PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

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

PINE RIVERS

PART 1
DESIGN STANDARDS FOR ROADWORKS

PINE RIVERS SHIRE COUNCIL

PART 1 - DESIGN STANDARDS FOR ROADWORKS

SECTION 2
THE RESIDENTIAL STREET

2.1.0 PHILOSOPHY OF THE RESIDENTIAL STREET

2.1.1 FUNCTION OF THE STREET

The residential street serves a number of functions, i.e.:-

- **access to residences**
  - motor vehicles - residents, visitors, delivery and service vehicles
  - cyclists
  - pedestrians

- **public transport**
  - reasonable access to / for vehicles for public transport

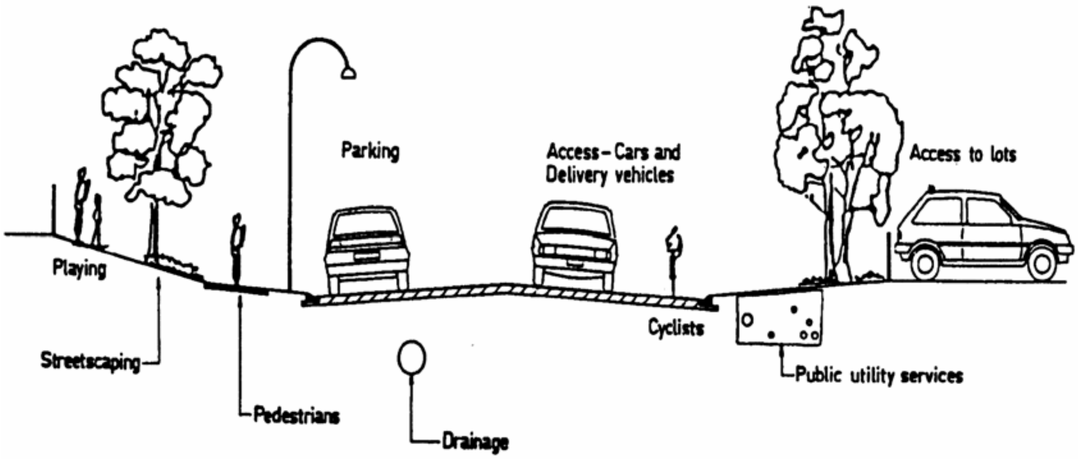
- **parking**
  - visitor vehicles and overspill of residents' vehicles

- **social and activity space**
  - for neighbours to chat and children to play

- **setting and approach**
  - desirably with high aesthetic and amenity quality for the residences located on it

- **stormwater drainage path**
  - both underground and overground

- **services location**
  - for utility services to residences



THE FUNCTIONS OF A RESIDENTIAL STREET

Figure 2.1.A

2.1.2 MOTOR VEHICLE v THE REST

The only potentially incompatible street user within the above list is the **motor vehicle**.

Without the need to cater for its requirements the street could be a park strip, planted and landscaped, with a narrow pathway meandering between the trees - the ultimate in **safety, amenity and economy**.

Over the last several decades however, the motor vehicle has entrenched itself into our society to an extent where the validity of its perceived needs has been accepted with little question.

In the last few years, however, the legitimate claims of other street users and of residential amenity have been recognised.

The challenge of contemporary street design is therefore to resolve these conflicting interests, or at least to reach an acceptable compromise.

2.1.3 COMPROMISE

Like it or not, the motor car is an integral and essential part of the typical Australian lifestyle and therefore the most practical solution appears to be a modification of our accepted conventional street system to achieve a reasonable compromise between the perceived needs of the motor vehicle and those of street users.

The extent of this conflict of needs is a function of:-

- traffic volume
- traffic speed

The greater the traffic volume and speed, the more detriment it is to the goals of safety, amenity, convenience and economy.

- **safety** - greater chance of accidents with volume and increase in accident severity with speed
- **amenity** - increased traffic noise and exhaust fumes
- **convenience** - less opportunity for pedestrians to cross roads and drivers to enter traffic streams
- **economy** - greater construction costs to safely provide for increased traffic volume and speed
- **environment** - greater impact on the environment with increased traffic volume and speed

The necessary compromise is therefore to limit traffic volume and speed in residential streets to a level which is reasonably compatible with the safety and amenity of other street users.

Above the limit of traffic volume where this is no longer acceptable, frontage of residential allotments to the street should not be permitted.

2.1.4 TRAFFIC CHARACTERISTICS

Vehicular

Vehicular traffic in properly planned residential streets mainly comprises cars with some light delivery vehicles.

There is the occasional larger vehicle such as:-

- garbage truck - weekly or bi-weekly service
- larger truck, with e.g. building materials
- furniture van
- resident's boat or caravan
- local bus service

While these larger vehicles must be able to negotiate the street, their comparative rarity is such that is it not reasonable to design for their total convenience. Reduced speed and reduced passing clearances are therefore acceptable for a car passing a truck or bus and still more so for the even rarer event of trucks or buses passing.

Pedestrian and Cyclists

In the typical low volume – low speed traffic situation which should exist in most residential streets, pedestrians and cyclists may be provided for on the carriageway on the basis of equal sharing with motor vehicles, subject to positive restriction on vehicle speed.

2.1.5 PHILOSOPHY OF TRAFFIC OPERATIONS

The basic principle of traffic operation in the low-volume, low-speed residential street environment is that:-

vehicles do not have unrestricted two-way movement at all times.

To provide such unrestricted movement, with uncontrolled parking on the carriageway, requires a carriageway width of approximately 10.0m minimum. While many existing fully residential streets do have carriageways of such width, they are quite unnecessarily wide and undesirable because of the traffic speeds they encourage.

A residential carriageway width of 8m (approximately) does not provide unrestricted movement when two vehicles park opposite each other. In such circumstances, drivers accept the slight inconvenience of having to slow down or briefly stop to give way to a vehicle coming the other way, particularly as it is quite likely to be a neighbour.

The expectation of having to slow or stop for a vehicle coming the other way will tend to keep speeds low, which is in accordance with the design philosophy for residential streets.

For consistency, it is highly desirable for all residential streets to be designed on this basis, to reinforce the difference in driver expectation, i.e.:-

residential street	**-**	**give way situations**
traffic route	**-**	**unrestricted two-way movement**

It is therefore considered both acceptable and desirable to have a "one-moving lane" situation in places (whether constructed that way or caused by parking of vehicles) **provided** that:-

- passing opportunities are available at reasonable intervals

- the incidence of opposing vehicle meetings is not sufficiently frequent to cause unreasonable delays

2.1.6 FUNCTIONS OF THE CARRIAGEWAY

The street carriageway therefore will have three functional components, as far as vehicles are concerned:-

- a single moving lane
- provision for opposing vehicles to pass
- provision for parked vehicles

The requirements in respect of each of these functions are dealt with in the following sections.

2.1.7 CARRIAGEWAY LANES

In subsequent sections, carriageway width is referred to in terms of the number of "lanes" e.g. **single lane, two lane or three lane**.

This, however, does not imply either that "lanes" are linemarked on the carriageway, or that a particular width of the carriageway is dedicated to a particular purpose. In this, the residential street differs from a major road, where "lanes" are formally delineated and generally dedicated to a specific use e.g. through traffic lanes, parking lanes, turn lanes, deceleration lanes etc.

In general, the width of the residential street may, at different times, be used for moving vehicles (either direction), passing opposing vehicles or for parked vehicles.

In this context "single lane", "two lane" or "three lane" therefore means a carriageway with a width designed to accommodate one, two or three vehicles within its cross-section, irrespective of whether those vehicles are moving or parked.

2.1.8 PHILOSOPHY OF THE RESIDENTIAL STREET

<u>DESIGN DATA</u>

Objectives

- To provide a high level of safety for all street users.

- To provide acceptable levels of residential amenity and protection from the impact of traffic.

- To provide a reasonable level of convenience for all street users.

- To provide maximum possible economy of construction, consistent with the other objectives.

Specific Outcomes

- ❖ Limitation of traffic speed and volume in residential streets to levels which are compatible with the safety and amenity of other street users and residents.

- ❖ Frontage of residential allotments to be permitted only to streets where these limitations of traffic speed and volume can be attained.

- ❖ Limitation of carriageway width to a minimum necessary to satisfactorily provide for required traffic functions.

Probable Solutions

- ❖ Conformity with the provisions of Section 2 of the Design Standards for Roadworks, and the Planning Scheme provisions.

2.2.0 TRAFFIC VOLUME

2.2.1 EFFECT OF TRAFFIC VOLUME

A high traffic volume in the residential street is detrimental to:-

- **safety** - increased risk of accident
- **amenity** - loss of amenity due to increased noise and exhaust fumes
- **convenience** - reduced opportunities for entering traffic streams or crossing roads

2.2.2 ENVIRONMENTAL CAPACITY

The most significant effect of traffic volume in the residential street is loss of amenity due to **noise**.

Assessment of a maximum acceptable limit for traffic noise is very subjective, with various research and standards suggesting that this limit occurs anywhere between **1200** and **5000** vehicles per day (see Table 2.2.C).

The most significant recommended range of maximum acceptable traffic volume for residential streets with direct frontage access of allotments is **2000** to **3000** vehicles per day.

The Pine Rivers Shire Council has resolved that the "deemed-to-comply" maximum acceptable traffic volume is **3000** vehicles per day with an absolute maximum of **3500** vehicles per day being considered subject to appropriate performance standards being met.

This limit is commonly referred to as the **environmental capacity** of the street, in contrast to the traffic capacity, which is a measure of the ability of the street to carry traffic. Depending on geometric design, the traffic capacity may be several times the environmental capacity.

2.2.3 LIMITATION OF TRAFFIC VOLUME

Restricting the traffic volume in the street to acceptable environmental capacity limits requires:-

- **limitation of the "catchment"** contributing traffic to the street, to an appropriate extent

  This is considered in detail in the following sections.

- **exclusion of through traffic** to ensure that only traffic actually generated by that catchment uses the street

  In the case of the cul-de-sac, or a small precinct with only one street connection, the exclusion of through traffic is automatically achieved. However, for all areas with more than one street connection, the possibility of through traffic must be carefully examined and the layout amended if necessary **to positively discourage through traffic**.

  This aspect is dealt with in detail in Section 3 of the Design Standards for Roadworks.

- **exclusion of unplanned traffic generators**

  Town Planning controls need to ensure that land uses other than those designated, do not encroach on single dwelling areas. Should an alternative land use be required, appropriate modification of the street system is a requirement for approval for such use.

2.2.4 TRAFFIC VOLUME

Practical application of the environmental capacity limit requires the means to calculate the traffic volume which will be generated in the street.

In a residential street, with through traffic excluded, this will be the product of the **"catchment"** expressed in "dwellings" and the **traffic generation rate**, expressed in vehicle trips per day, per dwelling.

2.2.5 CATCHMENT

For a single cul-de-sac, or a larger area having only a single street connection, the number of dwellings in the catchment may be counted directly as the number of single-dwelling allotments, on the basis that ultimately all allotments will be built on. Allowance must be made for any future resubdivision of larger allotments, or likely extension of the street system.

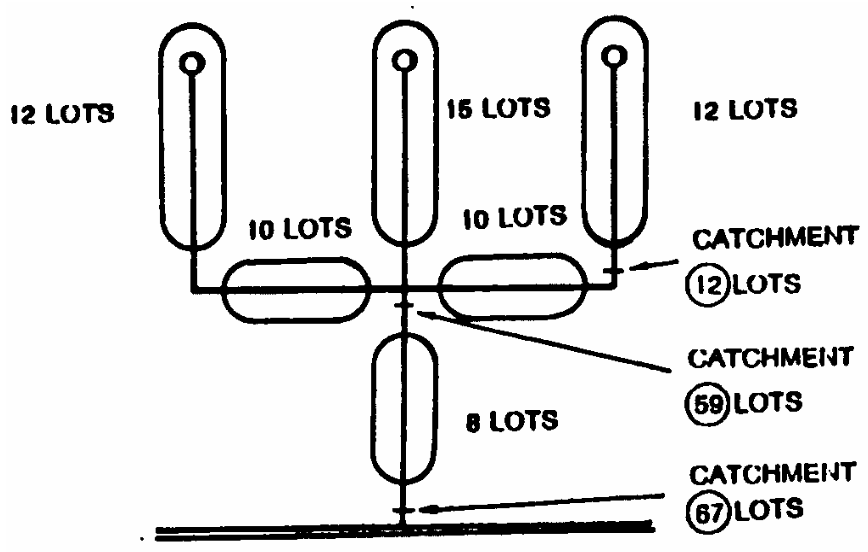
For "loop streets", however, or other areas with two or more connections, a judgement must be made as to the likely split of catchment to each connection, based on consideration of the locations of likely traffic attractions, e.g. employment centres, shopping centres, schools etc.

Where all traffic attractions are in the same general direction, this is relatively simple, requiring only selection of a "split point" from which alternative routes offer equal convenience for drivers. Notwithstanding intersections or "slow points", this will usually be the point of equal distance.

Where traffic attractions are in different directions, however, a separate assessment of the catchment generating traffic for each attraction must be made. An example of such a calculation is given in Section 2.2.8 of the Design Standards for Roadworks.

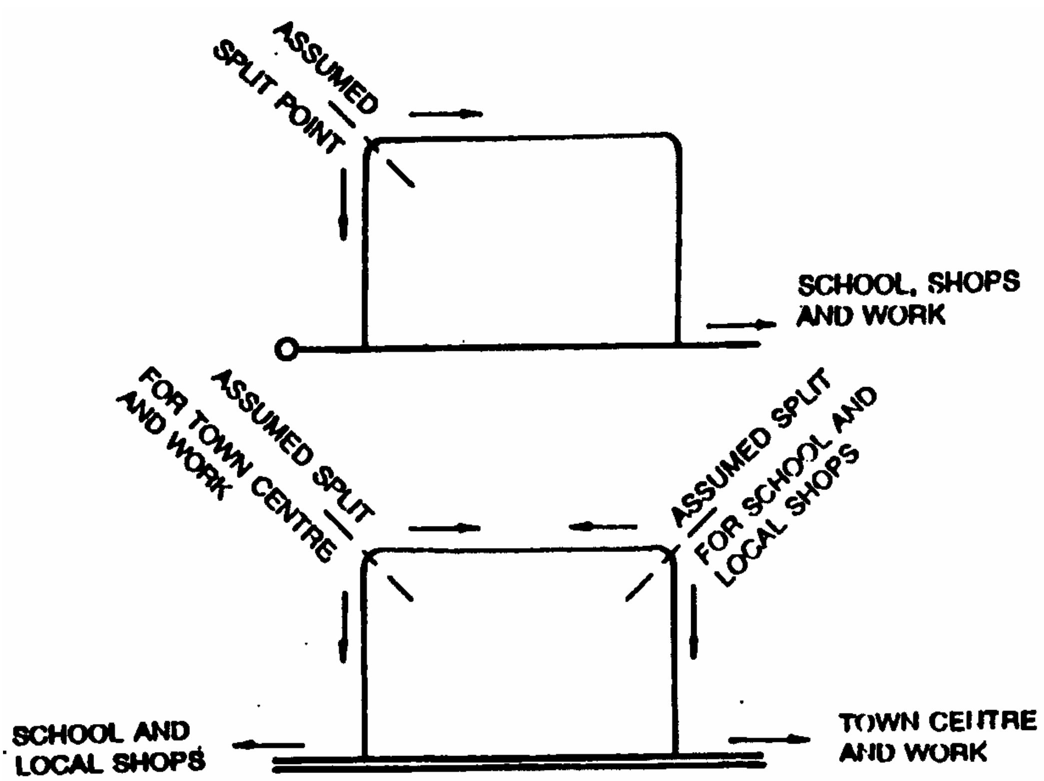
In practice, the network may be far more complicated as a number of alternative routes will often be available and in such cases a study by a traffic engineer will be necessary.

The requirements for provision of bus services and a bus route through the neighbourhood needs to be considered early in the planning stage of the neighbourhood and the street network. Refer to Section 3.5.0 of the Design Standards for Roadworks for the requirements for planning and locating bus routes.



TRAFFIC CATCHMENT

Figure 2.2.A



CATCHMENT SPLIT POINTS

Figure 2.2.B

SOME RECOMMENDED TRAFFIC VOLUME LIMITS FOR STREETS WITH RESIDENTIAL ACCESS (Brindle – 1988)

PLACE	MAX TRAFFIC LEVEL	SOURCE	
Standards and Guidelines			
U.K. Design Bulletin 32	300 dwellings	DoE	(1977)
Cheshire City Council	200 dwellings	Cheshire CC	(1976)
Canberra (1980)	4000 veh/d	T Brimstone	(Unpub)
New South Wales	300 traffic units		
	(2500-3000 veh/d)	Stapleton	(1984)
Orange County, California	1200 veh/d	Spitz	(1982)
Calgary	5000 veh/d	Bolger et al	(1985)
Winnipeg	4000 veh/d	Bolger et al	(1985)
Toronto	3000 veh/d	Bolger et al	(1985)
Mississauga	2000-3000 veh/d	Bolger et al	(1985)
Seattle	5000 veh/d	Bolger et al	(1985)
San Jose	3000 veh/d	Bolger et al	(1985)
Thousand Oaks	250 dwellings	Bolger et al	(1985)
Recommendations			
U.S. Research	2000 veh/d	Appleyard	(1981b)
Australian Thesis	2500 veh/d	R. Morris	(Unpub)
Australian Review	300 dwellings	Comerford	(1986)
Australian Review	2500 veh/d	McKinna	(1976)
Australian Review	3000 veh/d	Holton & Pattinson	(1976)
Commonwealth Bureau of Roads	1500 veh/d	Unpublished	
Nicholas Clark and Associates	3000 veh/d	Clark	(1975)
Alan M.Voorhees and Partners	2000 veh/d	Voorhees	(1978)
Traffic in Towns	2000-3000 veh/d	Buchanan	(1963)
U.S. Review	1200 veh/d	Spitz	(1982)

Table 2.2.C

2.2.6 GENERATION RATE

Single Dwellings

Traffic generation from residential areas can vary widely, dependent on a number of factors, such as:-

- size of traffic catchment
- geographical location
- demography of population (e.g. young couples, families with adult children, retirees)
- location of and distance to facilities (shopping, schools, employment)
- economic situation of residents (number of cars per dwelling)
- availability of public transport
- time (as demography of area changes)

As an example only, Figure 2.2.D shows the variation of trip generation with traffic catchment and over a period of time, for a number of different catchments in a particular area (southern Albert Shire).

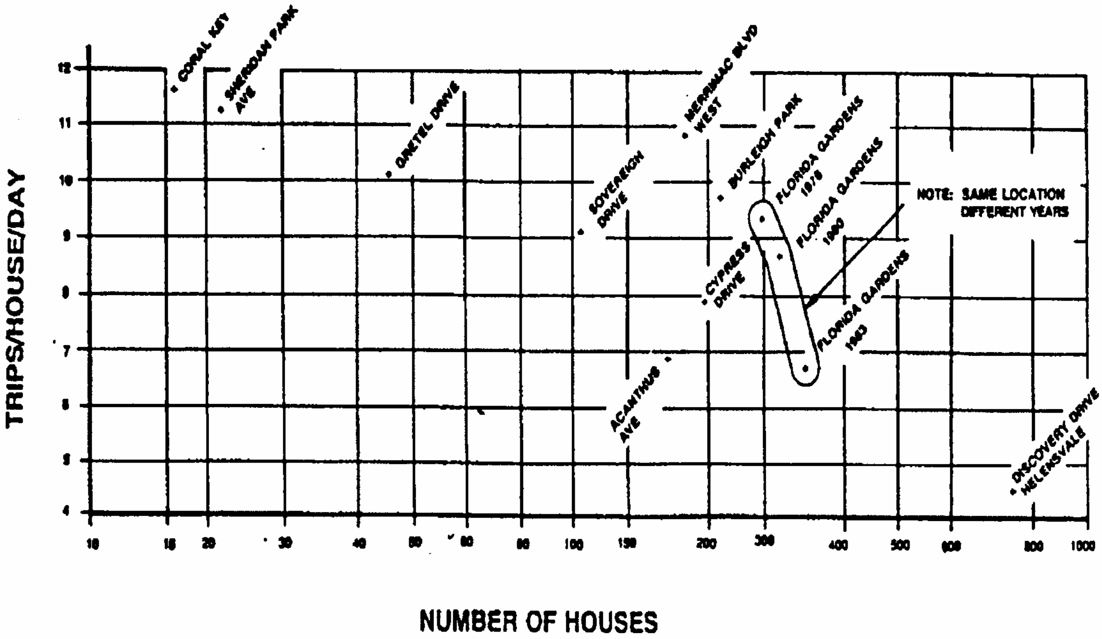


Figure 2.2.D

Source – Albert Shire Traffic Counts

The generally accepted design generation rate for catchment sizes applicable to residential streets is:-

10 trips per dwelling per day

This figure includes some allowance for a future increase in generation rates.

