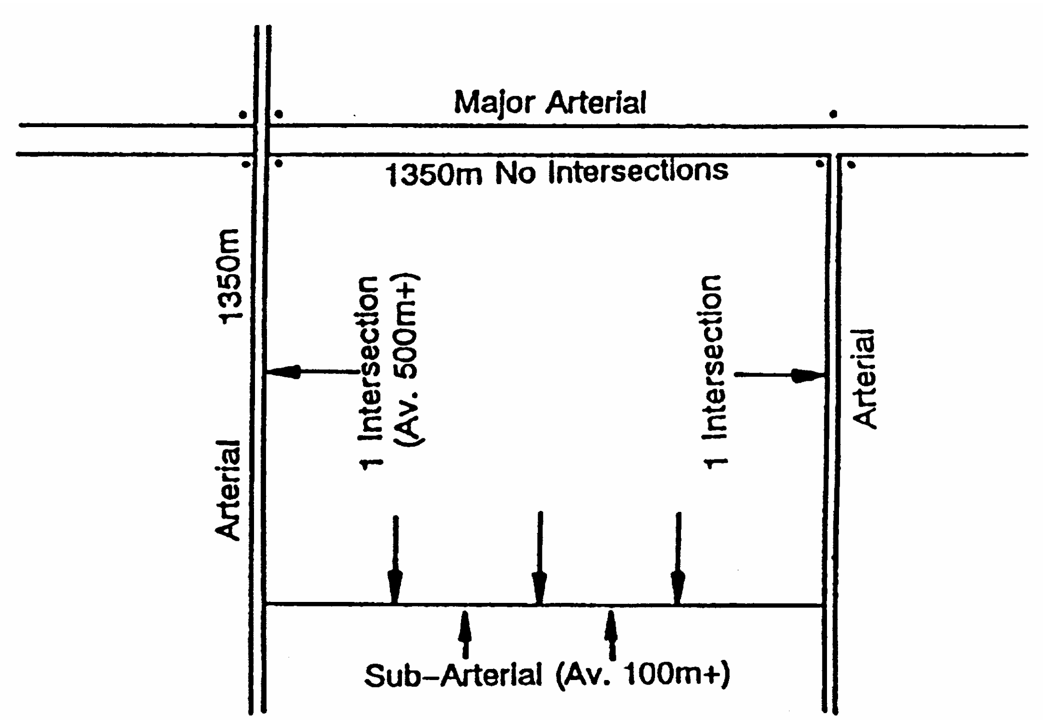


Figure 3.3.B

3.3.4 TYPES OF INTERSECTION

In general the following types of intersection are appropriate between the residential street system and major roads (see Section 4.0 of the Design Standards for Roadworks for major road categories).

- Major Arterial -
  Generally no intersections.

- Arterial -
  Generally traffic signals, roundabout or left-in/left-out intersections (particularly appropriate where roundabouts at major intersections provide for U-turns).

- Sub-Arterial -
  Dependent on traffic volume, uncontrolled T-junctions acceptable, otherwise signals, roundabouts or left-in/left-out.

In all cases, full channelling and auxiliary lanes (right turn, left turn, acceleration and deceleration) should be provided.

3.3.5 DETAILED DESIGN

The detailed design of intersections should be in accordance with the following publications:-

- Austroads – Guide to Traffic Engineering Practice
  - Part 5 Intersections at Grade
  - Part 6 Roundabouts
  - Part 7 Traffic Signals

- Queensland Department of Main Roads - Road Planning and Design Manual

- Manual of Uniform Traffic Control Devices (MUTCD)

3.4.0 PRINCIPLES OF COLLECTOR SYSTEM DESIGN

3.4.1 THE COLLECTOR SYSTEM

As discussed in Section 2.9.0 of the Design Standards for Roadworks, **all** streets within the residential area have the **access** function as paramount and the traffic function as subservient. Nevertheless, of necessity, some do have a greater traffic function than others, these being the **collector streets** serving a traffic catchment of 75 to 300 allotments (350 allotments maximum).

Within the neighbourhood two sub-categories of street may therefore be identified, the differences being in degree rather than function:-

- Collector system
  The "larger branches" and "trunk or trunks" connecting to the major road system.

- Access system
  The "twigs" and "small branches" connecting to the collector system.

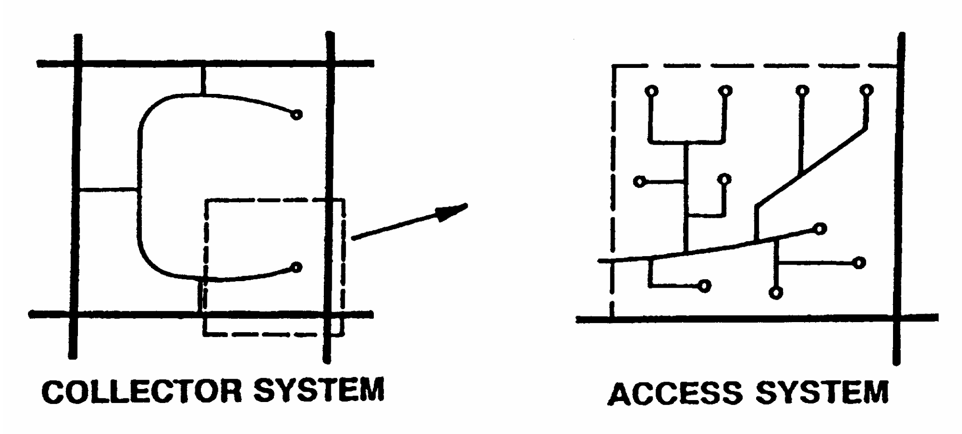


Figure 3.4.A

3.4.2 DESIGN FACTORS

There are a number of factors to be considered in the design of the collector street system and in several cases the "ideals" of the various factors are in conflict.

Factors to be considered include:-

- connectivity (internal circulation)
- permeability to through traffic
- legibility of layout
- economy
- bus routes (see Section 3.5.0 of the Design Standards for Roadworks)

3.4.3 CONNECTIVITY

The degree to which the street system provides for vehicular circulation within the neighbourhood is often referred to as "connectivity".

A **reasonable degree** of connectivity is desirable to provide for:-

- vehicle access from any allotment within the neighbourhood to the neighbourhood facilities (e.g. school and shops) without the need to use major roads

- shortest reasonable access from any allotment to the major road system:-

  - for driver convenience, by minimising travel time in a low-speed environment (desirably 60 seconds maximum, which equates to about 600m)

  - to minimise traffic volume on the residential streets

- alternative routes for emergency use (e.g. accident, fire, street or service repair). Desirably, every "precinct" of more than 100 allotments should have more than one possible access route.