Uses other than Single Dwellings

While the predominant land use in average residential streets is single detached dwellings, some catchments may contain other dwelling types or land uses.

For traffic generation calculations it is convenient to reduce these uses to "equivalent dwellings", using the factors given in Table 2.2.E.:-

EQUIVALENT DWELLINGS

Separate dwellings or duplexes	1.0
Flats, units, townhouses (Average quality, generally single family)	0.6
Luxury units or likely multi-family occupancy units	1.0
Retirement villages - per unit	0.4
Local shops - per 100m^2 of gross floor area	6.0
Primary school	50.0
Small local sporting and similar facilities	10.0

Table 2.2.E

<u>EXAMPLE</u>: - retirement village of 20 units
"equivalent dwellings" = 20 x 0.4 = 8

2.2.7 MAXIMUM TRAFFIC CATCHMENT

For the great majority of streets, where there is no directional split of traffic (see Section 2.2.5 of the Design Standards for Roadworks), a combination of:-

- an environmental capacity of **2000** to **3000 v.p.d.**
- a maximum 3500 v.p.d
- a traffic generation rate of 10 trips per dwelling per day

gives the following standards for the "maximum traffic catchment" for a street with direct residential frontage:-

- desirable traffic catchment - 200 to 300 equivalent dwellings
- maximum traffic catchment - 350 equivalent dwellings

The maximum should only be considered where alternatives to reduce the traffic catchment (e.g. alternative routes) are not available or extremely expensive to implement.

2.2.8 TRAFFIC DISTRIBUTION

Where traffic attractions are in different directions, a separate assessment of the traffic volume resulting from each attraction must be made and the individual volume added to obtain the total volume at any point in the street.

This procedure requires a judgement of the **distribution** of the total traffic generation between the individual traffic attractions.

As discussed in Section 2.2.6 of the Design Standards for Roadworks, the total traffic generation per allotment varies with a number of factors, and the actual distribution of the traffic generated will also vary with these factors and in particular, with:-

- the extent and location of facilities within the neighbourhood (shop and schools)
- location of employment centres external to the neighbourhood
- location of major retail centres and other attractions external to the neighbourhood

Assessment of future traffic generators must take into account existing Planning Scheme Zoning, Development Control Plans and Strategic Planning. This will often involve a detailed traffic analysis for a limited area and discussions should be held with the Pine Rivers Shire Council officers to establish the extent of the study.

In some cases previous traffic studies may provide area-specific data to use as a basis for assessment of traffic generation and distribution, but in default of such data the following figures are suggested:-

	Trips per Dwelling per day	
Home to/from locations within the neighbourhood	**Shops:**	2
	School:	1
Home to/from locations external to the neighbourhood	**Work:**	4
	Retail:	2
	Other:	1
	TOTAL:	10

Table 2.2.F

The following is a worked example showing the method of determining the relevant traffic generation for a given street using the methodology outlined in Sections 2.2.6, 2.2.7 and 2.2.8 of the Design Standards for Roadworks:-

Example:-

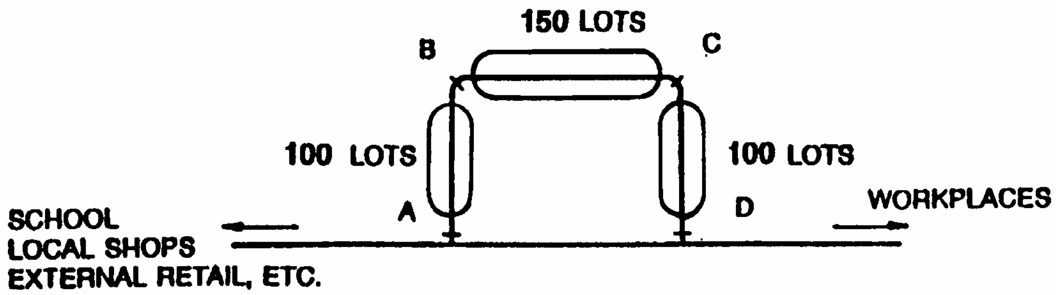


Table 2.2.G

Westward Attractions		**Eastward Attractions**
Neighbourhood school	1	Work – 4 trips/day
Neighbourhood shops	2	
External retail	2	
External other	1	
TOTAL	**6 trips/day**	**4 trips/day**

SPLIT POINT – C

Node	**Catchment**		**Trips**		**Volume**
B	150	x	6	=	900
A	250	x	6	=	1500
D	100	x	6	=	600

SPLIT POINT - B

Node	**Catchment**		**Trips**		**Volume**
C	150	x	4	=	600
D	250	x	4	=	1000
A	100	x	4	=	400

TOTAL VOLUME (V.P.D.)

A	1500	+	400	=	1900
B	900	+	-	=	900
C	-	+	600	=	600
D	600	+	1000	=	1600

2.2.9 TRAFFIC VOLUME

DESIGN DATA

Objective

- To provide acceptable levels of residential amenity and protection from the impact of traffic, while retaining reasonable user convenience and economy of construction.

Specific Outcomes

- Street layout which provides that no dwelling fronts a street which carries an unacceptable volume of traffic.
- Street layout which provides that a maximum percentage of dwellings front streets which carry a minimum volume of traffic.
- A street layout that incorporates planning for bus routes on bus collector streets

Probable Solutions

- Street layout which provides that no dwelling fronts a street with a traffic catchment exceeding 300 equivalent dwellings, or a traffic volume exceeding 3000 vehicles per day (see below and Section 2.2.7 of the Design Standards for Roadworks).
- Street layout which provides that the majority of dwellings front a street with a traffic catchment of less than 200 equivalent dwellings.
- Street layout which positively excludes through traffic.
- Traffic volumes are calculated in accordance with Tables 2.2.E, 2.2.F and 2.2.G or accepted traffic engineering practice.
- Conformity with compliance criteria of Section 3 of the Design Standards for Roadworks.
- In accordance with the discussion in Section 2.2.5 of the Design Standards for Roadworks, Council may accept a traffic catchment of 350 dwellings as an absolute maximum.

2.3.0 TRAFFIC SPEED

2.3.1 EFFECT OF TRAFFIC SPEED

Higher traffic speeds in residential streets are detrimental to:-

- ❖ safety - increased risk and severity of accident
- ❖ amenity - reduced residential amenity by noise
- ❖ convenience - greater gaps necessary to enter traffic or cross streets

Of these, the most significant effect of traffic speed is the potential risk to the **safety** of pedestrians and cyclists.

Studies suggest the following degrees of severity of possible injury for pedestrians and cyclists involved in an accident with a car:-

24 km/h or less	-	slight injury
24-39 km/h	-	moderate
40-52 km/h	-	serious
52 km/h+	-	fatalities start to occur
		(Oei, 1988)

2.3.2 CONTROL OF SPEED

Traditionally, traffic speed has been regulated by legislation and police enforcement. However, within residential streets, effective police enforcement is quite impracticable.

Speed regulation, therefore, should be built in to the street geometry to create an environment where drivers are actively discouraged from driving at more than a moderate speed.

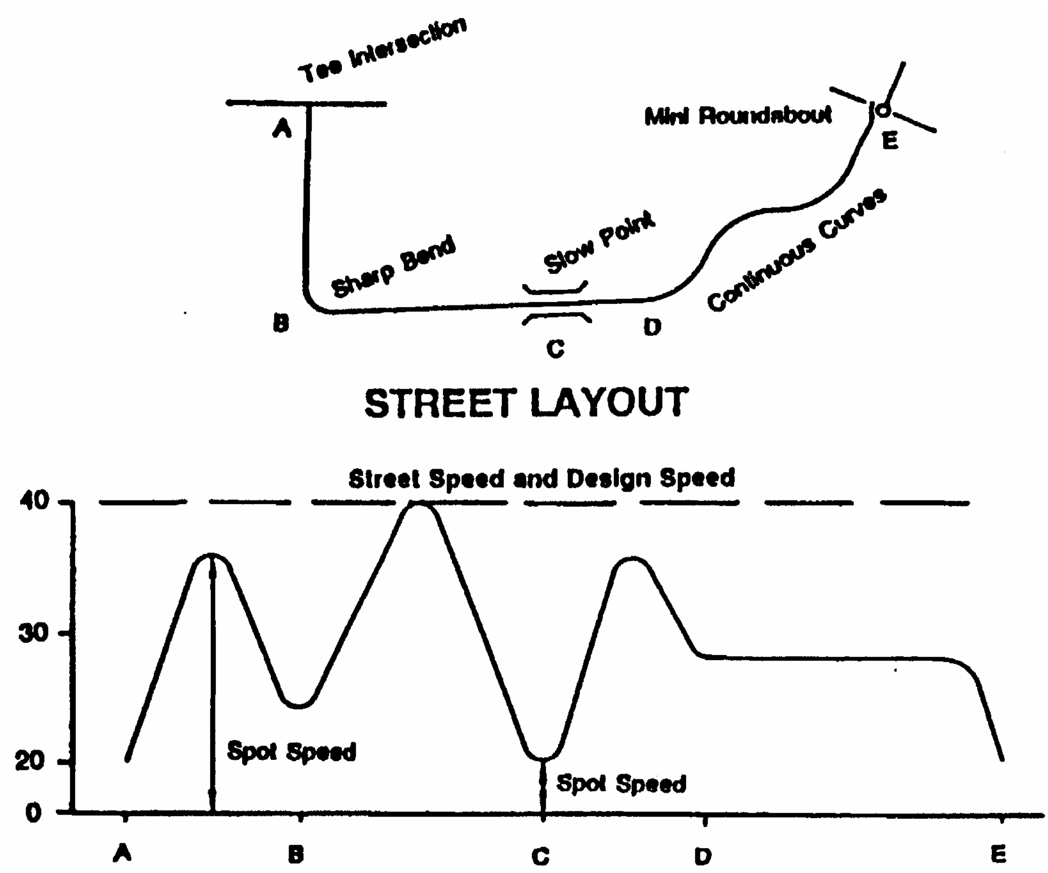
This can be achieved by inducing drivers into a feeling of constriction. A wide, straight road with long sight distance will invite a higher speed, while in constrained conditions, such as on a narrow winding bush track, with trees close on either side, or in a narrow urban laneway with tall buildings and parked trucks on both sides, a slower speed is instinctive.

2.3.3 SPEED PROFILE

Typical vehicle speed along a street will vary with the street geometry, slow at entry intersection, accelerating to a maximum and then decelerating to the end of the street, intersection or tight radius bend.

Only on a long straight, or through a long curve or a series of curves, will the maximum speed be sustained.

Figure 2.3.A shows diagrammatically the relationship of the speed profile to street geometry.



SPEED PROFILE

Figure 2.3.A

2.3.4 DEFINITIONS

Spot Speed

The spot speed is defined as the 85 percentile maximum operating speed (i.e. the maximum speed not exceeded by 85% of vehicles) at a particular point within the street.

Street Speed

The street speed is defined and the 85 percentile maximum operating speed attained at any point within the street.

Design Speed

The design speed is defined as the street speed selected as being appropriate to the subject street.

2.3.5 CARRIAGEWAY WIDTH

On long straight sections of street the speed of traffic is controlled only by the width of the carriageway.

On a single-lane carriageway the street speed may be expected to be limited to 25 to 30 km/h, due to the constriction of the carriageway width, and the likelihood of having to slow or stop for opposing traffic.

On wider carriageways, however, actual speeds will vary considerably with traffic volume and the incidence of parked vehicles on the carriageway.

It is therefore considered that, while street carriageway widths should be the minimum necessary for satisfactory traffic operations (see Section 2.6.0), carriageway width in itself should not be relied on to restrict traffic speed, but considered as one factor in creating a low-speed environment.

2.3.6 VERTICAL ALIGNMENT

The actual extent of sight distance available as a result of the vertical alignment of a street is not readily judged by drivers. Hence, while a restricted vertical alignment can be a factor in creating a low-speed environment, it can also promote dangerous situations and as such should not be relied on to limit traffic speed.

2.3.7 SPEED RESTRICTIVE DESIGN

Limiting speed by means of street design geometry is therefore essentially a matter of **restricting the maximum length of the uncontrolled straight (or apparently straight) street to the length in which the selected design speed may be reached**.

This may be attained by:-

- **limiting total street length** - in the case of short cul-de-sacs or connecting streets
- **limiting length of straight** - by introducing sharp bends in the street layout
- **curved alignment** - either a single curve or a series of curves
- **control devices** - in an otherwise straight alignment (subject to the Pine Rivers Shire Council approval in each case)

2.3.8 STREET LENGTH

For straight (or virtually straight) street alignment, with end conditions which reduce vehicle speed to 20 km/h or less, a relationship between street leg length and street speed is given in Table 2.3.B.

2.3.9 BENDS OR CURVES

Where speed restriction is provided by bends or curves in the street alignment the relationship between the radius of the bend and the street speed is given in Table 2.3.C.

It should be noted, however, that bends or curves are only effective for speed restriction if median strip is provided through the bend or the deflection angle is **relatively large** – e.g. close to 90°.

2.3.10 COMBINATION ALIGNMENT

Where a bend or other forms of speed restricting devices can be negotiated at a speed higher than 20 km/h, the length of a following straight within which a vehicle can attain the design speed should be less than that given in Table 2.3.B.

Table 2.3.D gives the relationship between the negotiation speed of the bend or slow point and the maximum length of following straights between restrictions, to limit traffic to a particular design speed.

2.3.11 SELECTING A DESIGN SPEED

It must be noted that the "design speed" used in this manual is the 85 percentile **maximum** speed of traffic within the street, and hence is quite different to the highway design concept, where the design speed is the **minimum** safe speed at any point on the road.

For pedestrian and cyclist safety, the ideal is the lowest possible design speed.
The ideal, however, must be evaluated in the context of:-

- **practical limitations**
- **driver convenience**

2.3.12 PRACTICAL LIMITATIONS

From Table 2.3.B, a street length of 75m is applicable to a design speed of 30 km/h and 120m to a design speed of 40 km/h.

In all streets except short cul-de-sacs, a street length of 120m is considered by the Pine Rivers Shire Council to be the least practically attainable and 40 km/h is therefore proposed as the design speed to be sought for the majority of residential streets.

2.3.13 DRIVER CONVENIENCE

There is a reasonable limit to the time which drivers may be expected to tolerate the low-speed conditions sought in residential streets. This time is generally considered to be between 60 and 90 seconds.

This limitation may require acceptance of rather higher design speeds on the residential streets serving larger traffic catchments.

40 km/h, however, is considered to be the highest design speed desirable for residential streets with direct frontage access, in consideration of residential amenity, pedestrian and cyclist safety.

2.3.14 TRAFFIC SPEED

<u>DESIGN DATA</u>

Objectives

- ❖ To provided a street environment which allows all users - motorists, pedestrians and cyclists - to proceed safely, without unreasonable delays.

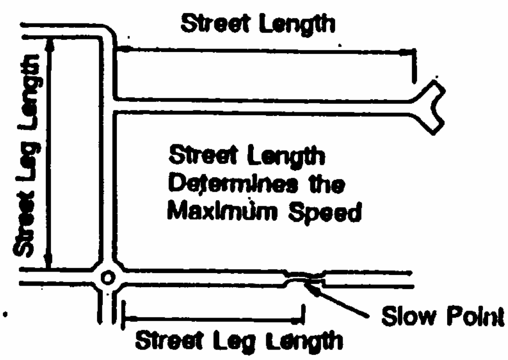
Specific Outcomes

- ❖ Street geometry design which effectively restricts vehicular speeds to appropriate limits, by **street alignment** rather than by speed control devices, wherever possible.

Probable Solutions

- ❖ Selection of appropriate design speeds for each street, in accordance with Section 2.10.1

- ❖ Detailed design to provide the appropriate design speed, in accordance with Tables 2.3.B, 2.3.C and 2.3.D.



STREET LENGTH

Figure 2.3.B

DESIGN SPEED (km/h)	STREET LEG LENGTH (m)
25	40
30	75
35	100
40	120
45	140
50	155
60	180

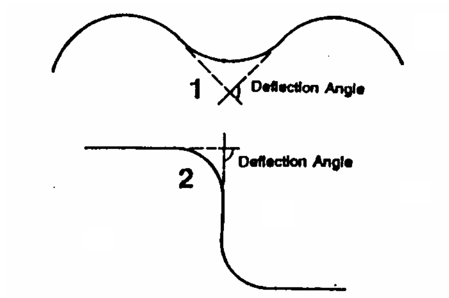
Note:-
* End Condition – 20 km/h or less
* For gradients of 5 to 10% - add 5 km/h
* For gradients over 10% - add 10 km/h

AMCORD – 1990 (modified)

Table 2.3.B

"End conditions" reducing vehicle speed to 20 km/h may include:-

- ❖ T-intersections with radii conforming to Section 2.11.5
- ❖ roundabouts conforming to Section 2.11.6
- ❖ bends (approximately 90°) of radius 9m or less
- ❖ traffic control devices (e.g. speed humps or slow points) of appropriate design



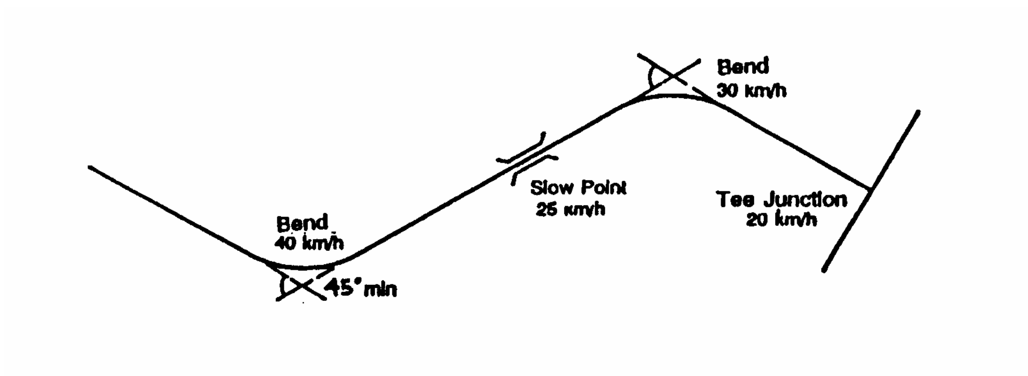
BENDS OR CURVES

Note:-
- May not be effective with deflection angles less than (say) 60°
- Curve radii on carriageway centreline.

Figure 2.3.C

Desired Maximum vehicle speed (km/h)	Curve Radius Continuous Series of Bends (1) (m)	Curve Radius Isolated Bends or in a Chicane (2) (m)
20	15	10
25	20	15
30	30	20
35	50	30
40	90	40
45	105	50
50	120	60
55	140	70
60	160	80
(1) Based on field surveys (Stapleton, 1988) (2) E + F = 0.35 AMCORD - 1990		

Table 2.3.C



COMBINATION ALIGNMENT

Figure 2.3.D

Negotiation Speed of Bend etc (km/h)	Length of Straight (m) Between Restriction to Limit Design Speed (km/h)						
	25	**30**	**35**	**40**	**45**	**50**	**60**
20 or less	40	75	100	120	140	155	180
25	-	45	75	100	120	140	165
30	-	-	45	80	100	120	150
35	-	-	-	50	80	100	135
40	-	-	-	-	55	80	120
45	-	-	-	-	-	60	105

AMCORD - 1990 (modified)

Table 2.3.D

- **Example: -** What is the maximum allowable straight between bends of 30m radius, to maintain design speed of 50 km/h?

    - From Table 2.3.C negotiation speed of 30m radius bends is 35 km/h.
    - From Table 2.3.D negotiation speed of 35 km/h, maximum length of straight for design speed of 50 km/h is **100m**.

- **Note:-**

    - Where adjacent speed restricting devices have different negotiation speeds, use the mean of the two negotiation speeds.
    - Gradient correction as for Figure 2.3.B.

2.4.0 PARKING

2.4.1 ON-STREET V ON-SITE PARKING

Vehicle parking within the street is an unwelcome necessity:-

Unwelcome in that:-

- vehicles take up space on the carriageway which is an inefficient use of a relatively expensive facility

- vehicles parked on the carriageway impede drivers' visibility of children or other vehicles

- parked vehicles are a visual intrusion in a residential area

Necessary in that provision must be made for:-

- overspill of some residential vehicles
- visitor's vehicles
- service and delivery vehicles

Hence as much parking as possible should be provided **within the allotments**, with only a reasonable minimum being provided within the street.

2.4.2 TOTAL PARKING REQUIREMENT

In "traditionally" designed subdivisions there is generally ample availability of parking space on the street, and often an oversupply, due to the wider carriageways and larger allotment areas. However, narrower carriageways, smaller allotments and reduced or zero front set-back, all reduce parking opportunity, and make it necessary to ensure that adequate parking is available both within the allotments and within the street.

Total parking demand will reflect vehicle ownership and will vary greatly, dependent on such factors as:-

- socio-economic situation of the area generally and of each household

- demography of each household (which will vary with time)

- location of the area, in relation to facilities and employment

- availability of public transport

The Pine Rivers Shire Council has recognised the need for adequate parking within an allotment by requiring all detached houses to be provided with three on-site parking spaces, one space enclosed or capable of being enclosed by a structure, plus two spaces suitable for parking on site.

Duplex dwellings require a similar provision, while other forms of multiple dwellings require two spaces, plus visitor spaces at 0.5 spaces per unit.

2.4.3 PARKING WITHIN ALLOTMENTS

Factors which affect the availability and use of parking within the allotment include:-

- allotment area and shape
  - smaller allotments and frontage reduce parking opportunity
- slope of allotment
  - steep slope reduces parking opportunity
- location of dwelling and other improvements
  - affects number and convenience of use of parking spaces. Reduced set-back reduces parking opportunities
- future construction e.g.:-
  - swimming pools or conversion of garage to rumpus room may reduce original parking opportunities
- width of street carriageway, traffic volume and security of the area
  - perceived risk to vehicle encourages parking within allotment

2.4.4 ALLOWANCE FOR STREET PARKING

Design Parking Provision

The Pine Rivers Shire Council on-site parking requirement for on-street parking is **0.5 spaces per allotment**.

Street parking must be located conveniently if it is to be used by residents. Hence, each allotment should have a car parking space within a **maximum of 25m** (measured between the nearest points of the allotment boundary and parking space) and a double-length space, for use by the occasional delivery vehicle, should be available within 40m of each allotment.

Peak Parking Demands

On occasions there will be a parking demand in excess of available on-street parking, such as for a party, garage sale or auction.

It is not reasonable to design for such infrequent occasions and at these times parking must be expected to overspill on to the grassed verge or into adjacent streets.

External Parking Generators

In some cases, the subdivision layout may be such that external non-residential uses generate a parking demand within adjacent residential streets due to convenient pedestrian pathway connections – e.g. school, kindergarten, shops, railway, bus-stop, park or sporting facilities.

It is not necessary to ensure that adequate parking is provided to avoid parking overspill into the adjacent streets.

Non-Residential Vehicles

Premises in the residential 'A' zone shall not be erected or used for the purpose of heavy vehicle parking except as permitted under the Pine Rivers Shire Council Town Planning Scheme.

2.4.5 ALTERNATIVES FOR STREET PARKING

Parking provision within the street may be in various forms:-

- **on-carriageway parallel** – the "traditional" method, where the carriageway is of sufficient width to provide one or more moving lanes, and for parking on one or both sides

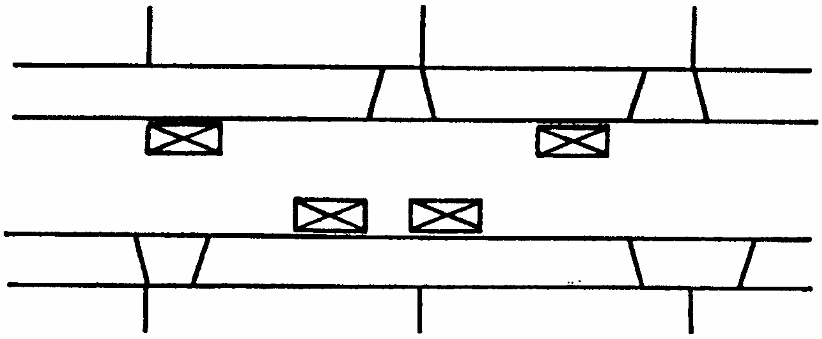


Figure 2.4.A

Parking facility is continuous for the full street length, and the pavement construction is of constant type

For - simple design and construction

Against - carriageway area may be greater than necessary
- visually wide carriageway encourages higher speed

- **indented parallel parking bays** – a carriageway providing two moving lanes, or one moving lane with passing areas, may be supplemented by indented parking bays for parallel parking, on one or both sides of the carriageway

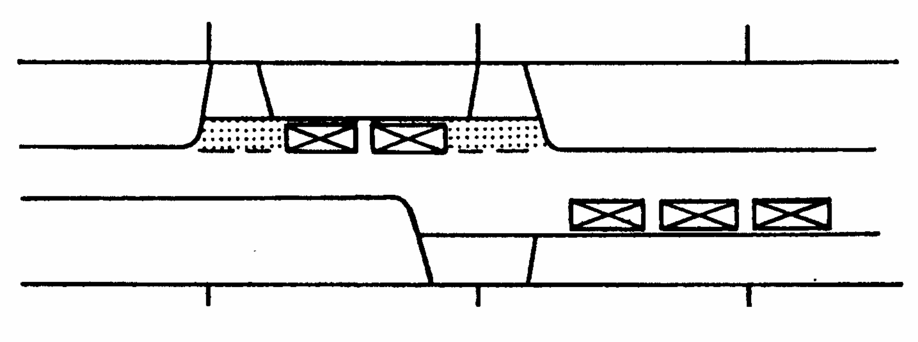


Figure 2.4.B

Only sufficient length of parking bay to cater for demand need be provided. Desirably, the bays should be of a different surfacing to the moving lane(s).

For - minimum area of carriageway required
- visually narrow carriageway discourages higher speeds
- may be efficiently combined with driveways

Against - relatively complicated design and construction

- **indented 90° parking bays** –a carriageway for one or two moving lanes may be supplemented by parking bays at 90° to the carriageway, on one or both sides

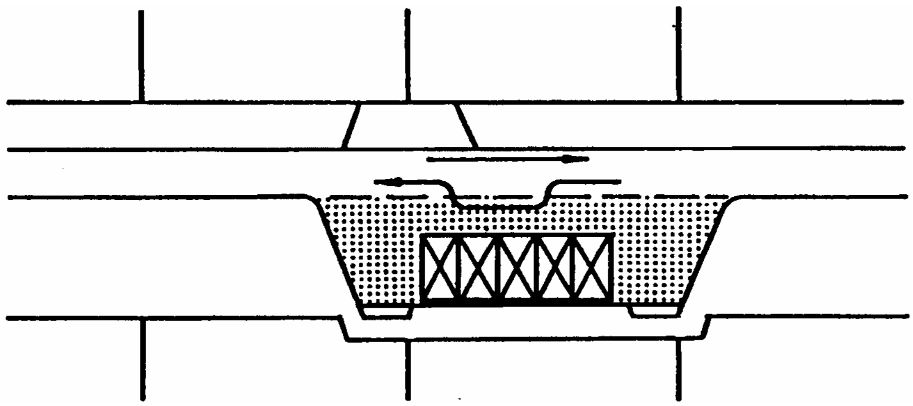


Figure 2.4.C

In the case of a single moving lane carriageway, the necessary width for vehicles to turn into the parking bays may also provide for opposing vehicles to pass.

This parking configuration is considered suitable only for lower design speed streets, to 40 km/h maximum.

For - provides also for vehicle passing opportunity
- minimum visual carriageway width

Against - concentrates parking activity (noise, headlights) in front of a few allotments
- requires greater localised reserve width (but varied width may be an advantage)

- **special parking** – parking bays may be provided in areas such as in the centre of cul-de-sac turning circles, combined with “hammerhead” or “Y” turning areas, or within wide medians.

  They are particularly appropriate at the end of cul-de-sac streets, where narrow allotment frontages may reduce both on and off-street parking opportunities (see Sections 2.12.4 and 2.12.5 of the Design Standards for Roadworks).

2.4.6 PARALLEL PARKING REQUIREMENTS

For parallel parking, either on-carriageway or in indented bays, the total length required will be dependent on:-

- design rate of parking demand (spaces per allotment)
- average allotment frontage
- driveway requirements

Driveways

On narrower street carriageways such as proposed, the typical driveway geometry required is:-

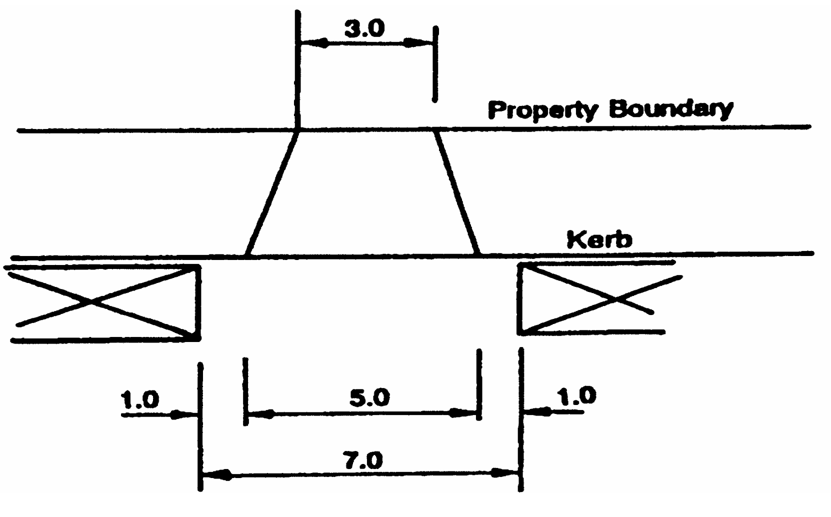


Figure 2.4.D

Each driveway therefore requires 7.0m of lane length.

Conventional Frontages

For conventional residential allotments with a minimum allotment frontage of 18m in accordance with the Pine Rivers Shire Council standards, the general parallel parking capacity within the street is **two spaces per allotment frontage** which may be subject to occasional variation due to unusual driveway locations.

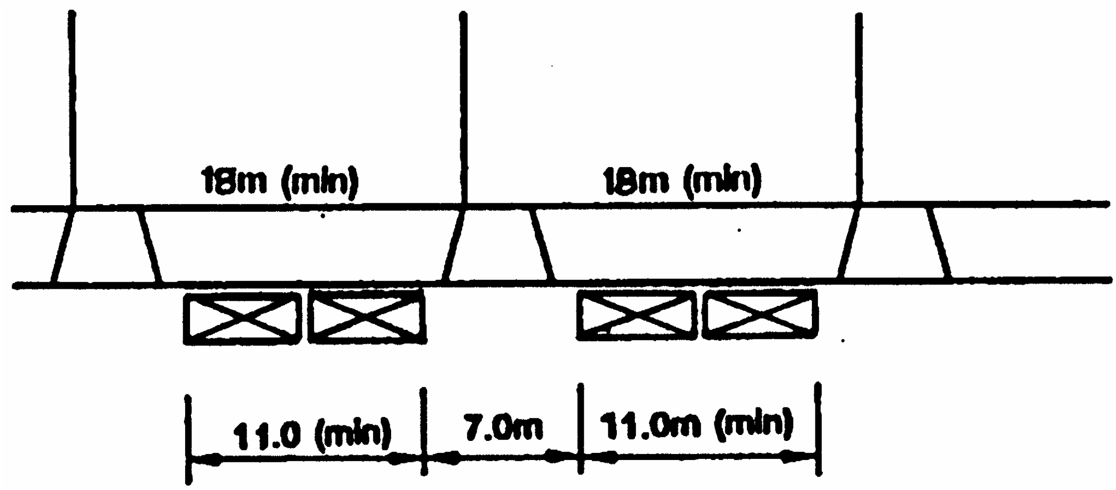


Figure 2.4.E

The resultant theoretical parallel parking capacity of a street, allowing for a single unobstructed moving lane, will therefore be:-

“Two lane” street	-	1 space per allotment
“Three lane” street	-	2 spaces per allotment

These are not **practical** parking capacities due to the lack of passing opportunity for opposing vehicles.

It is evident however, that the required design provision of **0.5 spaces per allotment** can be provided on the carriageway of either a two lane or three lane street with adequate allowance for random passing opportunities, as this level of parking demand will occupy approximately 30% of the length of a single lane.

Smaller Frontages

Reduced allotment frontages may occur in:-

- integrated house and land developments, where smaller frontages may be permitted
- “hatchet” allotments, in conventional subdivision
- cul-de-sac heads, in conventional subdivision

In such cases the parallel parking capacity will be substantially less than for conventional allotment frontages.

In the first two cases, the theoretical capacity may be reduced to 0.5 spaces per allotment on a two lane street, insufficient to satisfactorily provide for both parking and passing opportunity, while in a cul-de-sac, head parking may not be possible at all, due to driveway spacing.

In such cases special design of parking provision on the narrower carriageways will be necessary (see Section 2.5.6 of the Design Standards for Roadworks).

2.4.7 PARKING

DESIGN DATA

Objectives

❖ To provide sufficient and convenient parking for residents, visitors and service vehicles.

Specific Outcomes

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

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

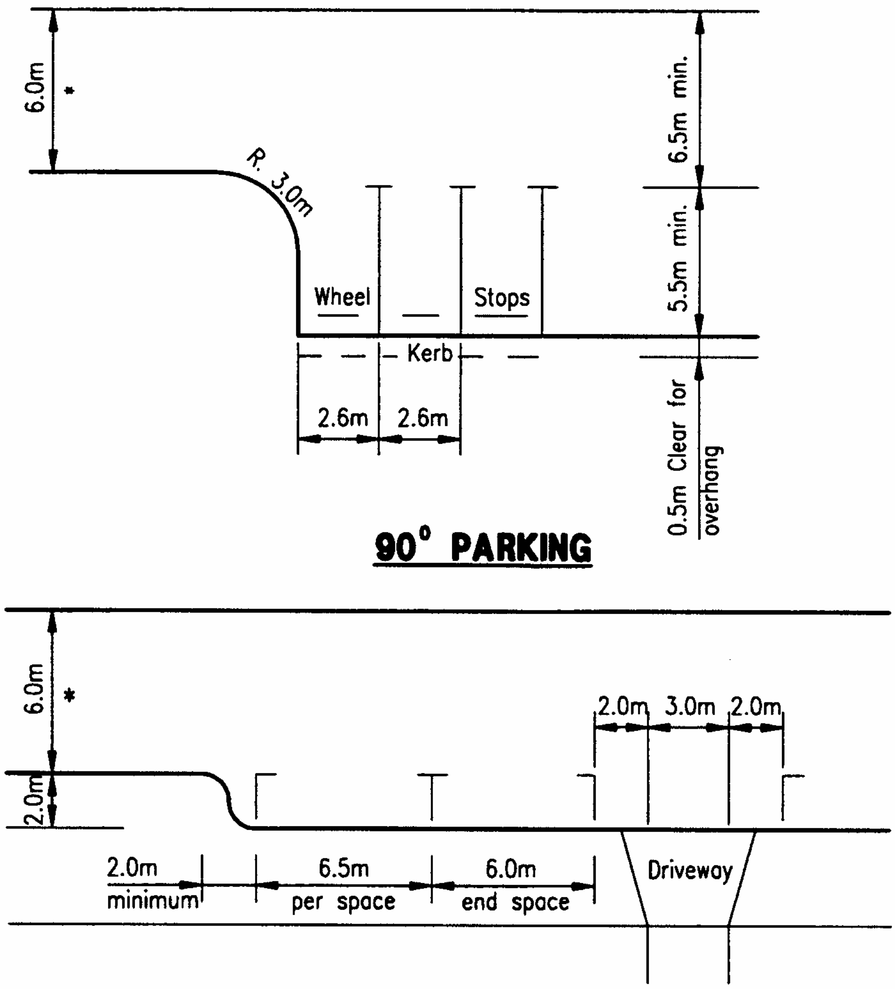
❖ Design of parking to provide:-

  - no obstruction or danger to the passage of vehicles on the carriageway, or to pedestrians
  - efficient design of parking spaces and accesses
  - convenient vehicle access to allotments

Probable Solutions

❖ Car spaces may either be provided on the carriageway, in which case provision shall be ensured for vehicle passing in accordance with Section 2.5.0 of the Design Standards for Roadworks, or in constructed bays within the verge.

❖ The dimensions of all parking spaces and access thereto shall be in accordance with Figure 2.4.F.



PARALLEL PARKING

* 3.5 m permitted in special circumstances

TYPICAL STREET PARKING DETAILS

Figure 2.4.F

2.5.0 PROVISION FOR PASSING

2.5.1 CONCEPT

The concept of a “single-moving lane” obviously relies, for its successful operation, on the availability of adequate opportunities for vehicles travelling in opposite directions to pass each other.

2.5.2 TYPES OF PASSING PLACES

Provision for opposing vehicles to pass may be:-

- **Designed**
  - Either solely for passing purposes or serving a dual purpose, for example:-

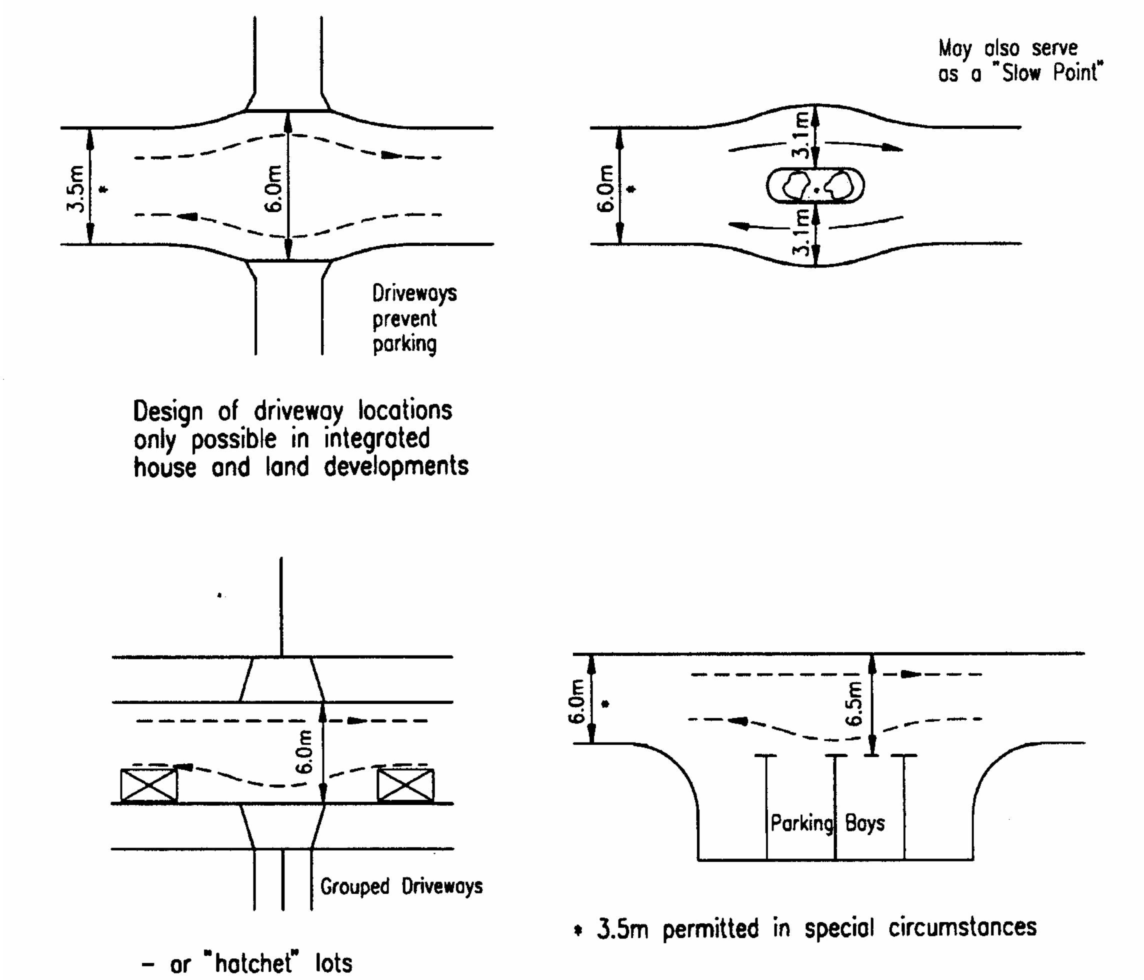


Figure 2.5.A

- **Random**

    - A carriageway width in excess of a single lane provides for both parking and passing of vehicles.

    - The extent to which this extra width exceeds parking demand creates passing opportunities at random intervals, which will vary both from place to place and from time to time.