- possible bus route (see Section 3.5.0 of the Design Standards for Roadworks)

Excessive connectivity is undesirable, however, as it may:-

- encourage through traffic to "rat run" through the neighbourhood (see Section 3.4.4 of the Design Standards for Roadworks - "Permeability")

- result in traffic flows in excess of the designed volume on some streets

- alternatively, as assessment of traffic volume becomes indeterminate, some streets may be over designed, with loss of economy (see Figure 3.4.B)

- the street layout may become confusing to visitors (see Section 3.4.5 of the Design Standards for Roadworks "Legibility")

Regardless of the degree of connectivity for vehicular traffic, **pedestrians and cyclists** require a high degree of connectivity for access to neighbourhood facilities, bus routes and regional transport facilities.

This requirement, however, can be provided relatively simply by pedestrian/cycle links between the ends of cul-de-sac streets and through parklands.

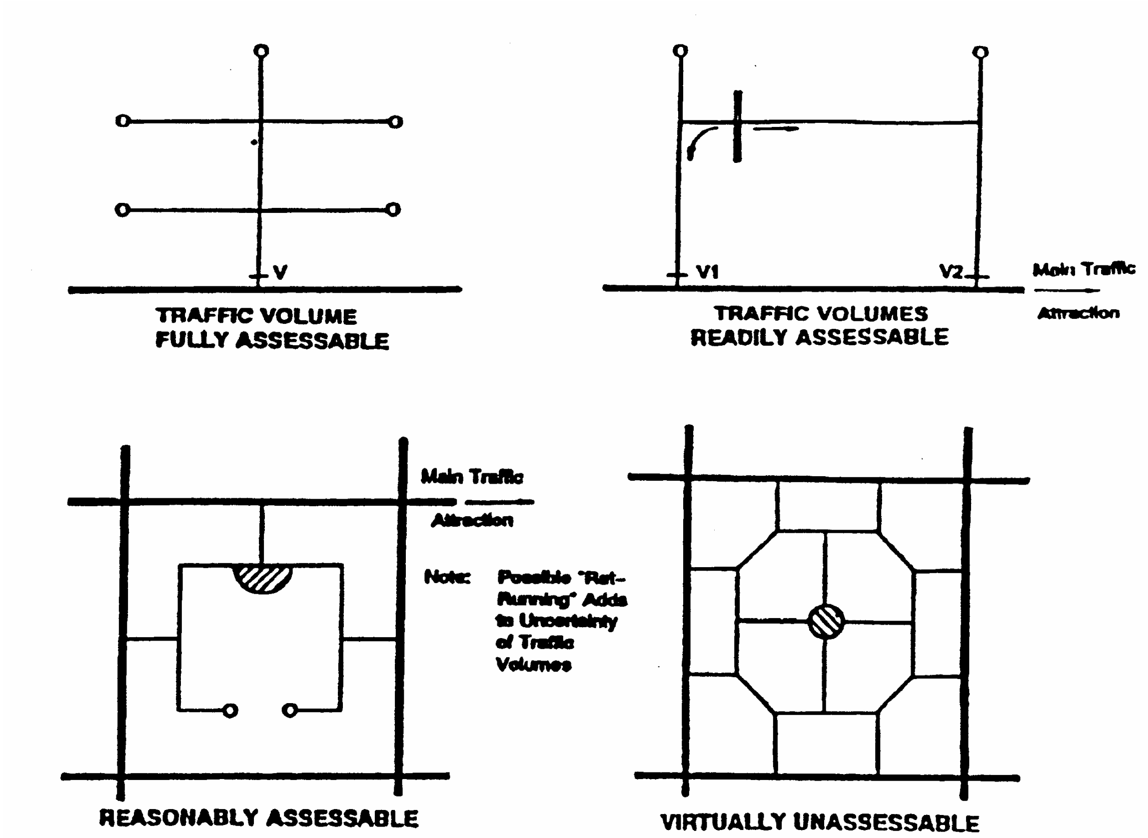


Figure 3.4.B

3.4.4 PERMEABILITY TO THROUGH TRAFFIC

The whole design of the residential street system is based on the assumption that it carries only traffic with its destination or origin within the neighbourhood and that **through traffic is absolutely excluded**.

Any permeation of through traffic across the neighbourhood will cause excessive traffic volume on the residential streets with consequent loss of safety and amenity to residents.

The likelihood of such "short-cutting" or "rat-running" may be minimised in two ways:-

- by avoiding "bottle-necks" on the major road system, which result in unreasonable delays
- by making any connections across the neighbourhood sufficiently circuitous to discourage through traffic

In general, connections which provide loops accessing the same major road are unlikely to cause problems. Connections, however, which provide for routes between major roads, either parallel or at 90° to each other, should be viewed with suspicion.

In assessing the likelihood of connections encouraging "rat-running" it must be borne in mind that a major signalised intersection may have 90 seconds of red time, during which time a driver can travel about 800m through the residential street system. Delays may be even longer if traffic does not clear the signals in one cycle.

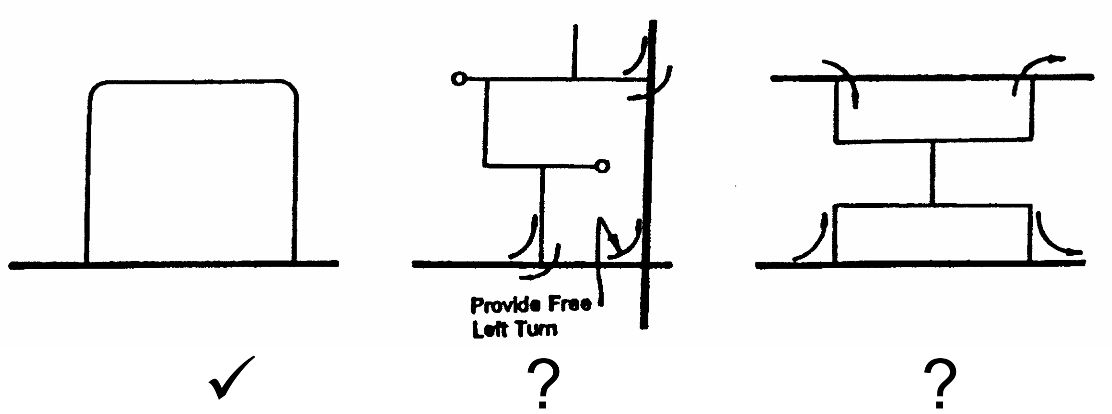


Figure 3.4.C

On a system of divided arterial roads, the most likely form of "spur-of-the-moment" rat-running is across a left turn intersection, to avoid long signal delay. Provision of a free left turn will reduce this tendency. Premeditated right-turn rat-running by regular travellers may, however, be a greater problem.

The situation can be minimised by identifying the most likely rat-running movements in the morning and evening peaks and keeping connections through the neighbourhood generally at right-angles rather than parallel to the main traffic movements. Possible future traffic generators should also be considered when assessing main traffic movements.