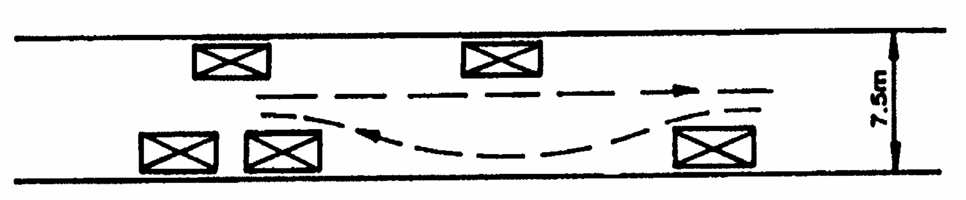


Figure 2.5.B

- **Combination**

    - Designed and random passing opportunities may be combined in the same street.

2.5.3 DEMAND FOR PASSING OPPORTUNITY

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

This **"incidence of opposing meetings"** varies with:-

- **Traffic volume** of opposing traffic which in turn will vary with:-
    - number of allotments in the traffic catchment; and
    - time of day (peak or off-peak traffic)

- **Travel time** which will vary with:-
    - the travel distance; and
    - travel speed

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

Figure 2.5.C gives an indication of the number of meetings with opposing vehicles which could be expected to occur under various circumstances, for a typical residential subdivision layout.

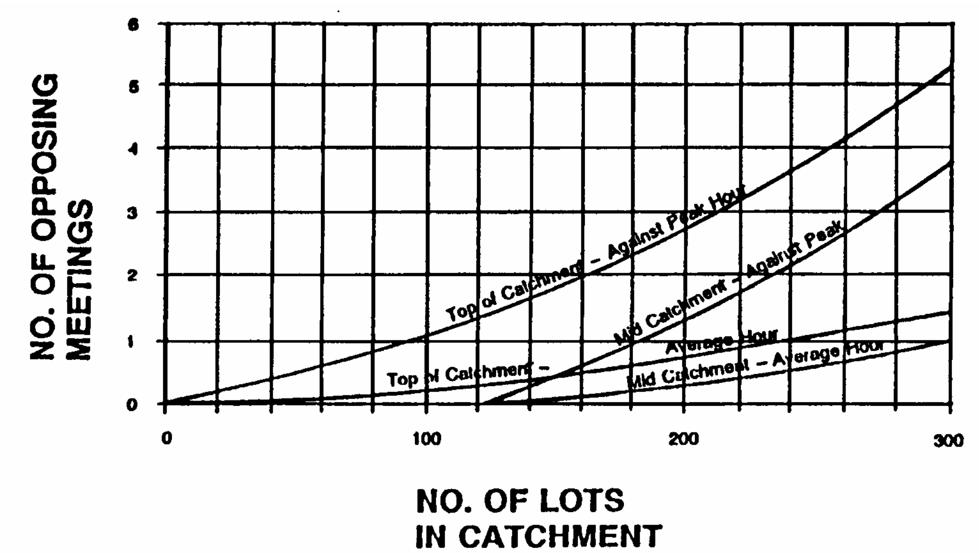


Figure 2.5.C

2.5.4 SUPPLY OF PASSING OPPORTUNITY

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

An **under-supply** of opportunity will result in increasing delays to traffic and, in the extreme, to virtual blockage of traffic trying to travel “against the tide”. On the other hand an **over-supply** is wasteful of carriageway area and undesirable for the reasons listed in Section 2.1.6 of the Design Standards for Roadworks.

2.5.5 SINGLE LANE CARRIAGEWAY

For a single lane carriageway, the only passing opportunity is provided by **designed** passing places at appropriate intervals.

Because single lane carriageways are often perceived by residents as unduly restrictive, the Pine Rivers Shire Council policy is to limit their use to traffic catchments of **twelve allotments maximum only in special circumstances**.

Generally the spacing of passing places should be within the range of 30m to 60m, a lesser spacing being uneconomical and a greater spacing making it difficult for drivers to judge the location of an opposing vehicle. **Passing places must be clearly visible from one to the next.**

Passing places must be designed to minimise the risk of their being made ineffective by incorrect parking (see Figure 2.5.A for examples).

Adjacent to an intersection, a single lane carriageway should be widened to two lanes for a minimum length of 10m to allow a vehicle to turn into the side street, even if another vehicle is standing in the side street.

2.5.6 TWO LANE CARRIAGEWAY

❖ **Conventional allotment frontages**

As noted in Section 2.4.6 of the Design Standards for Roadworks, where the average allotment frontage is 18m or more, the percentage of street length required for design parking provision is relatively low (approximately 30% of one lane). In addition, the intervals between parked vehicles provide acceptable passing opportunities.

❖ **Small allotment frontages**

As noted, again, in Section 2.4.6 of the Design Standards for Roadworks, where allotment frontages are less than 18m, as may occur in integrated house/land development or, where there is a succession of "hatchet" allotments, parking demand may result in lack of acceptable random passing opportunities.

In such cases there are two possible approaches:-

- **designed passing places** to be provided as for single lane carriageways, at a maximum spacing of 60m
- **additional parking spaces** to be provided clear of the two lane carriageway, to increase the availability of random passing opportunities. The required additional parking to provide a passing opportunity approximately equivalent to 18m allotment frontages is shown in Table 2.5.D.

2.5.7 THREE LANE CARRIAGEWAY

A three lane carriageway provides for two moving lanes and one parking lane, or two parking lanes and one moving lane. Hence free passing of opposing vehicles is obstructed only when parked vehicles are located opposite each other or close enough to prevent both moving vehicles from weaving courses between them.

Even with a considerably higher level of parking than the adopted 0.5 vehicles per allotment (or with smaller allotment frontages), two free lanes will be available over much of the street length, and delay will only occur when two opposing vehicles meet, or come in close proximity to vehicles parked opposite each other. The **majority** of passing movements will occur without any delay other than perhaps a momentary slowing.

2.5.8 DELAYS

Assessment of the actual delay which might result in each of the above situations involves a number of assumptions. For a single lane carriageway the results are calculable, but in the other cases can be indicative only. However, typical average delays per meeting can be calculated as:-

Single lane	-	60m between passing places	**4.5 secs**
		30m between passing places	**3.2 secs**
Two lane	-		**3.0 secs**
Three lane	-		**0.75 secs**

2.5.9 ACCEPTABLE LIMIT OF DELAY

The limit of the application of the "single moving lane" concept is the extent to which delays due to meeting opposing vehicles can be kept to a level acceptable to the majority of drivers.

While selection of an appropriate allowable percentage increase in travel time is very subjective, it is considered that **10%** is a reasonable figure, this being calculated on the **maximum** opposing traffic volume. The **average** percentage increase in travel time, over all situations, will then be approximately 2.5 to 3%. On this basis, the maximum acceptable number of allotments in the traffic catchment for each street cross-section can be calculated as:-

Single lane	-	72 allotments (theoretical)
Two lane	-	75 allotments
Three lane	-	303 allotments

Given the potential variables in assessment of traffic capacities, however, the Pine Rivers Shire Council policy is to adopt more conservative maximum traffic catchments, i.e.:-

Single lane	-	12 allotments (permissible only with special approval)
Two lane	-	50 allotments
Three lane	-	300 allotments

The Design Chart Figure 2.6.E is derived on the basis of the above figures.

2.5.10 TRAFFIC CATCHMENT OVER 300 ALLOTMENTS

From Section 2.5.9 of the Design Standards for Roadworks the maximum capacity of a continuous three lane carriageway, from consideration of acceptable passing delays, is 303 allotments.

While this is compatible with the **desirable** traffic catchment limitation of 300 allotments (see Section 2.2.7 of the Design Standards for Roadworks), in the special circumstances where a catchment of 350 allotments is permitted, alternative design measures must be employed to avoid the risk of unacceptable traffic delay in the street lengths where the traffic catchment exceeds 300 allotments (i.e. volume exceeds 3000 v.p.d.).

A possible alternative would be to provide a **four-lane carriageway** i.e. two moving lanes and a parking lane each side. However, the departure from the **"single moving lane"** concept to one of **"unimpeded movement"** would be inconsistent with the traffic operation philosophy as set out in Section 2.1.5 of the Design Standards for Roadworks and would inevitably result in traffic speeds higher than acceptable for safety and amenity.

The preferred option, therefore, is to retain a basic three-lane carriageway, but provide occasional, additional indented parking, such that the random passing opportunities are increased in proportion to the increased traffic volume.

The minimum additional parking provided should vary from zero at 300 allotments catchment up to **0.25 spaces per allotment** at 350 allotments catchment.

Smaller frontage allotments (i.e. less than 18m) should **not** be permitted on streets with traffic catchments in excess of 300 allotments, as this would further reduce passing opportunities.

2.5.11 BUS ROUTES

Bus collector streets provide additional carriageway width to permit frequent passing opportunities, reduced inconvenience and enhanced clearances between buses, other large vehicles (garbage trucks) and cars.

The bus collector effectively provides three generous lanes with an opportunity for improved on street parking over the complete length of the street, or four lanes at significantly reduced speed, clearance, and convenience.

Bus collector streets are to be provided for planned bus routes.

2.5.12 PASSING

<u>DESIGN DATA</u>

Objectives

- To provide sufficient and convenient provision for vehicles to pass opposing vehicles.

Specific Outcomes

- Passing provision to be such that delays resulting from meeting opposing traffic are kept to a level acceptable to the majority of drivers.

Probable Solutions

General

- Passing provision such that the increase in travel time in any street length resulting from meeting delays is a maximum of 10%.

Two-Lane Carriageway

- Number of allotments in traffic catchment - 50 maximum.
- Total lane lengths to be provided in accordance with Figure 2.6.E.
- Additionally, where allotment frontages are less than 18m, **either**:-
    - designed passing spaces to be provided as for single lane carriageways and with maximum spacing of 60m; or
    - additional parking spaces to be provided in accordance with Table 2.5.D.

ALLOTMENT FRONTAGES	ADDITIONAL PARKING SPACES PER ALLOTMENT
18	0.0
16	0.1
14	0.2
12	0.3

Table 2.5.D

Three-Lane Carriageway

- ❖ Number of allotments in traffic catchment - 300 maximum.
- ❖ Total lane length to be provided in accordance with Figure 2.5.E and width in accordance with Figure 2.6.E
- ❖ Minimum of two lanes to be provided at any point, unless a "slow point" is deliberately designed.
- ❖ Where three lanes are provided, the minimum length of the three lane section to be 35m.

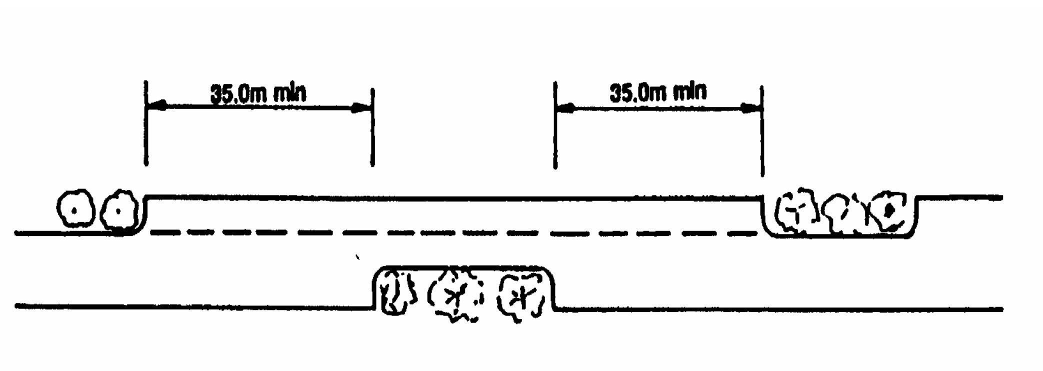


Figure 2.5.E

Where, in accordance with the discussion in Sections 1.5.5 and 2.2.7 of the Design Standards for Roadworks, the absolute maximum of **350** allotments in the traffic catchment is permitted, the following provisions apply to the section of the street where the traffic catchment is between 300 and 350 allotments:-

- ❖ minimum of three lanes to be provided at any point
- ❖ additional indented parking spaces to be provided at a minimum ratio varying from zero at 300 allotments traffic catchment to 0.25 spaces per allotment at 350 allotments catchment
- ❖ all allotments to have a minimum frontage of 18m

2.6.0 CARRIAGEWAY WIDTH

2.6.1 GENERAL

The width of the carriageway required for a residential street is a function of:-

- design traffic volume
- design traffic speed
- parking provision - on or off carriageway
- planned bus route

While the carriageway width must be sufficient to adequately cater for these traffic needs, **excessive** width can be detrimental to:-

safety	-	wider carriageways encourage higher speeds (see Section 2.3.0 of the Design Standards for Roadworks)
amenity	-	visual amenity is reduced
	-	stormwater runoff and heat reflection are increased
convenience	-	pedestrians have greater crossing distance
	-	greater allotment access problems on side slopes
economy	-	greater capital and maintenance costs
	-	greater street reserve width required

2.6.2 CARRIAGEWAY LANES CONCEPT

The total required carriageway width, in terms of the number of lanes, can be shown diagrammatically as:-

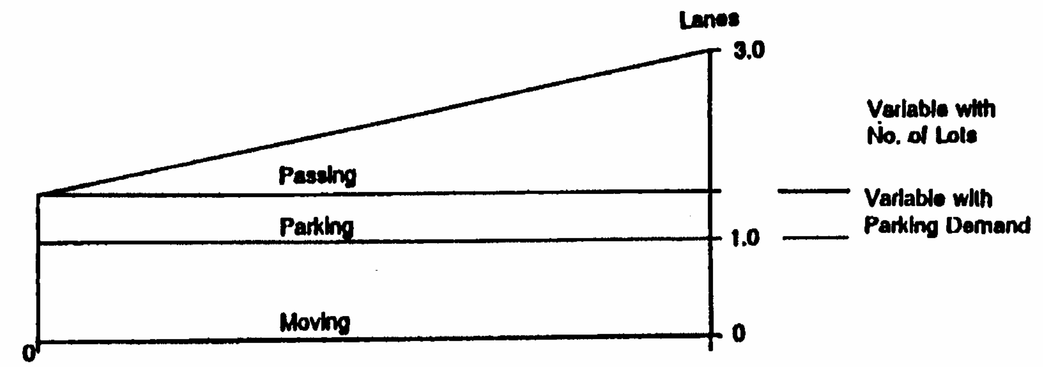


Figure 2.6.A

This figure combines the conclusions derived in previous sections, i.e.:-

- a single **moving** lane is required for the full street length
- on-carriageway **parking** requires an amount of lane length which is variable with parking demand, but for a given demand is constant throughout the street length
- **passing** requirement increases with traffic catchment throughout the street length

Figure 2.6.E presents this information in a form whereby the **carriageway width**, required for a given **traffic catchment**, may be ascertained.

Its interpretation, however, requires some explanation. The "required total lanes" is the **average number of lanes** required for the **street length** under consideration, based on the traffic catchment at the "downstream" end of the street length.

At any particular point in that street length, the carriageway width must be an exact number of lane widths, i.e. one, two or three.

Some examples are as follows:-

- **Catchment Less than 12 Allotments**

  In this range the designer has two options:-

  - **single-lane carriageway** (special circumstances only)

    With parking provided off-carriageway (e.g. in 90° indented bays) and passing places provided at spacings of maximum 60m.

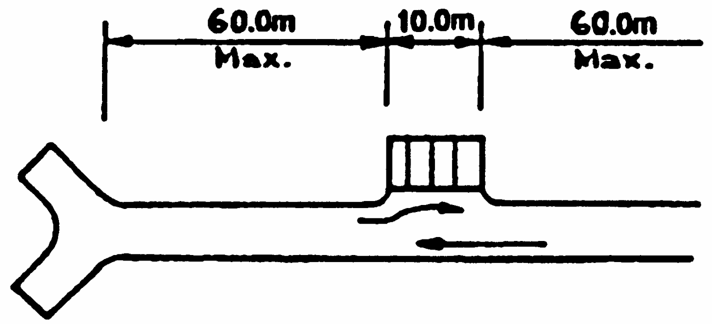


Figure 2.6.B

  - **two-lane carriageway**

    Allotment frontages are not significant for such a limited traffic catchment.

- **Catchment 12 to 50 Allotments**

  In this case the allotment frontages are significant. For conventional allotment frontages of 18m (or more) two lane width over the full length is adequate.

  For lesser frontages, however, either additional parking space clear of the two-lane carriageway must be provided, or designed passing areas made available (see Section 2.5.6 of the Design Standards for Roadworks).

- **Catchment 50 to 300 Allotments**

  For a catchment over 50 allotments an average width in excess of two lanes is required, increasing up to 3.0 lanes at 300 allotments catchment. A constant width of three lanes may be provided over the full length, or the number of lanes may be varied locally, provided that the **average** is in accordance with Figure 2.6.E. However, the minimum length of three-lane sections should be 35m to provide reasonable opportunities for unimpeded passing of opposing vehicles.

Example:-
For a 190 allotment catchment the required minimum average width is 2.5 lanes. This may be provided in a variety of configurations:-

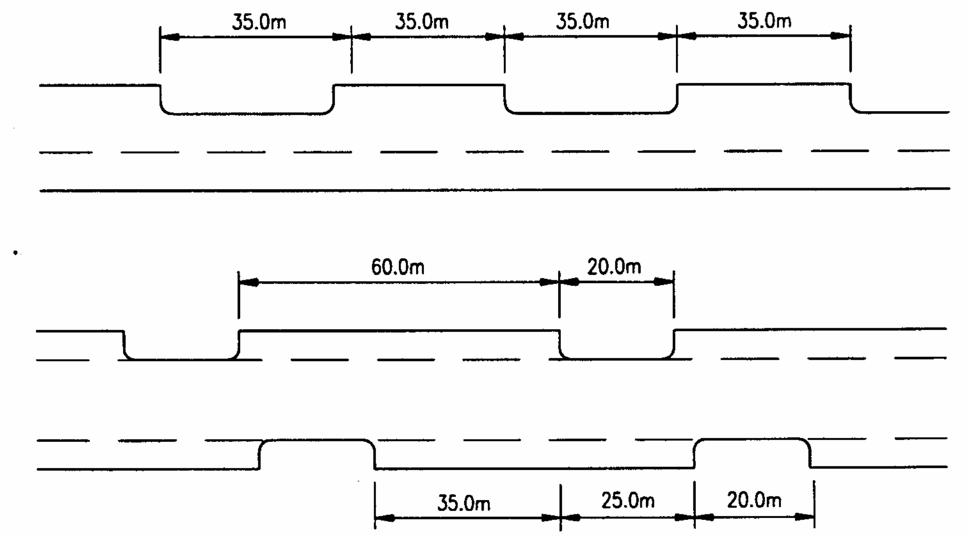


Figure 2.6.C

For street lengths, however, where allotment frontages are less than 18m, the full three lane width of carriageway should be provided.

❖ **Catchment 300 to 350 Allotments**

For a catchment between 300 and 350 allotments a carriageway width of three lanes minimum is required, with additional indented parking, in accordance with Sections 2.5.10 and 2.5.11 of the Design Standards for Roadworks.

❖ **Bus Route – All catchments**

The planning requirements for a bus route are provided in Section 3.5.0 of the Design Standards for Roadworks. Street carriageway width is constant at three generous lanes over the full length of the street. Four lanes are possible, providing added flexibility for rare occasions (eg. Parties etc.) at very constrained speeds.

2.6.3 CARRIAGEWAY WIDTH

The full width of the carriageway on residential streets is usually multi-use and “lanes” should not generally be delineated. Hence the total carriageway width at any point should be considered, rather than the sum of individual, specific-purpose lanes.

Widths should be the **minimum** necessary for “normal” traffic movements (car passing car or cyclist) to be carried out at the design speed for the street, with “abnormal” movements (truck passing car or other truck) being possible, at **reduced speed** if necessary.

From Sections 2.3.12 & 2.3.13 of the Design Standards for Roadworks "traffic speeds", a practical design speed for a one lane street is 30 km/h and for a two or three-lane street is 40 km/h.

Where carriageway widths in excess of standard widths are used, the required street reserve width will need to be increased by a width not less than the carriageway widening.

CARRIAGEWAY WIDTH REQUIREMENTS

	10 km/h	**20 km/h**	**30 km/h**	**40 km/h**	**50 km/h**	**60 km/h**
Car/Cyclist	3.0	3.5	3.5	4.0	4.5	5.0
Car/Parked Car	4.0	4.5	5.0	5.5	6.0	6.5
Car/Moving Car	4.0	4.5	5.5	6.0	6.5	7.0
Car/Parked Truck (or v.v.)	4.5	5.0	5.5	6.0	6.5	7.0
Car/Moving Truck	4.5	5.0	6.0	6.5	7.0	7.5
Truck/Parked Truck	5.0	5.5	6.0	6.5	7.0	7.5
Truck/Moving Truck	5.0	5.5	6.5	7.0	7.5	8.0
Car/Two Parked Cars	6.5	7.0	7.0	7.5	8.0	8.5
Truck/Two Parked Cars	7.0	7.5	8.0	8.5	9.0	9.5
Moving Coach and Truck + Two Parked Cars	8.5	9.0	9.5	-	-	-

(Pak-Poy & Kneebone 1988)

Table 2.6.D

Widths are for drive-over type kerb and are measured between channel inverts.

From Table 2.6.D and the foregoing criteria, the carriageway widths appropriate to various lane widths are:-

Single-Lane Carriageway (special circumstances only)

Primary Factor - car passing cyclist at 30 km/h - **3.5m**
(Note: - Anything wider, e.g. 4.0 m would encourage attempts to use as two lane)

Two-Lane Carriageway

Primary - car passing moving car at 40 km/h - **6.0m**
Secondary - truck passing car at reduced speed
(Note: - Anything wider would encourage higher speed and attempts to use as three-lane)

Three-Lane Carriageway

Primary	-	car passing two parked cars at 40 km/h	-	**7.5m**
Secondary	-	truck passing two parked cars at reduced speed		

(Note: - Anything wider would encourage higher speed)

Three-Lane Bus Collector Carriageway

Primary	-	truck and coach passing one parked car at 60 km/h	-	**9.5m**
Secondary	-	truck and coach passing two parked cars at reduced speed		

The two lane widths may be used for any Access Place or Access Street and the three lane widths may be used for <u>any</u> residential street (i.e. Access Place, Access Street or Collector and Bus Collector street).

Objectives

❖ Carriageway width to be sufficient to enable the street to efficiently and conveniently fulfil its required traffic and parking functions, but in the interests of safety, amenity and economy, to be no greater than necessary for this purpose.

Specific Outcomes

❖ The number of vehicle lane widths in any street length to be sufficient to provide for:-

  - a single moving lane
  - the design level of on-carriageway parking
  - reasonable opportunity for passing of opposing vehicles

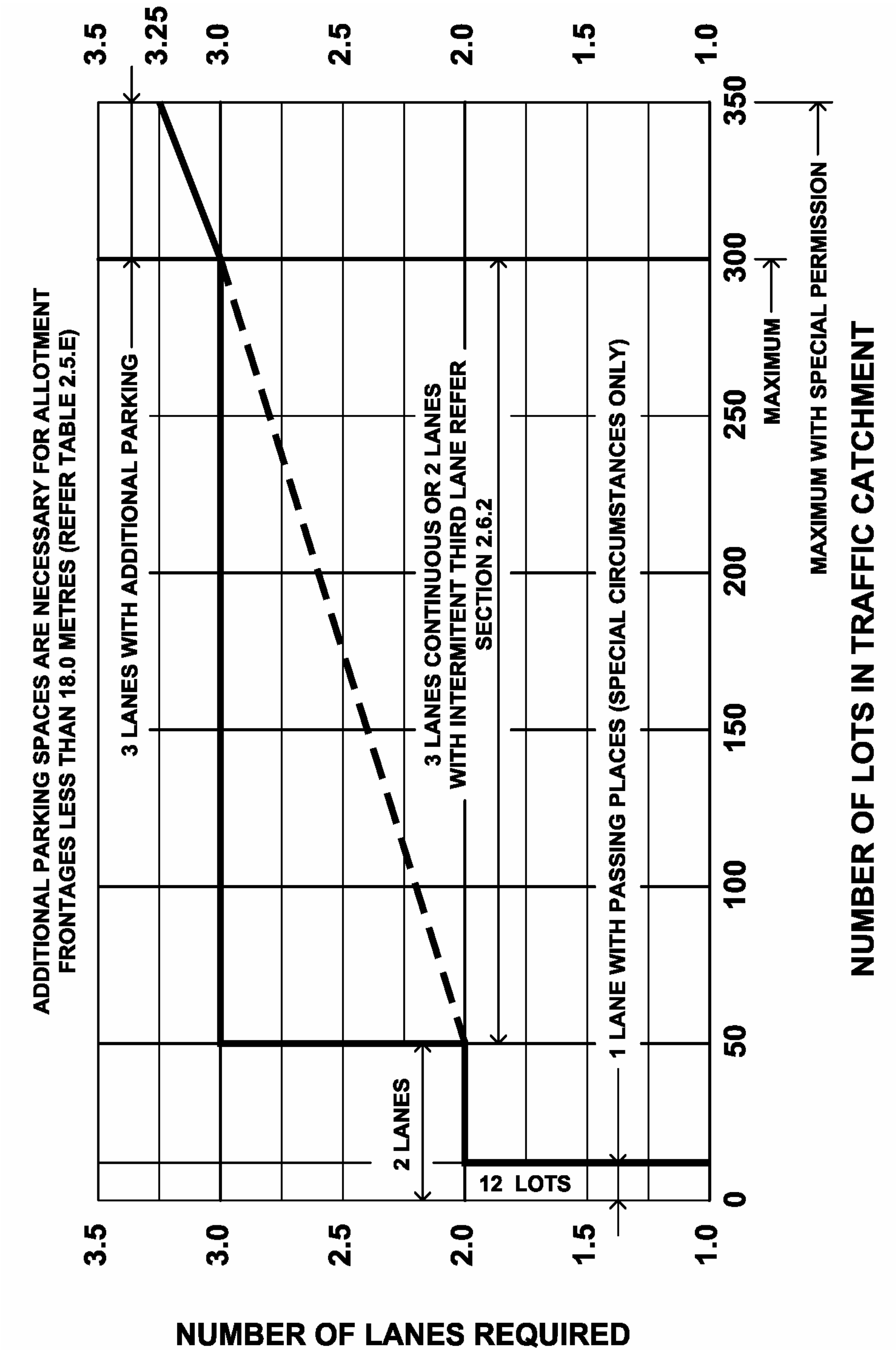
❖ Carriageway width to be the minimum necessary for normal traffic movements to be carried out at the design speed, with abnormal movements possible at reduced speed.

Probable Solutions

❖ Carriageway width of each street length, in terms of the number of lanes, to be not less than as shown in Figure 2.6.E.

❖ Carriageway width (measured between channel inverts) to be:-

Single lane	-	3.5m (special circumstances only)
Two lane	-	6.0m
Three lane	-	7.5m
Bus Routes	-	9.5m



LANE WIDTH REQUIREMENTS

Figure 2.6.E

2.7.0 STREET CLASSIFICATION

2.7.1 GENERAL

In traditional subdivision theory, there is a "hierarchy" of streets, gradually increasing in order of traffic importance from the short cul-de-sac to arterial type roads.

This concept does not accord, however, with our philosophy that for all **residential streets** the **"access"** function is paramount and the **"traffic"** function subservient. Nevertheless, the wider carriageways necessary for the higher traffic volume within the acceptable range inevitably create a speed environment somewhat higher than that achievable on minor streets. Such slightly higher speed is also necessary to keep the total travel time within a lower-speed environment to an acceptable limit.

2.7.2 RECOMMENDED CLASSIFICATION

Hence, within the range of residential streets, a classification can be made, based on network function, carriageway width and design speed. Using generally accepted nomenclature, the recommended classification is:-

❖ **Access Place** - a single cul-de-sac street

❖ **Access Street** - or a "loop" street; a "stem" from which two or more cul-de-sac streets branch

In both cases
- allotment catchment is less than 50 allotments
- carriageway width two lanes (or one in special circumstances)

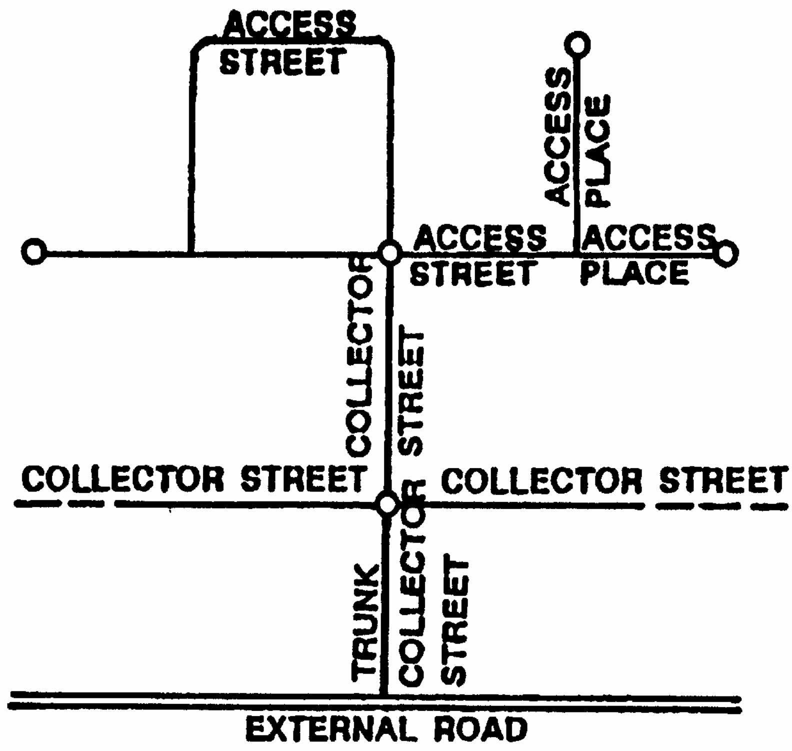
❖ **Collector Street**
- a "branch" which connects to a road of equal or greater classification
- total allotment catchment of 50 to 300 allotments
- carriageway width in excess of two lanes

❖ **Bus Collector Street** - a street with allotment access planned as a bus route. Any allotment catchment

2.7.3 TRUCK COLLECTOR STREET

Section 3.7.0 of the Design Standards for Roadworks identifies the need for a further class of street, for use where the traffic volume exceeds the maximum allowable for a street with direct frontage access to residential allotments.

Such a street is termed a **"Trunk Collector Street"** (see Section 3.7.6 of the Design Standards for Roadworks).



STREET CLASSIFICATION

Figure 2.7.A

2.8.0 VERGE

2.8.1 GENERAL

The verge (or nature strip) is the area of the street reserve between the property boundary and the carriageway.

2.8.2 FUNCTIONS

The verge fulfils a number of functions:-

- **Safety visibility area**

  For drivers of vehicles on the carriage to observe and react to pedestrians or cyclists exiting from dwellings on to the carriageway.

  For drivers reversing from driveways to see traffic on the carriageway.

- **Parking**

  For vehicles clear of the carriageway, in constructed indented parking bays.

- **Landscaping**

  Space for landscaping to improve the appearance of the street environment.

- **Utility services**

  Location for services, clear of the carriageway.

- **Changes in level**

  Space for batters to provide for level differences between carriageway and allotments.

On higher volume/higher speed streets, the verge additionally provides for:-

- **Pathways**

  For pedestrians and possibly cyclists.

- **Buffer area**

  For reduction in traffic noise level in dwellings.

2.8.3 SAFETY VISIBILITY

The **time** available for the driver of a vehicle proceeding along the carriageway to respond to a “hazard” entering the carriageway from a dwelling depends on:-

- speed of the “hazard” and
- distance between point of first sighting and point of potential impact.

Whether this time is sufficient for the driver to stop the vehicle is dependent on the vehicle **speed**. In general, therefore:-

- **the wider the verge, the better the driver’s chance of stopping in time to avoid a hazard**
- **the higher the design speed of the street, the greater is the verge width required for safety**

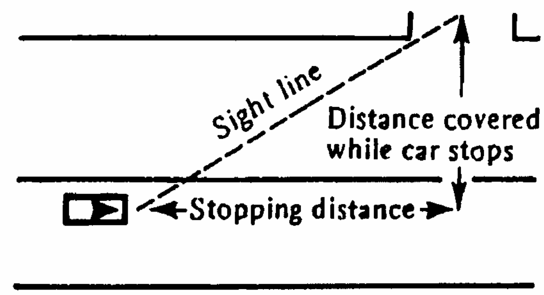


Figure 2.8.A

The situation does not lend itself to a rigid analysis, as there are a number of factors outside the designer’s control, e.g.:-

- visibility between approaching driver and a “hazard” is variable depending on existence/height of front fences, landscaping within the verge and front yards of houses, and presence of parked cars
- speed of the “hazard” may vary from (say) 2m/sec for a child running, to perhaps 5m/sec for a cyclist or skateboarder on a steep driveway

In a worst case of a cyclist exiting a steep driveway with high fences, landscaping on the verge, and an intervening parked car, the driver would have little chance of stopping in time, unless the verge were unreasonably wide.

Minimum verge widths appropriate for safety considerations are:-

DESIGN SPEED	VERGE WIDTH
40 km/h	3.5 m
60 km/h	5.0 m

These widths also provide sufficient width for a driver reversing from a driveway to see traffic on the carriageway before the rear of the car enters the carriageway (approximately 2.5m).

2.8.4 PARKING

This subject is fully dealt with in Section 2.4.0 of the Design Standards for Roadworks, however in regard to verge width it is noted that the minimum widths to accommodate various forms of verge parking are:-

❖ indented bay, parallel	4.2 m
❖ indented bay, 90°	
❖ on 3.5m carriageway	10.7 m
❖ on 5.5m carriageway	8.7 m

These widths are based on parking bay dimensions as shown in Figure 2.4.F and minimum clearances from the kerb line of the parking bay to the property boundary, as follows:-

❖ parallel bays	2.2 m
❖ 90° bay	2.2 m

2.8.5 UTILITY SERVICES

Residential streets do not normally have major trunk mains located within them and the Pine Rivers Shire Council standard services allocation is normally adequate to accommodate all required underground services.

It is highly desirable that utility services are **not** located under the carriageway, to avoid the necessity to excavate the carriageway for repairs.

Services, however, may be located under short indented parking bays, provided that they are in conduits to facilitate future replacement and that the minimum cover as for road crossings is provided. In the case of a watermain a conduit is not required, however water service connections are not to be located under parking bays.

2.8.6 FOOTPATHS

While pedestrians (and cyclists) can safely share the carriageway with motor vehicles in low volume/low speed streets, on streets with higher traffic, separate constructed footpaths for pedestrians must be provided within the verge.

The Pine Rivers Shire Council standard requirement is provision of a concrete footpath on one side of streets with a traffic catchment in excess of **40 allotments**, and adjacent to major pedestrian generators e.g. shops, schools.

Clearances required from the footpath are:-

❖ **Carriageway**

To minimise the potential risk of a pedestrian stepping off the footpath into the path of a vehicle on the carriageway, the distance from the pathway to the carriageway should be greater in higher speed streets.

Recommended minimum distances are:-

DESIGN SPEED	CLEARANCE (Edge of pathway to the channel invert)
40 km/h	**1.0 m**
60 km/h	2.5 m

Note: - The minimum of 1.0m is to provide clearance for opening car doors, cars partially parked on the verge, and streetlight poles. Where parking bays are indented, the minimum of 1.0m may be provided at the edge of the parking bay, regardless of the street design speed.

- **Property boundary**

  Clearance is required between the edge of the footpath and the property boundary for:-

  - safety from vehicles backing from driveways
  - overhanging vegetation from within properties

  Recommended minimum clearance is: - **0.8 m**

- **Verge width**

  The minimum verge width required to accommodate a constructed footpath 1.2m wide is therefore:-

DESIGN SPEED	VERGE WIDTH
40 km/h	3.0 m
60 km/h	4.5 m

Note: - This width is less than the minimum width required for safety considerations, and therefore the “safety” width as set out in Section 2.8.3 of the Design Standards for Roadworks is the adopted minimum verge width.

A greater verge width is highly desirable to allow “meandering” of the footpath alignment relative to the kerb line and occasional consolidated areas of landscaping (see Figure 2.9.A).

2.8.7 CYCLE PATHS OR DUAL-USE PATHS

For the purpose of this manual the term "cycle path" applies to shared footways as defined by the Manual of Uniform Traffic Control Devices.

Recommended minimum clearances are:-

- **carriageway**
  as for footpaths
- **property boundary**
  minimum 1.0m

The minimum verge width required to accommodate a 2.0m wide path is therefore:-

DESIGN SPEED	VERGE WIDTH
40 km/h	**4.0 m**
60 km/h	**5.5 m**

These paths are normally required in accordance with the Pine Rivers Shire Council adopted Bikeways Plan, but are unlikely to be required on streets of lesser classification than collector streets.

Wherever such paths are required, a verge width greater than the normal minimum will be necessary.

Note: - Since these widths exceed the minimum widths for safety considerations, they have been adopted as the verge widths for use when cycle paths are required.

2.8.8 VERGE CROSSFALL

Factors requiring consideration in selection of the verge crossfall are:-

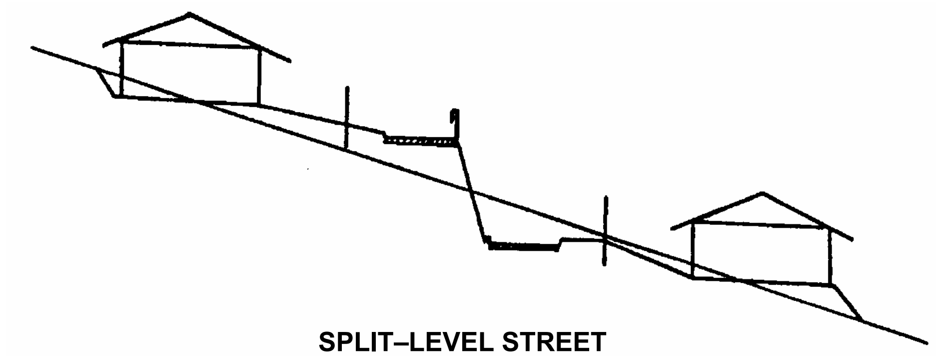
- drainage
  - surface must have sufficient gradient to provide drainage, say 1:40 (2.5%) minimum
  - there must be sufficient rise from the top of the kerb to provide reasonable capacity within the carriageway for overland stormwater flow - say 100mm minimum to the rear of the pathway
- vehicle access to allotments
  - changes of gradient across the verge must not be so severe that vehicles cannot easily enter allotment driveways without scraping on the kerb or road
- pedestrian movement
  - a relatively level width (suggested 2.2m width) must be provided for pedestrians, whether or not a paved footpath is constructed initially
- parking
  - to accommodate emergency parking a relatively level area (suggested 2.2m width) must be provided immediately behind the kerb

The maximum natural surface crossfall on which these standard cross-sections can be applied, with accesses graded to natural surface at the standard building line (6.0 m inside allotments), is approximately **1:8**.

Steep Crossfall

On steeper natural surface crossfall, special design solutions must be applied, such as:-

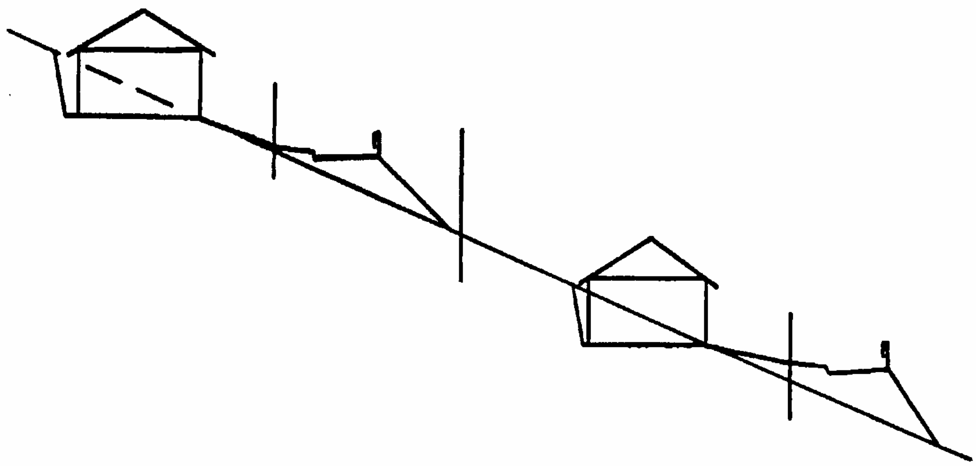
- split-level street - with two one-way carriageways at different levels



SPLIT–LEVEL STREET

Figure 2.8.B

- single-sided street - with allotments on one side only. This is often a better solution than a split-level street, as a narrow single-lane carriageway may generally be used for each street, avoiding the retaining wall normally required with a split-level.



SINGLE–SIDED STREET

Figure 2.8.C

2.8.9 VERGE

DESIGN DATA

Objectives

- To provide a buffer area of no greater width than necessary between the street carriageway and the residential allotments, sufficient for the functions of safety, amenity and convenience, but in the interests of economy.