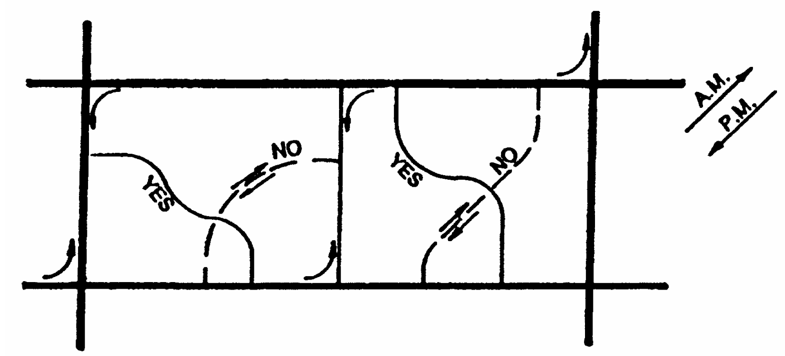


Figure 3.4.D

Off-setting intersections of residential streets to arterials, rather than using 4-way signalised intersections or roundabouts, will also assist in discouraging through traffic from using residential streets as alternative routes parallel to congested arterials.

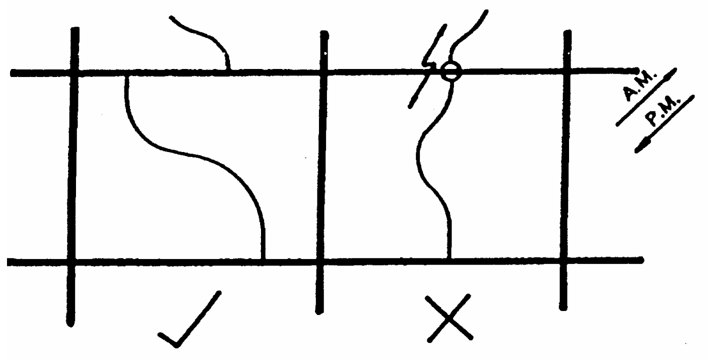


Figure 3.4.E

3.4.5 LEGIBILITY

"Legibility" refers to the ease with which the street layout can be "read" by street users, particularly visitors.

With regard to the main "framework" of the neighbourhood streets, the emphasis should be on simplicity of layout, with a minimum of alternative routes and a minimum number of turns to be made to reach a destination.

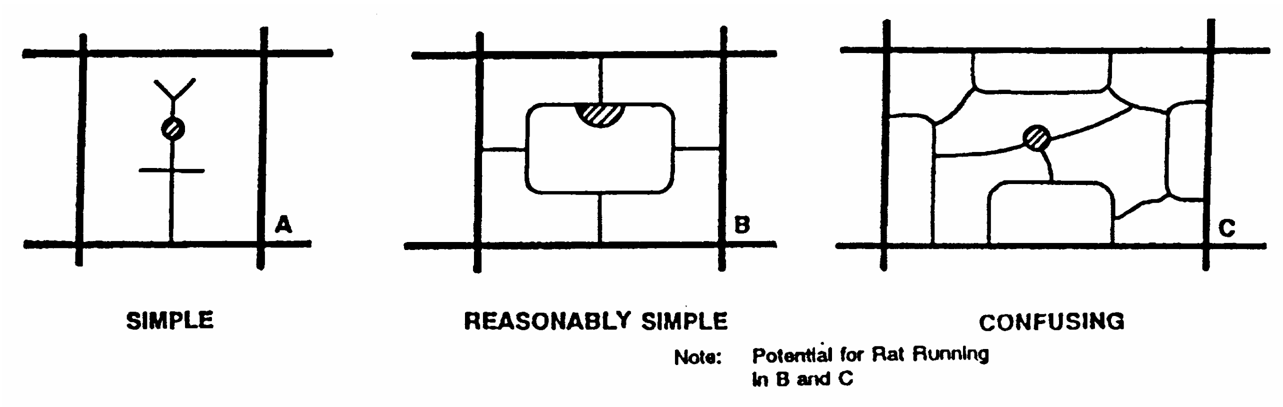


Figure 3.4.F

3.4.6 ECONOMY

Economical construction is achieved when:-

- the length of street within the neighbourhood to which residential frontage is denied is minimised (i.e. streets with traffic volume over 3000 v.p.d. maximum, 3500 v.p.d. absolute maximum). The "ideal" is obviously that there be no such streets; and

- no street is designed in excess of its required capacity

This implies a layout in which the traffic volume in every street can be reasonably assessed.

3.5.0 BUS ROUTES

3.5.1 RELEVANCE

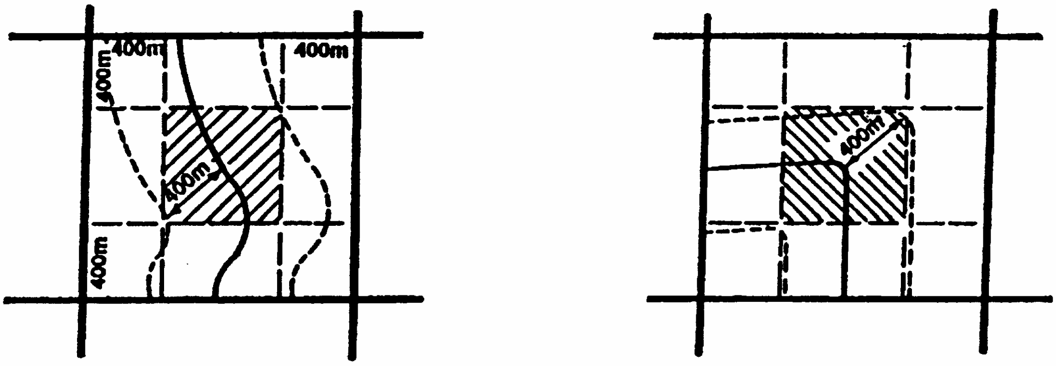
The relative importance of provision for bus-routes must be assessed for the area under consideration, in the light of the likelihood of a bus service being provided. In areas where a bus service exists, or may reasonably be expected to be provided in the future, the neighbourhood design should make appropriate provision for suitable future routes.

3.5.2 DISTANCE TO BUS ROUTE

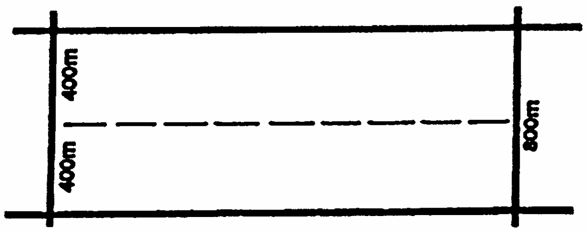
A commonly quoted “ideal” for the provision of bus transport is that each residence be within 500m walking distance of a bus-stop.

This may be converted to a guideline that **90% of allotments be within a 400m** straight-line distance **of a potential bus route**.

Effectively, this means that for most neighbourhoods a single potential bus route should be provided across the neighbourhood.



Bus route required to serve shaded area.



No bus route required.

Selection of an appropriate route through an individual neighbourhood requires consideration of routes in the surrounding area. If a “bus route strategy plan” is available, or there are existing services, these would provide a starting point. A logical strategy may provide for express buses on the major roads, with a local service traversing the neighbourhoods.