Specific Outcomes

Verge width adequate for: -

- safety visibility
- pedestrian movement
- landscaping for amenity
- noise reduction
- parking
- allotment access
- utility services

Verge crossfall suitable for**: -**

- allotment access
- pedestrian movement
- drainage
- overspill parking

Probable Solutions

Complies with Pine Rivers Shire Council Standard Drawings

2.9.0 STREET RESERVE WIDTH

2.9.1 GENERAL

In traditional subdivision design, street reserves are a constant width, specified for each street category.

There is, however, no intrinsic merit in a constant width and it is aesthetically more pleasing to have a variable width with occasional wider areas to accommodate massed landscaping, parking areas etc. and to allow the footpath to “meander” relative to the kerb and property lines.

Examples of the concept of a variable reserve width are shown in Figure 2.9.A. and Figure 2.9.B.

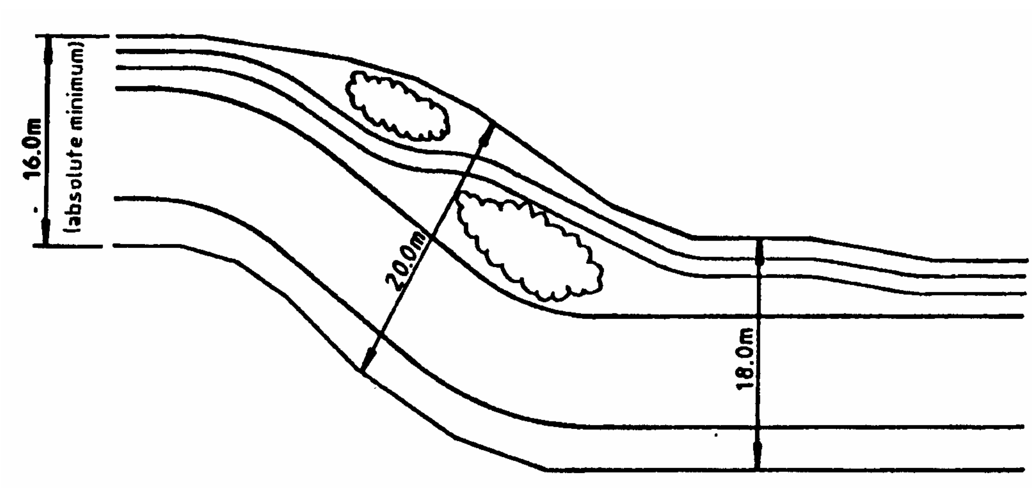
2.9.2 MINIMUM RESERVE WIDTHS

The minimum reserve width at any point needs to accommodate the sum of the applicable carriageway and verge widths at that point and also requires to provide sufficient width for aesthetics and visual separation of dwellings.

The Pine Rivers Shire Council requirements for minimum reserve width are: -

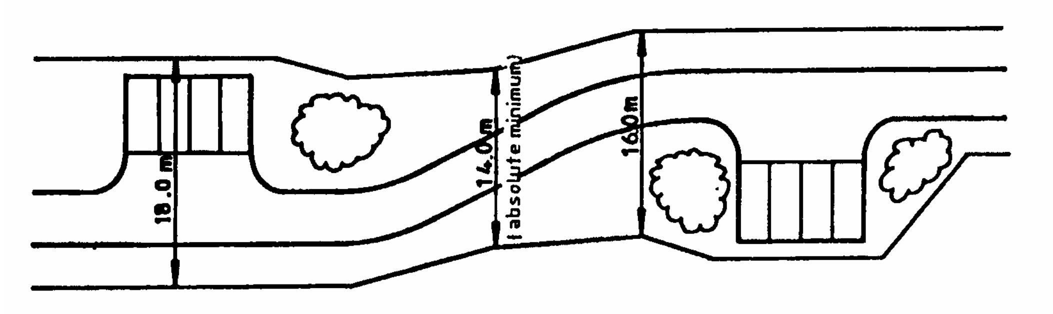
Access Place	-	15.0 m
Access Street	-	15.0 m
Collector Street	-	18.0 m
Bus Collector Street	-	20.0 m

Where a variable reserve width is proposed, the Pine Rivers Shire Council **may** consider a lesser minimum width at isolated locations provided that the average reserve width is not less than the above criterion for the respective reserve.



COLLECTOR STREET

Figure 2.9.A



ACCESS PLACE / STREET

Figure 2.9.B

2.9.3 STREET RESERVE WIDTH

<u>DESIGN DATA</u>

Objectives

- To provide sufficient width to effectively accommodate all street functions, but in the interests of economy, no greater width than necessary.

Specific Outcomes

- **Minimum** street reserve width at any point to be not less than the sum of the minimum widths for the carriageway and the verge, as identified in Sections 2.6.0 and 2.7.0 of the Design Standards for Roadworks.

- **Average** street reserve width to be sufficient to provide varied reserve width to allow for landscaping, parking areas, etc.

Probable Solutions

- Minimum reserve widths in accordance with Section 2.9.2 of the Design Standards for Roadworks

- Where carriageway widths in excess of minima are utilised to accommodate passing and parking requirements, the minimum reserve width should be:-

Access Place or Street	-	carriageway width + 9.0 m
Collector Street	-	carriageway width + 10.5 m
Bus Collector Street	-	carriageway width + 10.5 m

2.10.0 GEOMETRIC DESIGN

2.10.1 DESIGN SPEED

From Sections 2.3.12 and 2.3.13 of the Design Standards for Roadworks it is concluded that for streets with direct residential access **40 km/h** is:-

- the **lowest practical** design speed
- the **highest acceptable** design speed, in consideration of pedestrian and cyclist safety

For streets without residential access i.e. trunk collector streets, however, a higher design speed is necessary to keep total travel times to reasonable limits and for practical design limitations.

Maximum Design Speeds

From these considerations the Pine Rivers Shire Council design speeds for residential streets are: -

- access place and access street - 40 km/h
- collector street - 40 km/h
- bus collector street - 40 km/h
- trunk collector street (no frontage access) - 60 km/h

It must be remembered that these are **design maximum speeds**, and not design minimum speeds, as in highway design practice.

2.10.2 SIGHT DISTANCE

Sight distance requirements are dependent on the distance required for the driver of a vehicle travelling at the relevant speed to react, apply the brakes, and for the vehicle to stop. The stopping distances for various vehicle speeds are:-

Speed (km/h)	Stopping Distance (metres)
20	10
25	15
30	20
35	25
40	30
50	40
60	55

STOPPING DISTANCE AMCORD (1990)

Table 2.10.A

Sight distances required for various situations are specified in following sections. However, as all residential streets (other than Trunk Collector streets) operate on the concept of a "single moving lane", the G**eneral Minimum Sight Distance is that required for the drivers of two opposing vehicles to see each other in sufficient time to stop before collision. This distance is twice the above stopping distances, measured between "eye heights" each 1.15 m above the carriageway**.

2.10.3 HORIZONTAL ALIGNMENT

As discussed in Section 2.3.0 of the Design Standards for Roadworks, drivers react to restrictive horizontal alignment by slowing to an appropriate speed. Hence the desired maximum design speed is maintained by deliberately designing a restrictive horizontal alignment.

Quantitative details for alignment design on these principles are given in Section 2.3.14 of the Design Standards for Roadworks.

Sharp Curves

While the use of sharp horizontal curves is one means of limiting vehicle speed, the following requirements should be complied with to allow safe passing and operation of the occasional heavy vehicle: -

- **Minimum curve radius** (carriageway centreline)

access place or access street	-	10m
collector street	-	15m
bus collector street	-	20m

- **Carriageway widening**

curve radius	- 30m to 20m	-	0.5m
	- less than 20m	-	1.0m

Carriageway widening applies to all standard carriageway widths. Widening should be applied to the **inside** kerb line of the carriageway. Refer to Figure 2.10.D

Single-lane (3.5m) carriageways will generally need to be widened to two lanes on sharp curves, to conform to requirements for passing spaces to be visible from one to the next (see Section 2.5.5 of the Design Standards for Roadworks). In such cases the required carriageway width will be 6.0m plus appropriate widening.

Sight Distance

The minimum horizontal sight distance required at any point along the street is **twice the stopping distance for the spot speed** relevant at that point, i.e.:-

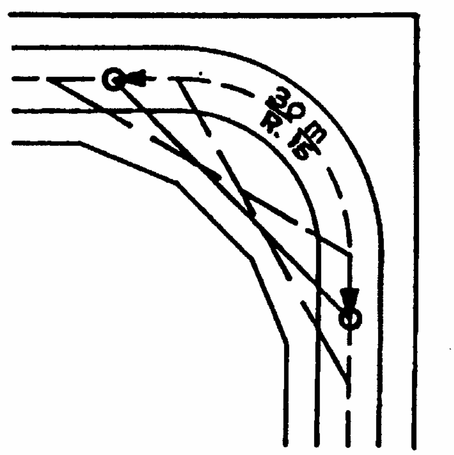
Spot Speed (km/h)	Minimum Sight Distance (Metres)
20	20
25	30
30	40
35	50
40	60
50	80
60	110

MINIMUM SIGHT DISTANCE

Table 2.10.B

The sight distance required is measured along the vehicle path.

Drawing the lines of sight between a number of pairs of points so that the distance between each pair is the required sight distance, defines the "sight distance envelope" required to be left clear of obstructions.



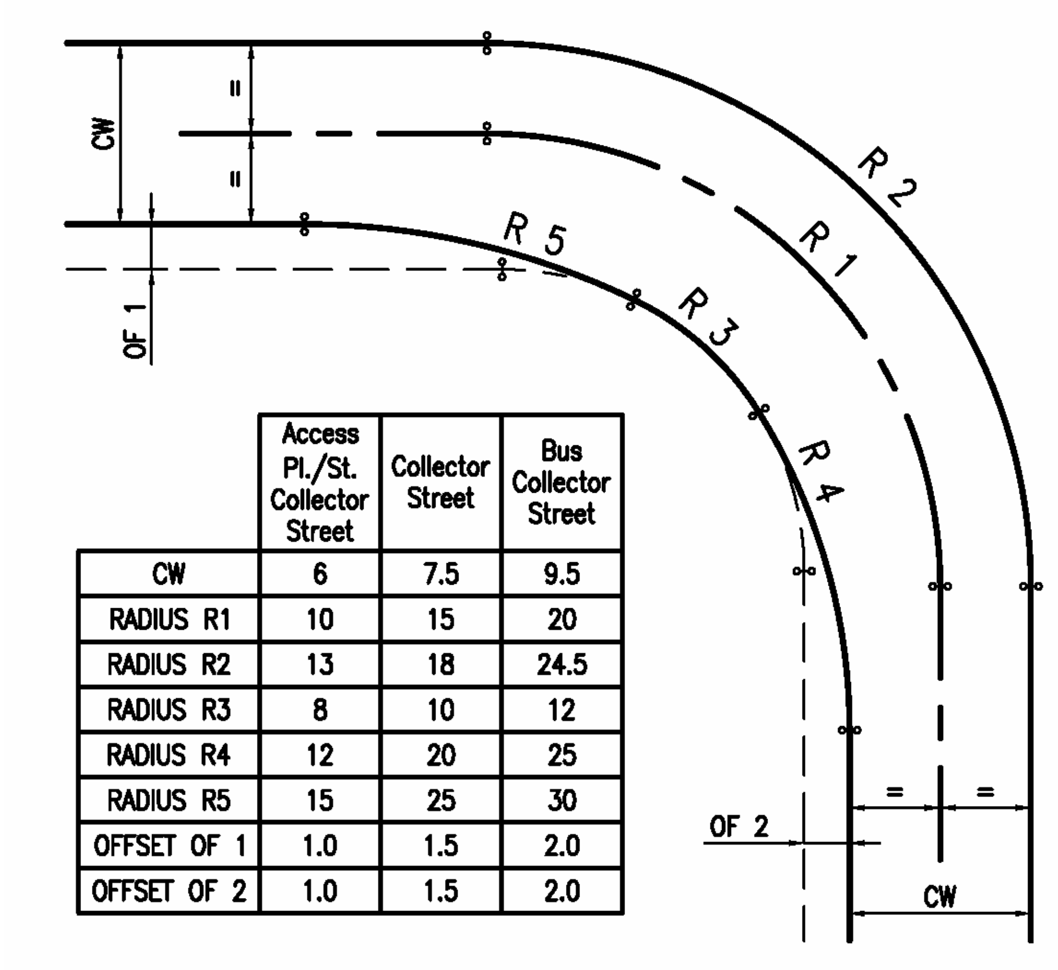
HORIZONTAL SIGHT DISTANCE

Figure 2.10.C

Example

Curve radius - 15m
Spot speed - 25 km/h
(Table 2.3.C)
Sight distance required - 30 m

measured along the vehicle path.



	Access Pl./St. Collector Street	Collector Street	Bus Collector Street
CW	6	7.5	9.5
RADIUS R1	10	15	20
RADIUS R2	13	18	24.5
RADIUS R3	8	10	12
RADIUS R4	12	20	25
RADIUS R5	15	25	30
OFFSET OF 1	1.0	1.5	2.0
OFFSET OF 2	1.0	1.5	2.0

Figure 2.10.D

2.10.4 GRADIENTS

The maximum longitudinal gradient on any street should ideally not exceed **12%**, in consideration of pedestrian walking convenience.

The **general** maximum gradient for all streets is **16%**.

Where this gradient cannot be reasonably attained, however, the Pine Rivers Shire Council may allow an **absolute** maximum gradient of **20%** for a maximum distance of 60m on access streets and access places where necessary to allow connection to an existing road.

The minimum longitudinal gradient, based on drainage requirements, is **0.40%**.

2.10.5 VERTICAL ALIGNMENT

General

The maximum permissible change of gradient without requiring vertical curve shall be: -

Design Speed (km/h)	Change in Gradient (%)
40	1.3
60	0.8

Table 2.10.E

These changes in gradient are only acceptable when joining an existing construction.

Crest Curves

The controlling factor in the design of crest vertical curves is the provision of **adequate sight distance**.

In contrast to horizontal alignment, vertical alignment is **not** readily recognised in advance by drivers and hence it is considered necessary that the vertical alignment ensure all **crest vertical curves** have a general minimum sight distance of twice the stopping distance for the **design speed** of the street, i.e.:-

- **Access Place and Access street - 60m**
- **Collector street and Bus Collector street - 60 m**
- **Trunk Collector street - 110 m**

These distances are measured between points that are 1.15 m above the carriageway.

The minimum crest vertical curves to satisfy the above criteria in most situations are: -

Design Speed (km/h)	Curve Radius (metres)
40	392
50	695
60	1315

Table 2.10.F

For **short vertical curves** (length less than sight distance) larger radii are required to provide the necessary sight distance as shown in Figure 2.10.N.

Requirements in terms of **vertical curve length** are shown in Figures 2.10.K and 2.10.N.

In addition to the above **general minimum** sight distance, which is required to be provided at all points along the street, at locations where there may be channelling or line marking, such as intersections or pedestrian crossings, it is desirable that the driver be able to see such indications within the stopping distance, i.e.:-

Sight distance from 1.15m eye height to zero is not less than single-vehicle stopping distance.

In most cases the minimum vertical curve to satisfy this requirement is identical with that required by the **general minimum** sight distance. However, for short vertical curves, a more generous curve may be required.

The requirements in terms of curve radii are shown in Figure 2.10.N, and in terms of curve length in Figures 2.10.K and 2.10.M.

It is noted that the above crest curves also satisfy the general **safety requirement** of providing stopping sight distance from 1.15m eye height to an object height of 0.2m above the carriageway.

Sag Curves

While streetlighting is provided in all residential streets, the level of illumination is insufficient to be relied on for stopping distance considerations.

For **sag vertical curves** therefore, the critical factor is **headlight sight distance**, which is the minimum vertical curve radius such that a vehicle's headlights will illuminate an object on the carriageway in time for the driver to stop.

Design data based on vertical **curve radius** are shown in Table 2.10.G and on **curve length** in Figures 2.10.L and 2.10.M.

Desirable minimum criteria are based on the current Austroads assumption of zero headlight beam elevation. However if these standards cannot be reasonably attained, the **absolute minimum** criteria (based on the previous NAASRA assumption of 1 degree headlight beam elevation) may be used subject to the Pine Rivers Shire Council approval. These recommendations also satisfy the **"comfort criteria"** of maximum vertical acceleration 0.05g.

Design Speed (km/h)	Desirable Minimum Curve Radius (metres)	Absolute Minimum Curve Radius (metres)
40	600	360
50	1050	560
60	2000	900

Table 2.10.G

Appearance Criteria

At small changes of gradient a vertical curve in excess of the above minimum requirements may be preferable from appearance considerations.

Recommended minimum lengths are: -

Access Street and Access Place	**25 m**
Collector and Bus Collector Street	**25 m**
Trunk Collector Street	**30 m**

Table 2.10.H

Combination Grading

While the previous design criteria give the requirements for individual crest and sag vertical curves, combinations of adjacent vertical curves in close proximity require checking graphically on the street longitudinal section to ensure compliance with sight distance requirements at all points.

2.10.6 CROSSFALL

The minimum carriageway crossfall for surface drainage is 0.025m per m, i.e. **1:40**.

Maximum crossfall, for driver comfort, opening of car doors, and allotment access, should not normally exceed 0.030m per m, **1:33**.

2.10.7 CARRIAGEWAY CROSS-SECTION

The forms of carriageway cross-section acceptable to the Pine Rivers Shire Council are:-

- **centre crown** - the "conventional" section, graded from a high point on the centreline to channels each side

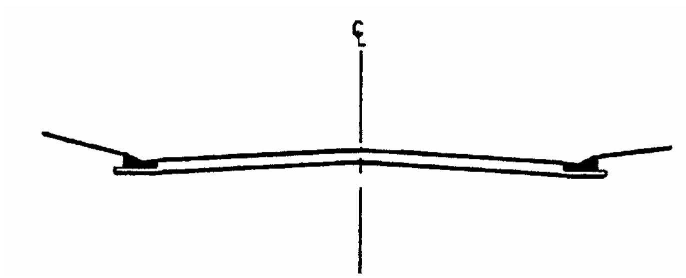


Figure 2.10.I

This is the preferred section for wider carriageways e.g. collector streets, as it keeps the travelled centre lane clear of stormwater flows.

- **one-way crossfall** - graded from a high point at one edge (generally kerb only) to a channel at the other edge

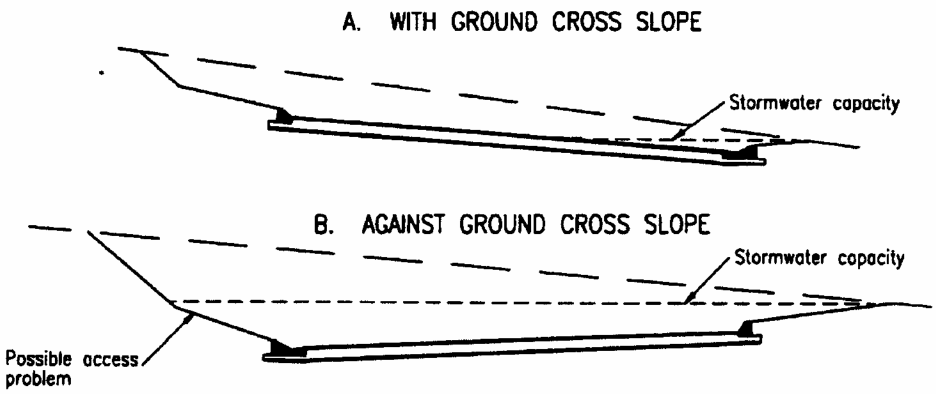


Figure 2.10.J

Features of this section are: -

- appropriate for narrower carriageways, e.g. **3.5m or 6.0m access places or access streets only**
- simple to construct and economical to drain
- crossfall **with** the ground cross-slope minimises earthworks and assists vehicle access to properties, but crossfall **against** the ground cross-slope provides maximum stormwater capacity within the carriageway and provision for high side house roof drains

  Compliance, however, with flow depth and velocity criteria of the Pine Rivers Shire Council Design Standards for Stormwater Drainage Standards should be verified.

2.10.8 GEOMETRIC DESIGN

DESIGN DATA

Objectives

- Geometric design criteria for the detailed design of the street to provide safety, amenity and convenience for all users, with maximum consistent economy of construction and maintenance.