3.5.3 BUS ROUTE REQUIREMENTS

Detailed bus route requirements within the neighbourhood are:-

- reasonably direct
- no “doubling back” (unless at the terminus of a route)
- minimum travel distance in low-speed streets (from consideration of both the buses and residents)

Collector streets required to provide bus routes through the neighbourhood are designated as **Bus Collector Streets.** Bus Collector Streets have a 9.5m carriageway.

Bus routes are to be designed into the neighbourhood road network to provide for new and for the extension of existing public transport routes.

Potential bus routes will be nominated by the Pine Rivers Shire Council, and in such cases provision should be made in the detailed design for sufficient verge width to accommodate possible indented bus-bays and passenger shelters likely at major bus stops.

“Bus-only” links are sometimes proposed to give direct bus connections but inhibit through traffic. Enforcement by regulation is unlikely to be effective, however, and physical constraints are likely to be hazardous to other vehicles.

In instances where planning has not provided a satisfactorily bus route, a bus can be accommodated on a collector street with a 7.5m wide carriageway occasionally, however at significantly reduced speed and increased nuisance and inconvenience to bus operators and residents.

Bus routes should **not** be located on streets of lesser classification than **Collector**.

3.6.0 NEIGHBOURHOOD SCHEMATIC LAYOUT

3.6.1 APPLICATION OF DESIGN PRINCIPLES

The design principles discussed in Section 3.4.0 of the Design Standards for Roadworks may be applied to a theoretical neighbourhood to investigate and evaluate the possible range of schematic layouts.

3.6.2 RESIDENTIAL "CELLS"

The requirement that the traffic volume in any residential street be desirably a maximum of 3000 v.p.d., and an absolute maximum of 3500 v.p.d., tends to result in a layout consisting of a series of "cells" or "precincts" each of 300 to 350 allotments (see Section 2.2.0 of the Design Standards for Roadworks), with a single major connection to the street or road system external to the "cell". The provision of connections to adjoining cells may tend to blur the boundaries between cells in the final layout but the "cell concept" provides a useful building block for schematic design.

A typical neighbourhood of approximately 1800 allotments may then be made up of **5 or 6 cells each of 300 to 350 allotments**.

3.6.3 SOME SCHEMATIC OPTIONS

Figures 3.6.A to 3.6.F show a range of possible schematic layouts, together with a summary of their respective advantages and disadvantages.

From these examples, three basic forms of schematic layout can be identified:-

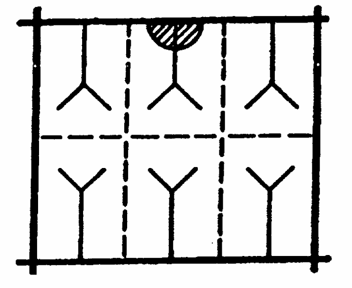
- connection of individual "cells" direct to major roads (Options 1 and 3)
- interconnection between cells, using collector streets (Options 2 and 4)
- no access internal street providing connection between cells and to the major road system (Options 5 and 6)

Each has its advantages and disadvantages, resulting mainly from the varying compromises between the factors of:-

- permeability
- connectivity
- economy

Option 1

INDIVIDUAL CONNECTION FROM EACH CELL TO ARTERIAL ROADS – NO INTERCONNECTIONS



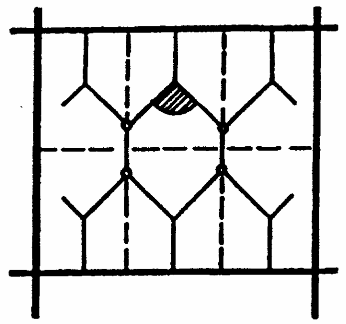
Each cell – 300 allotments
Each access – 3000 v.p.d.

FOR	AGAINST
- impermeable to through traffic - no uncertainty of internal traffic volume - no "no-access" streets required - minimum travel time in low-speed streets	- lack of internal connections need to use arterial roads to access facilities - no sense of "neighbourhood" - no alternative routes - no practical bus route - large number of intersections to arterial roads

Figure 3.6.A

Option 2

INDIVIDUAL CONNECTION FROM EACH CELL TO ARTERIAL ROADS – BUT INTERCONNECTIONS BETWEEN CELLS



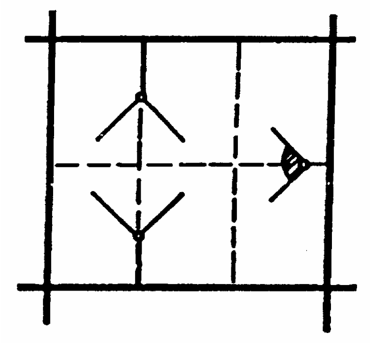
Each cell – 300 allotments
Each access – 2100 v.p.d. +

FOR	AGAINST
- internal connections to access facilities - alternative routes available - minimum travel time in low-speed streets - sense of "neighbourhood" - bus route possible	- uncertainty of internal traffic volume – likely connections exceed 3000 v.p.d. - permeability to through traffic - large number of intersections to arterial roads - bus route all in low-speed streets

Figure 3.6.B

Option 3

INDIVIDUAL CONNECTION TO ARTERIAL ROADS – NO INTERNAL CONNECTIONS



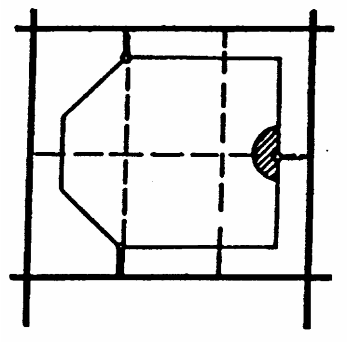
Each cell – 300 allotments
Each access – 6000 v.p.d.

FOR	AGAINST
- impermeable to through traffic - no uncertainty of internal traffic volume - number of intersections to arterials minimised	- lack of internal connections need to use arterials to access facilities - no sense of "neighbourhood" - no alternative routes - no practical bus route - "no-access streets" required (but minimum length

Figure 3.6.C

Option 4

COMBINED CONNECTIONS TO ARTERIAL ROADS - WITH INTERNAL CONNECTIONS BETWEEN CELLS



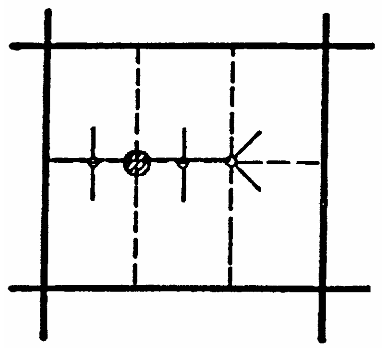
Each cell – 300 allotments
Each access – 4200 v.p.d. +

FOR	AGAINST
- internal connections to access facilities - alternative routes available - sense of "neighbourhood" - bus route possible - minimum intersections to arterials	- uncertainty of internal traffic volume - likely to exceed 3000 v.p.d. - permeability to through traffic - "no-access" streets required (but minimum length

Figure 3.6.D

Option 5

NO-ACCESS INTERNAL STREET TO CONNECT TO ALL CELLS
- DEAD END



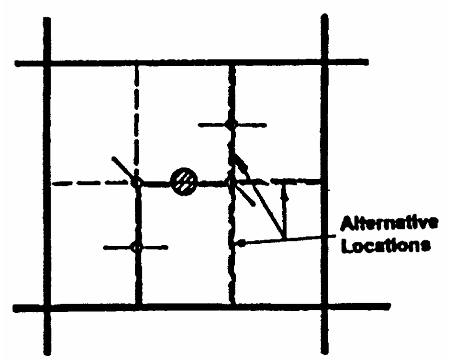
Each cell – 300 allotments
Each access – 12,600 v.p.d.