Specific Outcomes

- Gradients - sufficient for drainage of the carriageway, but otherwise minimum possible, for safety and convenience of all road users
- Speed restrictive alignment - to restrict vehicle operating speeds to minimum practical, consistent with a reasonable travel time
- Sight Distance - sufficient for safe vehicle operation at the design speed

- ❖ Carriageway Cross-Section - suitable for surface drainage, driver comfort and allotment access

Probable Solutions

Design speed

- Access Place and Access Street 40 km/h
- Collector and Bus Collector street 40 km/h
- Trunk Collector street 60 km/h

Sight distance

- **general minimum**
  (twice stopping distance - 1.15m to 1.15m)

- **horizontal**

Spot Speed (km/h)	Sight Distance (metres)
20	20
25	30
30	40
35	50
40	60
50	80
60	110

- **vertical**

  Access Place and Street 60m
  Collector and Bus Collector street 60m
  Trunk Collector street 110m

- **special situations** (intersections etc)
  in accordance with Sections 2.10.5 and 2.11.4 of the Design Standards for Roadworks

Horizontal alignment

- speed restrictive design in accordance with Section 2.3.14 of the Design Standards for Roadworks
- minimum curve radii and curve widening in accordance with Section 2.10.3 of the Design Standards for Roadworks

Gradients

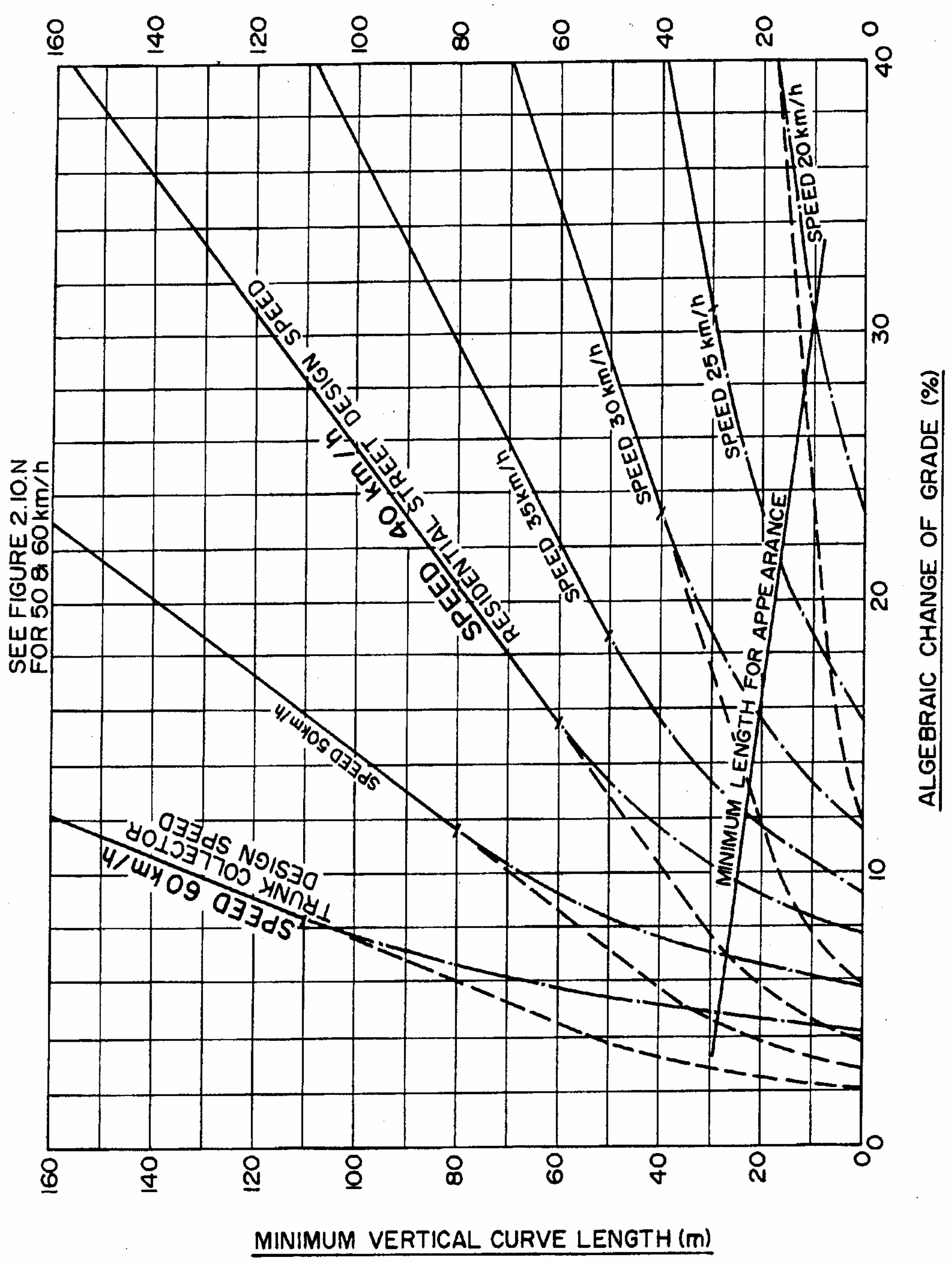
- **desirable** maximum, all streets 12%
- **general** maximum, all streets 16%
- minimum, all streets 0.40%

Vertical curves

- minimum radii and lengths
  see Tables 2.10.F, 2.10.G, 2.10.H and Figures 2.10.K, 2.10.L, 2.10.Mand 2.10.N.

Carriageway crossfall

- minimum 1:40
- maximum 1:33

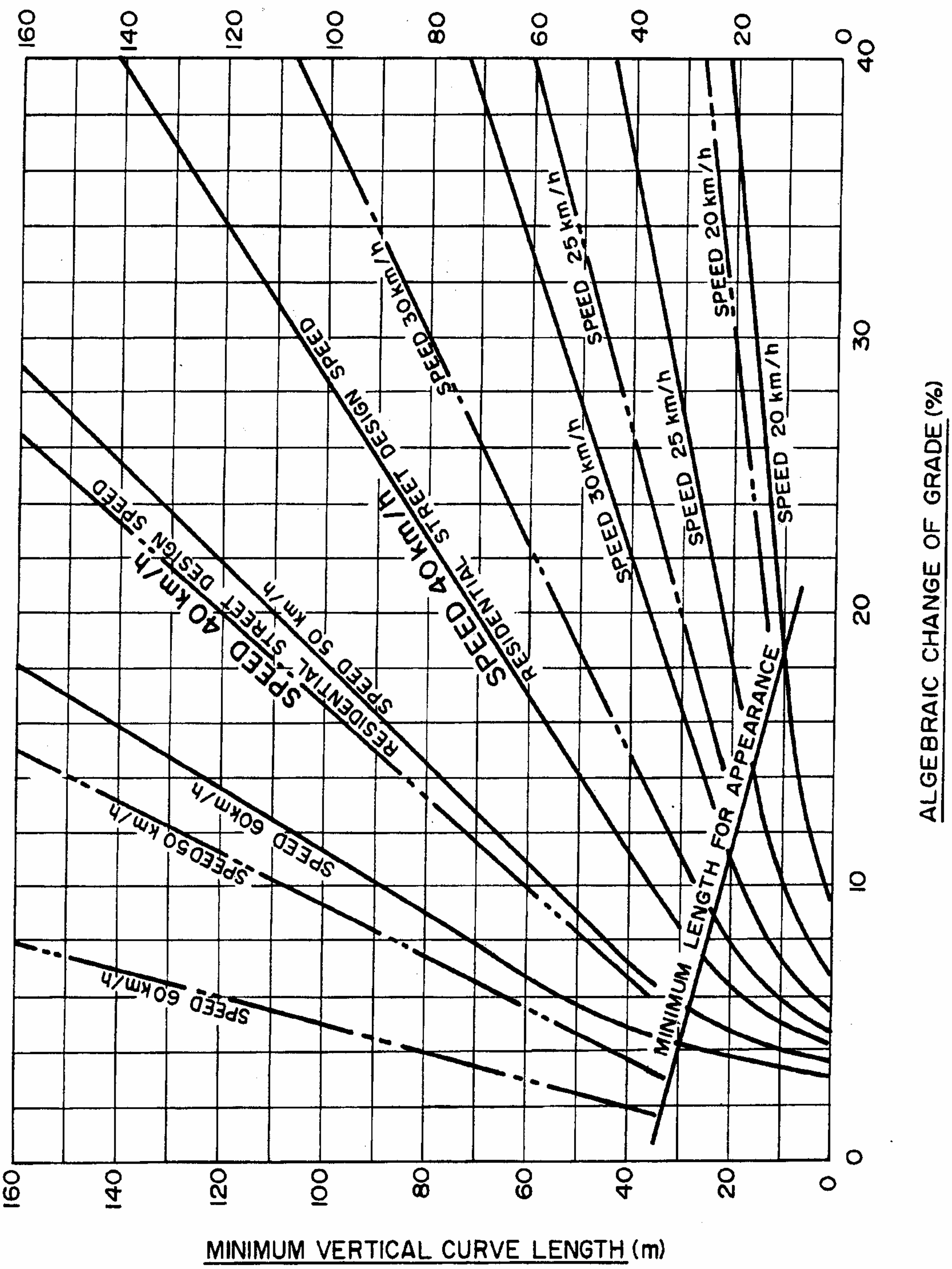


SIGHT DISTANCE TWICE STOPPING DISTANCE
MEASURED 1.15m to 1.15m ———·———

SIGHT DISTANCE = STOPPING DISTANCE
MEASURED 1.15m to 0.00m
(a) CURVE LONGER THAN SIGHT DISTANCE ————————
(b) CURVE SHORTER THAN SIGHT DISTANCE — — — —

MINIMUM LENGTH
OF CREST
VERTICAL CURVE

Figure 2.10.K



Desirable Minimum ——·-·——

Absolute Minimum ————————

LENGTH OF SAG VERTICAL CURVE FOR STOPPING DISTANCE WITHIN HEADLIGHT BEAM

Figure 2.10.L

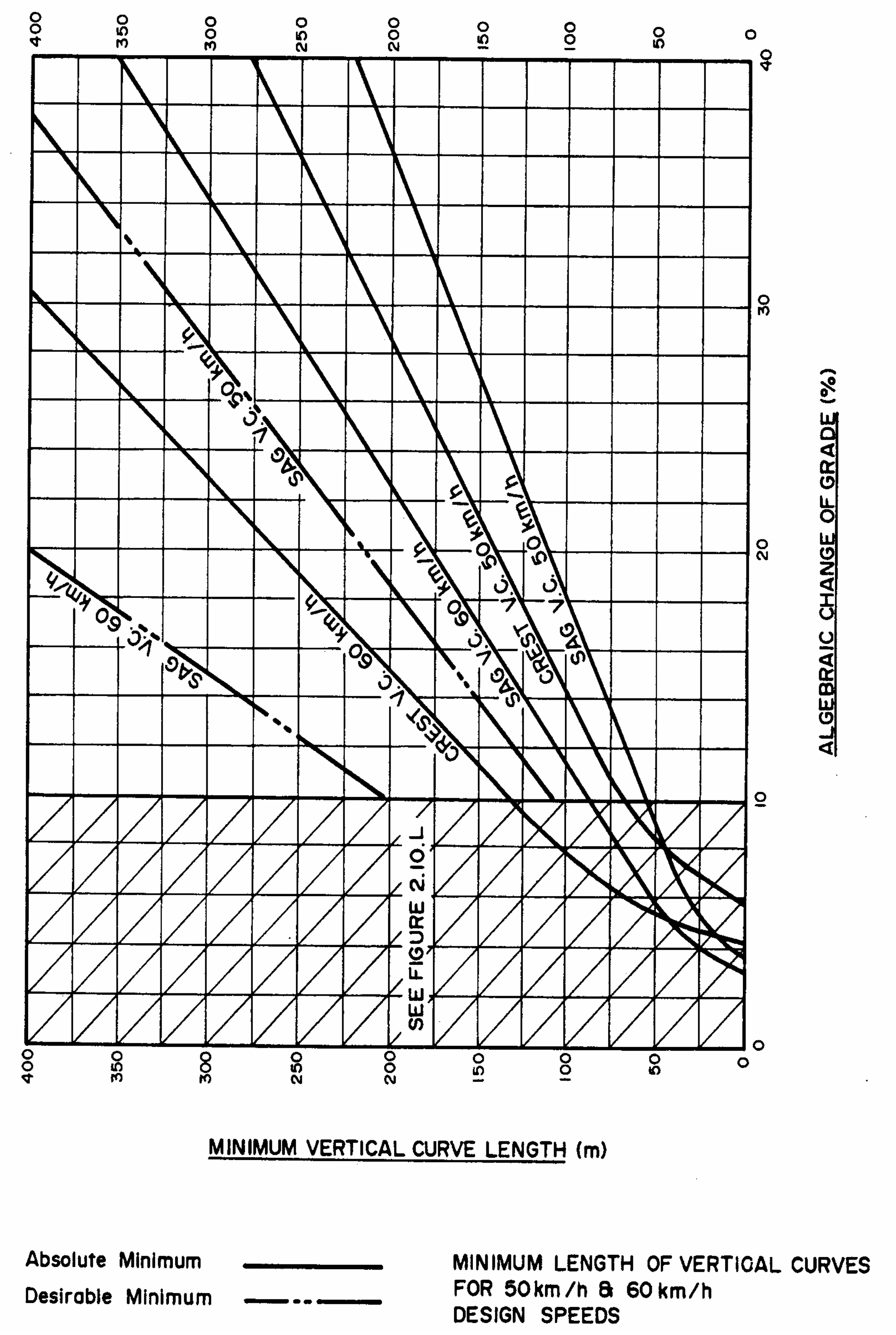
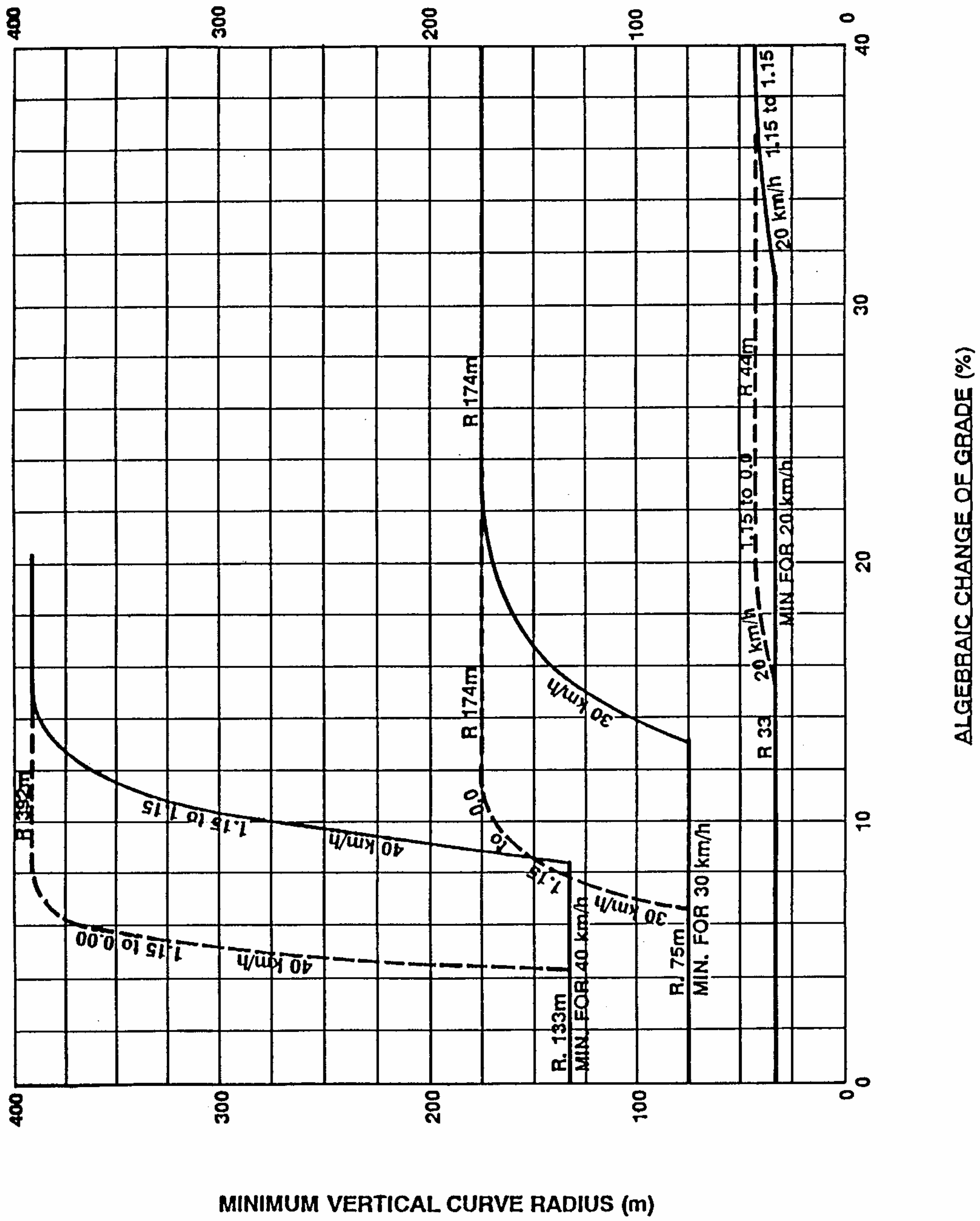

SAG V.C. 50 km/h
SAG V.C. 60 km/h
CREST V.C. 60 km/h
SAG V.C. 60 km/h
SAG V.C. 50 km/h
CREST V.C. 50 km/h
SAG V.C. 50 km/h
SEE FIGURE 2.10.L
ALGEBRAIC CHANGE OF GRADE (%)
MINIMUM VERTICAL CURVE LENGTH (m)
Absolute Minimum
Desirable Minimum
MINIMUM LENGTH OF VERTICAL CURVES
FOR 50 km/h & 60 km/h
DESIGN SPEEDS

Figure 2.10.M



SIGHT DISTANCE TWICE STOPPING DISTANCE MEASURED 1.15m to 1.15m ————

SIGHT DISTANCE = STOPPING DISTANCE MEASURED 1.15m to 0.00m — — — —

MINIMUM RADIUS OF CREST VERTICAL CURVE FOR 20, 30 & 40 km/h DESIGN SPEEDS

Figure 2.10.N (a)

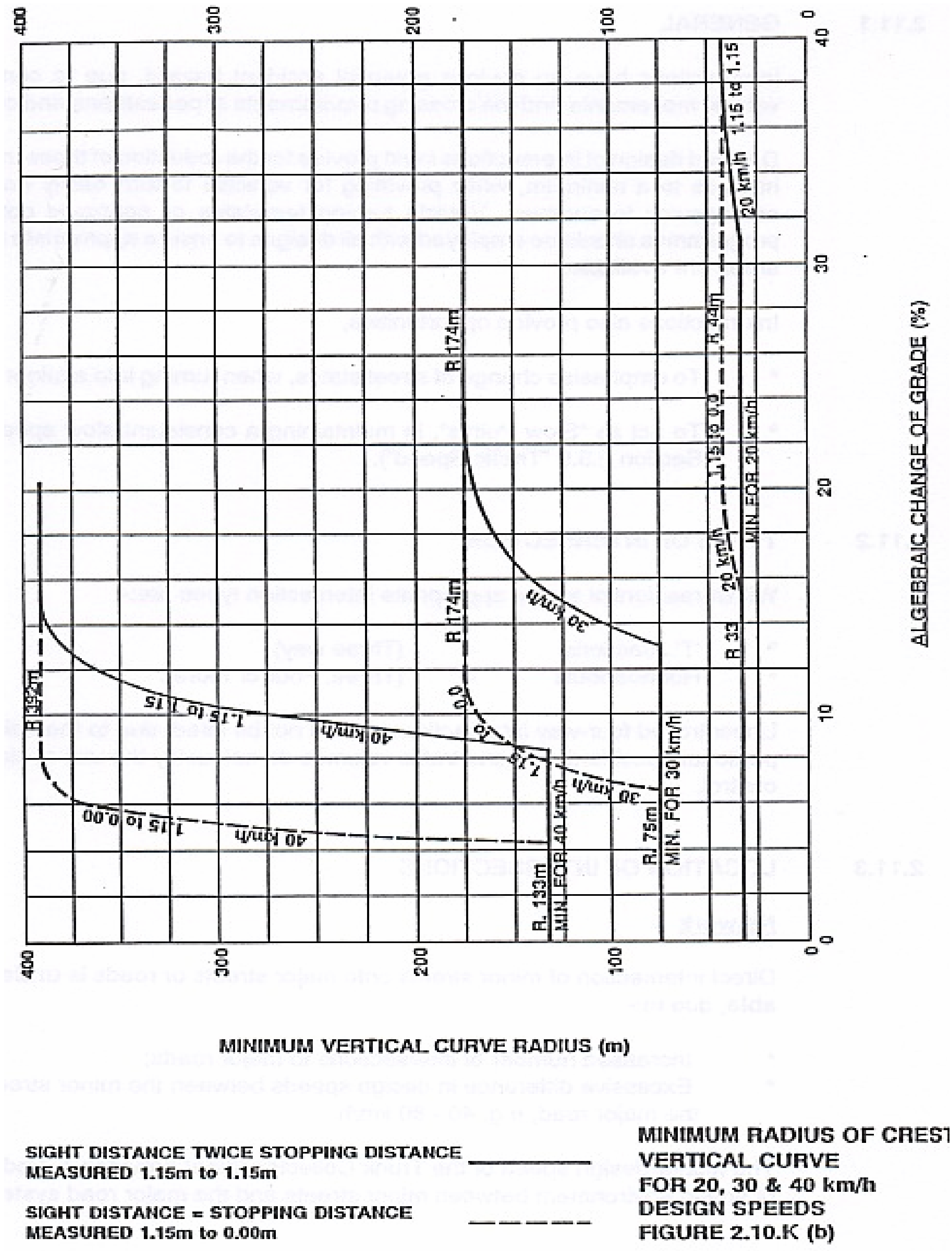


Figure 2.10.N (b)

2.11.0 INTERSECTIONS

2.11.1 GENERAL

Intersections have an obvious potential accident hazard, due to conflicting vehicle movements and the crossing requirements of pedestrians and cyclists.