FOR	AGAINST
- internal connections to access facilities - impermeable to through traffic - minimum intersection to arterial roads - no uncertainty of traffic volume - sense of "neighbourhood"	- considerable length of "no-access" road - no alternative routes - no provision for bus route (unless route terminates) - longer travel times

Figure 3.6.E

Option 6

NO-ACCESS INTERNAL STREET TO CONNECT TO ALL CELLS
- THROUGH STREET



Each cell – 300 allotments
Each access – 6,300 v.p.d. +

FOR	AGAINST
- internal connections to access facilities - no uncertainty of traffic volume on residential streets - alternative routes available - bus route available - sense of "neighbourhood"	- maximum length of "no-access" road - some permeability to through traffic - some uncertainty of traffic volume on through road - through road may be "divisive"

Figure 3.6.F

3.7.0 THE TRUNK COLLECTOR STREET

3.7.1 NEED FOR A “NO-ACCESS STREET”

From consideration of possible schematic neighbourhood layouts it is evident that it will not always be possible to maintain the traffic volume on collector streets below 3000 v.p.d. (desirable maximum) or 3500 v.p.d. (absolute maximum).

Whenever the number of accesses to the major road system is less than the number of “cells” and whenever there is connectivity provided between cells, there is the possibility of sections of the collector street system carrying volume **in excess of 3500 v.p.d.**

By definition, such a street cannot provide direct frontage access to residential allotments, due to the loss of amenity resultant from such traffic volume; hence the term “no-access street”.

3.7.2 NOMENCLATURE

A common terminology for such a street is a “no-access distributor”, while AMCORD applies the name “trunk collector” to the particular case of a street of this type 150m or less in length. As a compromise these guidelines propose that the term **“Trunk Collector”** be used, regardless of the street length.

It may be argued whether “street” or “road” is the appropriate term for this thoroughfare, as it is rather ambivalent by nature, being within the residential area yet not providing direct access to residential allotments.

The term **“street”** is, however, considered more applicable as:-

- it is within the residential neighbourhood
- design philosophy is to restrict speed, by geometric design, as for other residential streets (see Section 2.3.0 of the Design Standards for Roadworks)

3.7.3 TRAFFIC VOLUME

The methods of Section 2.2.8 of the Design Standards for Roadworks can be expanded to calculate the probable traffic volume on each section of Trunk Collector street.

The traffic capacity of such a street, with no frontage access or parking, is considerable, but having regard to speed restrictive design and the residential environment, the maximum traffic volume should be limited to **9000 v.p.d.**

3.7.4 ECONOMY

As the lack of facility to access residential allotments directly to this type of street can impose a certain economic penalty on subdivision development, the subdivision layout should keep the length of such streets to the reasonable minimum.

Judicious variations of the collector layout can minimise the extent of “no-access” streets required by reducing the traffic volume on critical sections of the Collector streets e.g.:-

- relocation of intersections to arterials
- relocation of cell connections to collectors
- omission or insertion of some connections
- detailed design to encourage or discourage use of appropriate routes

Maximum use of the street for access to uses other than single residential allotments will also assist economy (see Section 3.7.5 of the Design Standards for Roadworks).

The side boundaries of residential allotments may also adjoin the street, subject to the provision of adequate noise and visual buffer strips and prevention of vehicular access.

3.7.5 ACCESS

While the trunk collector provides no direct frontage access for residential allotments, it may provide access for multi-unit residential development, schools or shopping centres, provided that:-

- provision is made for internal turning of vehicles and hence ingress and egress are in a forward direction only

- the accesses are provided with auxiliary lanes and channels as necessary

- appropriate buffer strips are provided

3.7.6 STANDARDS

Typically, design standards appropriate for Trunk Collector streets are:-

- Design speed
  Design geometry to limit vehicle spot speeds to **60 km/h** in accordance with the provisions of section 2.3.0 of the Design Standards for Roadworks.

  60 km/h is considered appropriate for traffic capacity and travel time requirements as there is no direct frontage access. **Speed limiting** design is, however, also considered appropriate as the street is **within** a residential area and hence will carry internal vehicular traffic, pedestrians and cyclists.

- Traffic volume
  9000 v.p.d. maximum.

- Carriageway
  Width – 9.0m
  2 x 3.5m travel lanes, plus extra width for drainage and emergency passing.

  Provision for additional auxiliary lanes, possible cycle lanes and future bus bays.

- Drainage
  Standard “layback” type concrete kerb and channel.

  This is considered to be the appropriate edge treatment to be consistent with other streets within the neighbourhood as there will be frequent intersections and/or accesses.

- Cross-section
  Refer to the Pine Rivers Shire Council adopted standard drawings for the standard cross-section for this street classification.

  A further alternative is **a divided carriageway with a median**, particularly appropriate where there is a succession of channelled intersections and/or accesses. A median of 2.0m minimum width also greatly assists pedestrian crossing opportunity.

  Each carriageway should be 5.0m width to provide for passing a broken down vehicle.

- Reserve width

24-27m	dependent on selected carriageway cross-section. Extra width required at intersections for auxiliary lanes (refer to the Pine Rivers Shire Council adopted standard drawing).

- Parking

No provision	design to discourage on-road parking e.g. adequate on-site parking for adjacent development and landscape or fence barriers between road and development.

- Intersections
  Intersection of Trunk Collectors to:-

  - Arterial or Sub-Arterial - signals, roundabout or “T” (all movements or left in/left out)
  - other Trunk Collector or Collector - “T” or roundabout
  - access street or access place - intersection undesirable
  - minimum spacing - 100m

  All intersections and major development accesses (e.g. schools, shopping centres, multi-unit development) to be provided with right-turn, deceleration and passing lanes, 3.0m wide. Channelling at intersections and accesses is generally necessary.

- Bus bays
  Sufficient width for future indented bus bays at appropriate locations (e.g. schools, shopping centres, major intersections, pedestrian routes).

- Pedestrians and cyclists
  Provision dependent on overall planning and to be in accordance with the Pine Rivers Shire Council Bikeways Plan. Generally, dual-use pedestrian/cyclist paths in verge on one or both sides, or provision for pedestrians and/or cyclists on alternative route locations.

- Services
  Verge width sufficient for possible major services required.

- Aesthetics
  - mounding and landscaping to be provided
  - uniform fencing erected by the developer is desirable

- Noise Attenuation
  Required to be provided in accordance with the Pine Rivers Shire Council policy.

  Noise attenuation may be provided by:-

  - distance (traffic lane to house)
  - mounding and/or landscaping
  - fencing
  - house design (e.g. double glazing, blank walls)

  Distance alone may be sufficient for lower traffic volume. Indicative distances required from the nearest trunk collector traffic lane to the house façade, for acceptable attenuation without other measures, are:-

Traffic Volume (v.p.d.)	**Distance Required (m)**
3000	13
4000	16
5000	19
6000	22
7000	26
8000	29

From Pak Poy-Kneebone Pty Ltd AMCORD Background Data, 1989

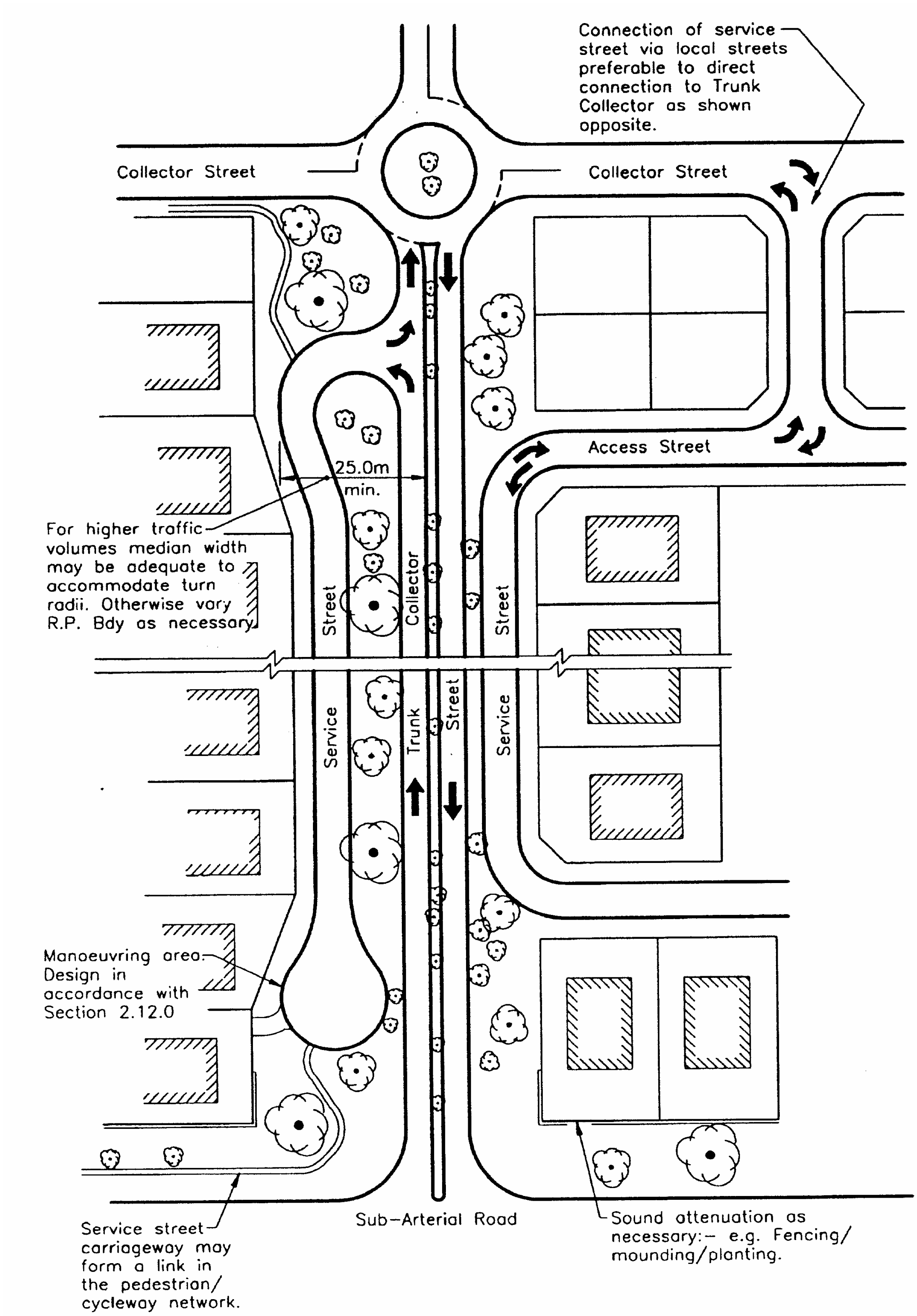
Figure 3.7.A

3.7.7 SERVICE STREET

A service street parallel to the trunk collector street carriageway, providing access to frontage residential allotments, is an option which may both provide the necessary road to house separation for noise attenuation and a much more aesthetic aspect from the trunk collector than side or rear allotment fencing.

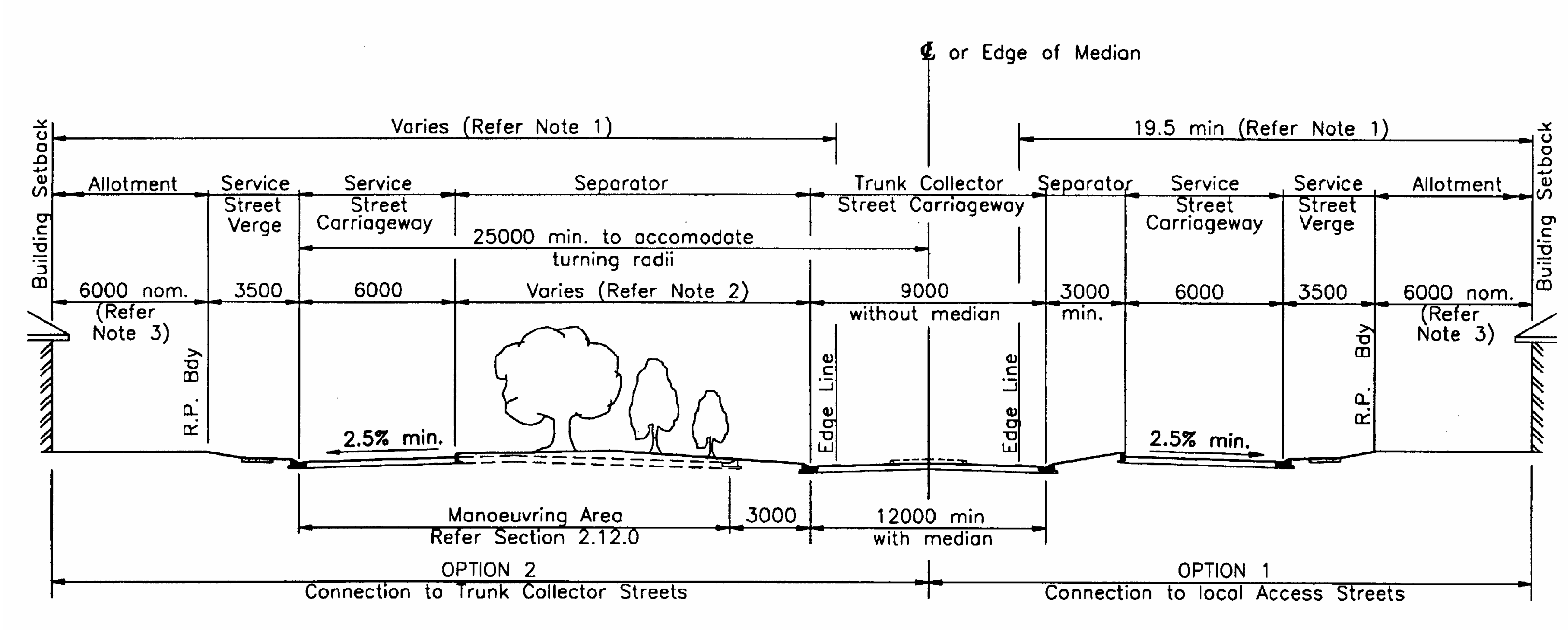
The practical limit to this option is the **economic viability** of providing the necessary median width, and possibly additional carriageway construction, compared to the cost and potential aesthetic detriment of other sound attenuation measures.

The service street carriageway may also serve as a link in the pedestrian/cycle way network, thereby obviating the construction cost and land requirement for a pathway within the trunk collector street reserve. Figure 3.7.B and Figure 3.7.C show some **possible options** for service street carriageways.



Trunk Collector Street with Service Street Options

Figure 3.7.B



Notes:-

1. For higher traffic volume, increase separator width to provide required total road/house distance in accordance with Section 3.7.6.
2. Separator width to be increased to accommodate turning radii for connection to Trunk Collector street and manoeuvring areas.
3. Variations to nominal building set back will affect the required separator width necessary to obtain design noise attenuation.

Trunk Collector Streets
Typical Cross-Sections

Figure 3.7.C

TRUNK COLLECTOR STREET
TYPICAL CROSS-SECTION

(REFER STANDARD DRAWING 8-10005)

3.8.0 COLLECTOR SYSTEM DESIGN

3.8.1 FACTORS

Application of the schematic layout theory to practical situations requires consideration of the following site-specific factors:-

- intersections to major road system
- type and location of neighbourhood facilities
- topography
- external traffic attractions – work opportunities, retail, other
- external bus routes

3.8.2 INTERSECTIONS

The opportunities and limitations for the location of intersections to the boundary major road system have been discussed in Section 3.3.0 of the Design Standards for Roadworks.

Points to consider in selection of intersection locations include:-

- the maximum number of intersections will reduce traffic volume and travel distance on Collector streets
- the risk of permeability ("rat-running") also tends to increase with the number of intersections

3.8.3 NEIGHBOURHOOD FACILITIES

The type and location of neighbourhood facilities are determined more by planning than engineering criteria. The only traffic-generating facilities likely to be provided within the neighbourhood, however, are:-

- neighbourhood shopping centre
- primary school
- child care centre

To provide a neighbourhood "nucleus", a reasonable arrangement could be to have the school separated by a neighbourhood park from the shopping centre and child care centre.

Both the shopping centre and the school are generally intended to serve only the subject neighbourhood and hence should be located for maximum accessibility from all parts of the neighbourhood.

A logical location for the facilities is on a major access into the neighbourhood, for convenience of residents entering and leaving the neighbourhood, but not so close to a major road as to attract traffic to the shopping centre from the major road system.

There will, however, inevitably be some traffic to these facilities from outside the neighbourhood (e.g. shop employees, deliveries, school teachers) and the probable "Trunk Collector" street between the major road and the neighbourhood facilities will provide for such traffic.

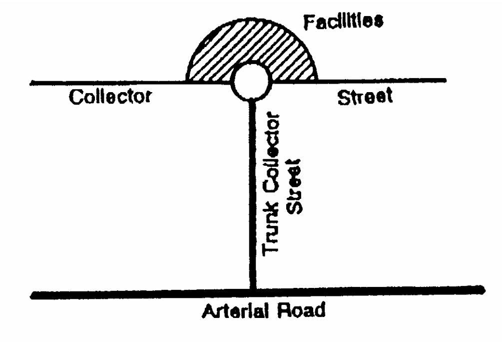


Figure 3.8.A

3.8.4 TOPOGRAPHY

While the detailed street design must necessarily take due account of topography, the schematic or concept design must also have regard to major topographic constraints, such as:-

- steep land (too steep for acceptable street gradients)
- flood prone land (unsuitable for residential use)
- major watercourses (minimising crossings)

3.8.5 EXTERNAL TRAFFIC ATTRACTIONS

Assessment of traffic volume on the internal collector street system requires a judgement on the location of both present and likely future main external traffic attractions, in order to infer the likely travel routes on the internal streets.

The directions of the morning and evening peak flows on the major road system, resultant from traffic to and from these main traffic attractions, is also significant, to judge likely "rat-running" tendencies.

3.8.6 BUS ROUTES

The location of existing, planned or likely future bus routes in the vicinity of the neighbourhood will assist in assessing the location for a practical potential bus route through the neighbourhood.

Bus Collector streets are to be included into the neighbourhood street network.

3.9.0 THE ACCESS STREET SYSTEM

3.9.1 DESCRIPTION

The access street system refers to the whole of the street system within the neighbourhood other than the system of trunk collector and collector streets which provide the connection between each street cell and the major road system (see Section 3.4.1 of the Design Standards for Roadworks).

Typically, the access street system will be made up of a number of virtually self-contained "cells", each with a single collector street "stem", connecting with either the neighbourhood collector system or the major road system, and in turn branching into a number of access streets and access places.

Interconnection between branches may, however, create a number of "loops", tending to blur the basic "branch" layout.

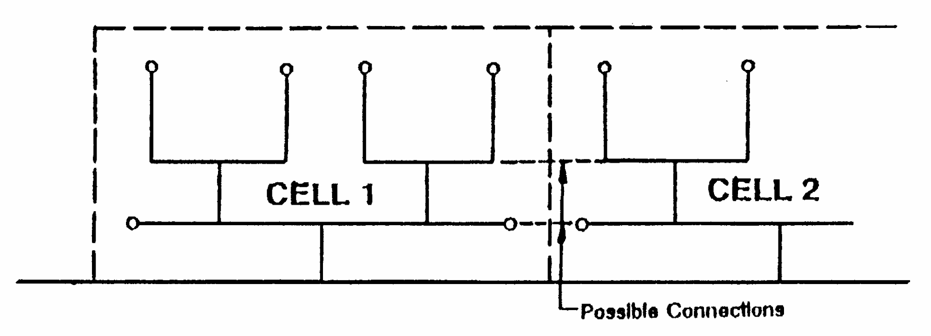


Figure 3.9.A

Layouts may be categorised by the number of branch systems or the number of turns necessary by a driver to reach the furthermost street, e.g.:-

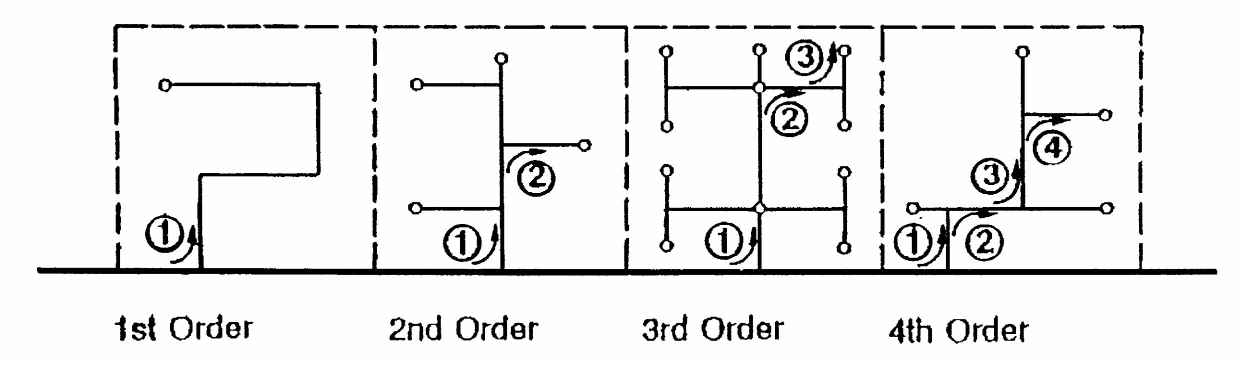


Figure 3.9.B

3.9.2 FACTORS

The design of access street layouts should recognise the following factors:-

- connectivity
- permeability
- legibility
- traffic volume minimisation
- travel time minimisation

The first three are identical to collector system considerations. For the access system, however, the emphasis is slightly different.

3.9.3 CONNECTIVITY AND PERMEABILITY

These two factors are inter-related:-

- without connectivity there is no permeability
- connectivity may result in permeability

The basic "branching" street layout should be designed to provide the most reasonably direct route for the majority of traffic movements. Assuming that this is the case, the only justification for additional connectivity is to provide alternative routes for emergency use.

A reasonable criterion for such connections is that any group of allotments larger than 100 maximum, or 50 desirably, should have a minimum of two access routes.

Excessive connectivity is undesirable as:-

- the "cell" may become permeable to through traffic from other cells, resulting in excessive traffic volume
- assessment of traffic volume becomes indeterminate due to the number of alternate routes, resulting in either over- or under-design
- the layout may become confusing for visitors

Where additional connections are provided, they should be approximately at 90° to the main traffic direction to avoid inadvertently creating alternative parallel routes to the collector street system.

As discussed in Section 3.4.3 of the Design Standards for Roadworks, regardless of the degree of connectivity for vehicular traffic, **pedestrians and cyclists** require a high degree of connectivity for access to neighbourhood facilities, bus routes and regional transport facilities, but this requirement can be provided relatively simply by pedestrian/cycle links between the ends of cul-de-sacs streets and through parklands.

3.9.4 LEGIBILITY

Taken to extremes a "multi-branching" layout can be confusing to street users, particularly visitors. Hence to keep the layout "legible", or easily read, layout should not generally exceed **"third order"**, i.e. a driver should not have to make more than three turns, or utilise more than three different streets between the neighbourhood collector street system and his destination.

A large number of alternative routes can also be confusing, which is another reason for limiting connectivity.

3.9.5 MINIMISING TRAFFIC VOLUME

While the maximum traffic volume in the street system is limited, it is also highly desirable that the **greatest possible percentage of allotments has the least possible volume of passing traffic**.

A desirable criterion is that 90% of allotments should have a passing traffic volume of less than 1000 vehicles per day.

This can be achieved by having as many allotments as possible located in short streets, i.e. a multi-order layout with a large number of very short cul-de-sac streets is preferred.

The Pine Rivers Shire Council preference in this regard is that the maximum number of allotments in a cul-de-sac be twenty.

3.9.6 TRAVEL TIME

For the convenience of all street users the distance from each allotment to the major road system should be a reasonable minimum.

Pedestrian and cyclists may be provided with convenient “short cuts” via pathways or park areas.

For vehicles the most significant factor is the travel **time**, as drivers may become impatient with the slow-speed environment if the time is excessive.

For comparison, indicative travel times for a 300 allotment catchment are:-

- first order layout - 250 secs
- second order layout - 70 secs
- third order layout - 60 secs

60 seconds is generally considered a reasonable travel time, with 90 seconds as a maximum. Hence either **second** or **third** order layouts are generally acceptable.

3.9.7 BUS ROUTES

The use of Access streets and Collector streets as bus routes is not permitted as part of the neighbourhood street layout.

3.9.8 PREFERRED LAYOUT

From the above considerations of legibility, minimising traffic volume and minimising travel time, **second** or **third** order layouts are generally the preferred basis for design.

3.10.0 THE STREET NETWORK

DESIGN CRITERIA

Objectives

A street layout which limits traffic volume and speed to a minimum, consistent with reasonable driver convenience.

Specific Outcomes

- neighbourhood areas which can each support its own primary school and shopping facilities
- minimum number of intersections to the major road system
- street layout to minimise travel time and traffic volume on neighbourhood streets
- street layout providing a reasonable degree of internal connectivity
- low permeability of street layout to positively discourage through traffic
- street layout to be “legible”
- traffic volume on all streets to be reasonably assessable
- street layout to provide maximum economy of construction
- provision for existing and potential bus routes
- provision for pedestrian and cyclist links

Probable Solutions

- neighbourhood areas within the range of 1500 to 1800 allotments
- intersection spacing of neighbourhood streets to major roads in accordance with Table 3.3.A of the Design Standards for Roadworks.
- design of intersections to major roads in accordance with Road Authority and/or NAASRA (Austroads) Standards
- maximum travel time of 60 seconds on low-speed streets (i.e. less than 60 km/h design speed)
- traffic volume of 3000 v.p.d. (desirable maximum) or 3500 v.p.d. (maximum) on any street with direct residential access
- 90% of allotments with a frontage traffic volume of less than 1000 v.p.d.
- all allotments with vehicular access to neighbourhood facilities without need to use major roads
- street layout not exceeding “third order” i.e. no allotment requiring more than three turns, or use of more than three streets, from the neighbourhood collector street system
- maximum of twenty allotments in any cul-de-sac
- all “precincts” of one hundred allotments and over, having an alternative street access route
- potential bus route located within 400m of 90% allotments
- bus routes planned and appropriate classification of streets included into street network
- minimum possible length of trunk collector streets
- design of trunk collector streets in accordance with Section 3.7.6 of the Design Standards for Roadworks
- design of all streets in accordance with Section 2.0.0 of the Design Standards for Roadworks