Detailed design of intersections must provide for the reduction of these inherent hazards to a minimum, while providing for vehicles to turn easily from one carriageway to another. Vehicle turning templates or approved computer programmes should be employed with all designs to ensure appropriate turning areas are available.

Intersections also provide opportunities:-

- to emphasise change of street status, when turning into a minor street

- to act as "slow points", in maintaining a consistent slow speed (see Section 2.3.0 of the Design Standards for Roadworks)

2.11.2 TYPES OF INTERSECTION

Within residential areas, appropriate intersection types are: -

- T-Junctions - (three way)
- Roundabouts - (three, four or more)

Uncontrolled four-way intersections should not be used. In addition, they offer a disproportionate accident risk if traffic volume does not justify the use of signal control.

2.11.3 LOCATION OF INTERSECTIONS

Network

Direct intersection of minor streets on to major streets or roads is **undesirable**, due to: -

- increased number of intersections to major roads
- excessive difference in design speed between the minor street and the major road, e.g. 40 - 80 km/h

The higher design speed of the Trunk Collector Street provides a gradation of speed environment between minor streets and the major road system.

In general, streets should intersect only with streets of the same or immediately adjacent classification e.g.:-

- Access Place - only to Access Place or Access Street
- Access Street - only to Access Street, Access Place or Collector Street
- Collector Street - only to Trunk Collector Street, Bus Collector Street, Collector Street or Access Street
- Bus Collector Street - only to Trunk Collector Street, Bus Collector Street, Collector Street or Access Street

- Trunk Collector - only to Trunk Collector (unusual), Bus Collector street, Collector Street or external road

Spacing

Intersections should be located sufficiently far apart to: -

- separate traffic movements at each intersection
- provide a reasonable time interval between driver decisions

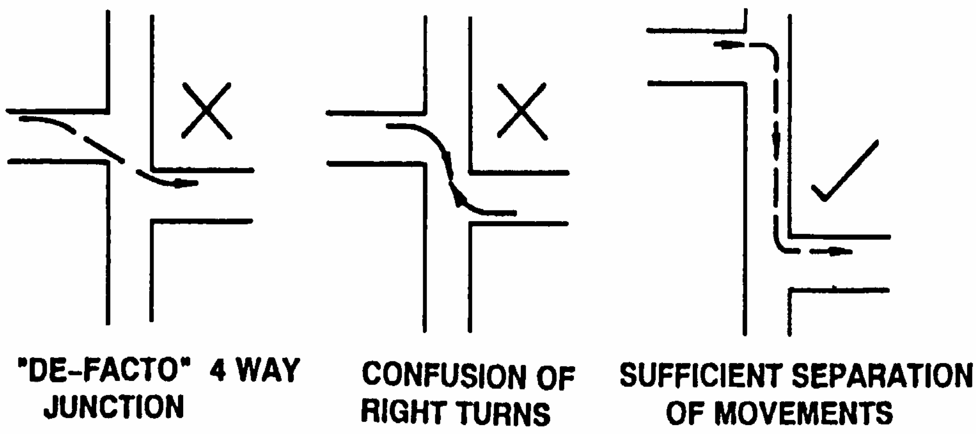


Figure 2.11.A

Desirable minimum intersection spacings (centre line to centre line) are: -

	Access Street & Collector Street	Trunk Collector Street
❖ On same side of through street	60 m	100 m
❖ On opposite sides of through street	40 m	60 m

A number of roundabouts in close succession can be unduly "fussy" and about **70m** is the recommended minimum distance between roundabouts where there are three or more in proximity.

2.11.4 SIGHT DISTANCE

General

Provision of adequate sight distance is one of the major factors in safe intersection design.

Intersections should be located to maximise available sight distance, by avoiding locations such as the inside of horizontal curves, just past a sharp curve, or on the crest of a sharp vertical curve.

In terms of geometric design of the roadway, site distance requirements shall be relative to the design speed of the street.

Sight Distance Criteria

There are two sight distance criteria applicable to residential street intersections:-

- **Approach Sight Distance (A.S.D.)**

  This is stopping distance, from 1.15m eye height to zero on the street carriageway.

- **Safe Intersection Sight Distance (S.I.S.D.)**

  This is a recognition and reaction distance, applicable to drivers on the through street. It is numerically equal to the general minimum sight distance and is measured from a height of 1.15m to 1.15m.

The A.S.D. should be provided on every leg of every intersection, while the S.I.S.D. is required only on the through legs of the intersection. However, the full length of each street is normally designed for the general minimum sight distance (see Section 2.10 of the Design Standards for Roadworks) and the A.S.D. requires the same vertical geometry as the S.I.S.D. except on short vertical curves.

A third sight distance criterion is identified by Austroads standards, "Entering Sight Distance" (E.S.D.). However, this is not relevant to residential street intersections.

Relevant design data is listed as follows:-

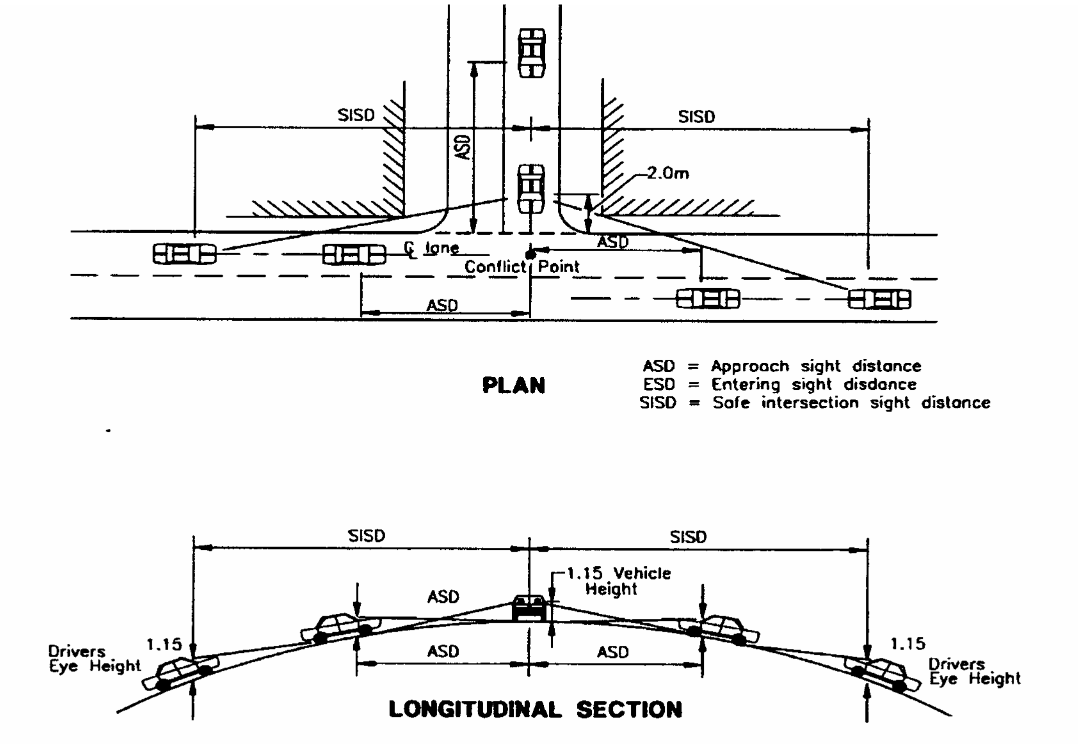
- stopping distances - Table 2.10.A
- minimum sight distance - Table 2.10.B
- crest vertical curves (radii) - Table 2.10.F
- (radii) - Figure 2.10.N
- (length) - Figures 2.10.K & 2.10.M
- sag vertical curves (radii) - Table 2.10.G
- (length) - Figures 2.10.L & 2.10.M

The **speed** used for ascertaining the required sight distance should be the **design speed** for the street under construction.

Sight Distance Triangle

The required S.I.S.D. and A.S.D. should be available at any location within the "sight distance triangle" as shown in Figure 2.11.B, except that view blocks of small lateral dimension are permissible e.g. signs, poles, tree trunks, small shrubs.

In the case of a roundabout, the S.I.S.D. should be available from 3m behind each approach holding line.



MEASUREMENT OF SIGHT DISTANCE

Figure 2.11.B

2.11.5 T-JUNCTIONS

- **Alignment** and threshold treatments of the approach streets should be such as to establish without any ambiguity the major street/minor street priority.

  The angle between the street centrelines should be **90°**, unless some skewing is essential in which case the **minimum** angle is 70°. The minor street centreline should be straight for a minimum of 10m from the tangent point of the kerb return.

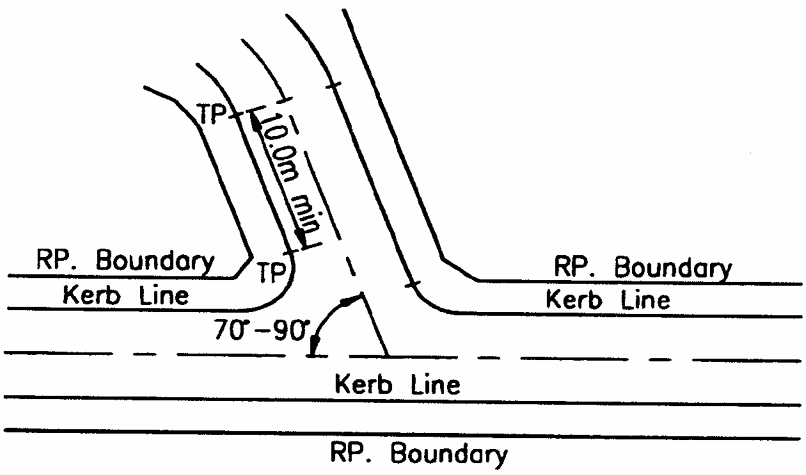


Figure 2.11.C

- **Carriageway width** should be a minimum of 6.0m in every leg of the intersection, i.e. 3.5m carriageways should be widened to 6.0m, for a minimum length of 10m, to allow a vehicle to turn into the minor road even if another vehicle is standing in that minor road.

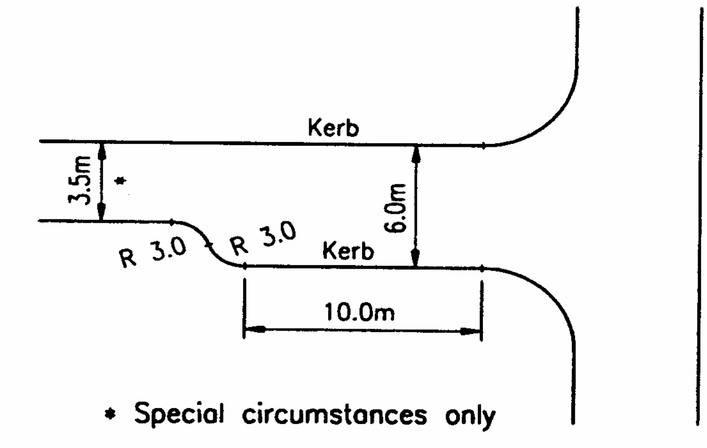


Figure 2.11.D

- **Kerb radii** should be the **minimum** appropriate for likely regular traffic in order to keep turning speeds to a reasonable minimum.

  The design basis should be:-

Vehicle	Turn Radius (metres)	Design Requirements
Car	8	- Kerb lane to kerb lane
Heavy Rigid	11	- Full width of 6.0m carriageways - Centre lane of 7.5m carriageway
Coach	12.5	- Centre lane of 9.5m carriageway

Refer also to Design Guideline DG 04 – “Local Area Traffic Management” where LATM treatments are proposed.

For 90^{o} intersection angle, the appropriate kerb radius for these criteria is:-

- Access street, Access Place, Collector Street to similar - 6.0 m

For intersections other than 90^{o} angle, channelled intersections, or intersections to a trunk collector street or a major road, specific design is required in accordance with Section 6.16.0 of the Design Standards for Roadworks and AUSTROADS “Guide to Traffic Engineering Practice - Part 5 - Intersections at Grade”.

- **Median islands** are not normally required in any residential street intersections, but may be included if desired for aesthetic purposes, or required for traffic reasons e.g. speed control or to clarify priority. In most cases islands will need to be mountable, to allow for turning by larger vehicles (Refer Section 2.13 of the Design Standards for Roadworks and Design Guideline DG 04 – "Local Area Traffic Management").

  At intersections where a pedestrian route or cycle route crosses, a median island can provide a refuge for pedestrians or turning cyclists.

- **Entry treatment** such as a change of pavement material or a strip of block paving, help to indicate the change of street status. A concrete "spoon" or "dish" drain across the minor road can serve both this and a drainage function (refer Section 7.17.5 of the Design Standards for Roadworks).

2.11.6 ROUNDABOUTS

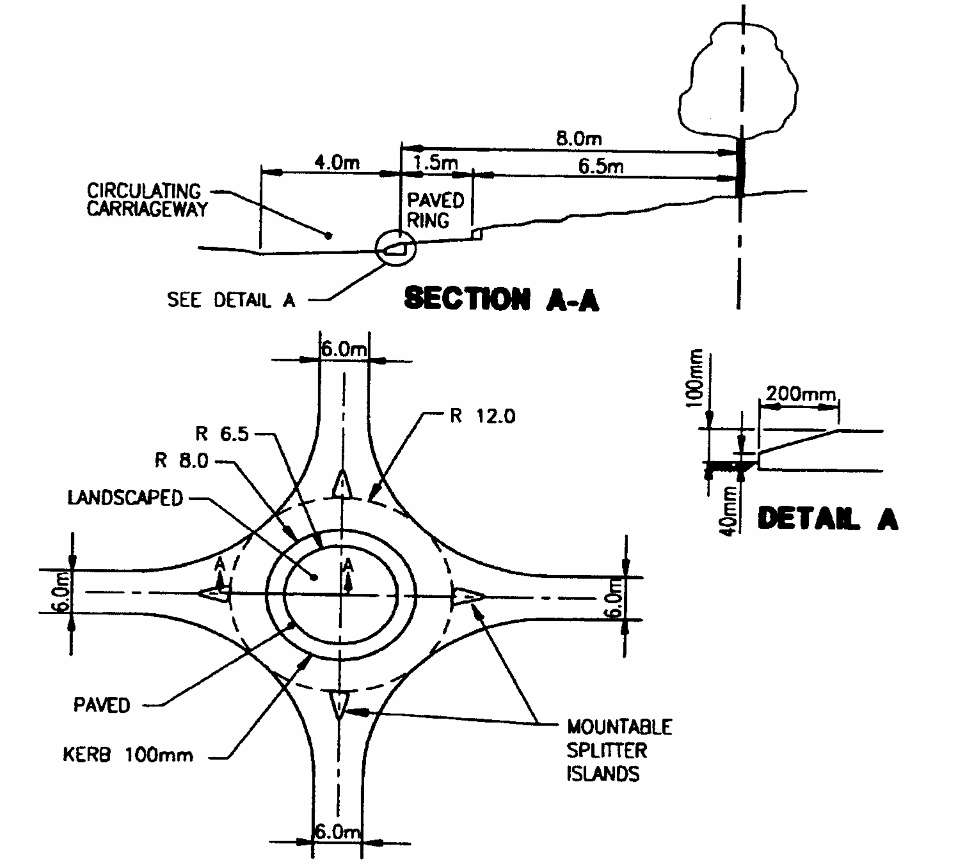
- **Roundabouts** in residential streets offer additional flexibility in subdivision layout, as they can safely provide for four-way intersections.

- Their use is consistent with the philosophy of all streets being of equal (minor) traffic significance and they act as "slow points" on all intersecting streets.

- **Splitter islands** are highly desirable in all roundabouts, but not essential in minor roundabouts.

- Where speed control is a function, the **geometric design** for residential street roundabouts should generally be based on the **design car** with the occasional truck or bus being allowed to mount the centre island and by providing a paved area behind the kerb of the island (see Section 2.13 of the Design Standards for Roadworks and Design Guideline DG 01 – "Roundabouts").

- The design will generally be site-specific. However for minor roundabouts being used as speed control devices at 90^{o} intersections, the following layout is typical:-



Refer also to the Pine Rivers Shire Council Design Guideline DG-01 – "Roundabouts".

Figure 2.11.E

2.11.7 LIGHTING

All intersections are required to be effectively lit, generally in accordance with the criteria of Australian Standard AS.1158 "Code of Practice for Public Lighting - Part 1".

2.11.8 TRUNCATIONS

Truncation of property boundaries at intersections may be required for:-

- intersection sight distance
- maintaining verge width

Sight Distance

For a normal T-junction with straight approaches at 90° sight distance does not require any truncation (see Figure 2.11.B). However, if the approach streets are curved, verge width at the intersection reduced, or the geometry is otherwise abnormal, the sight distance should be checked, and the property boundary truncated if necessary to clear the sight triangle.

In the case of a roundabout, all property boundaries will normally require truncation to clear the sight triangle.

Verge Width

A truncation of the property boundary is required at most intersections, to avoid any reduction in available verge width at the intersection.

While the verge width will vary both with the street classification and the location of the carriageway within the street reserve, for standard 90° T-junctions a single chord truncation of 3.5m chord length may be used.

For non-standard situations (e.g. roundabout T-junction channelled, or at other than 90°) a truncation is required such that the verge width at the kerb return is not less than the verge width available immediately adjacent to the intersection in either approach street.

In all cases a minimum truncation of 3.5m cord length is to be provided.

2.11.9 INTERSECTIONS

__DESIGN DATA__

Objectives

- ❖ To provide intersections between streets with maximum possible safety and convenience of operation, with minimum possible construction and operation cost.

Specific Outcomes

- ❖ Safety of operation
  - ❖ geometry clearly establishing approach vehicle priority
  - ❖ adequate approach sight distance
  - ❖ slow speed of negotiation, consistent with convenience
  - ❖ intersections generally only between streets of the same classification, or classification one above or below
- ❖ sufficient spacing of intersections to avoid driver confusion
- ❖ design to reinforce street classification and network legibility

Probable Solutions

- ❖ T-Junctions or roundabouts designed in accordance with Section 2.11 of the Design Standards for Roadworks and with the principles of relevant Austroads design codes.

2.12.0 MANOEUVRING AREAS

2.12.1 GENERAL

The term “manoeuvring“ is related to a low speed changing direction which may involve more than one turning movement as distinct from “turning” as would occur at intersections which is accomplished in one movement. This definition reflects the variation in turn radii adopted for the various manoeuvring and turning templates.

Facilities for vehicles to turn must be provided at the end of all cul-de-sac streets. However, the incidence of turning movements at the head of a cul-de-sac is not great, as resident and visitor cars parked within allotments or driveways will typically back out, and turn to drive straight out of the street. Even parallel parked cars are more likely to do a “three-point turn” in a convenient driveway rather than drive to the end of the street to turn, unless they are parked close to the end.

Service vehicles such as the garbage truck, milk vendor and other trade and delivery vehicles, casual visitors and a few residents’ vehicles are, therefore, the likely users of the turning facility.

The garbage truck is usually the main vehicle for turning movements.

2.12.2 DESIGN VEHICLES

Cul-de-sac turning areas are to be designed in accordance with the following criteria:-

- P.R.S.C. standard garbage truck - to be able to turn within the carriageway
- Heavy Rigid Vehicle (HRV - AS2890.1) - to be able to turn within the street reserve by driving over kerbs if necessary

Turning and manoeuvring templates for these design vehicles are shown in the Standard Drawings.

Note: - Special attention must be provided in the location of street light poles, signs and similar obstructions adjacent to the turning area.

Figure 2.12.B77

2.12.3 TYPES OF TURNING FACILITY

Turning facilities are preferred to be of the single turn type only, however in certain circumstances a three-point turn facility may be more considered.

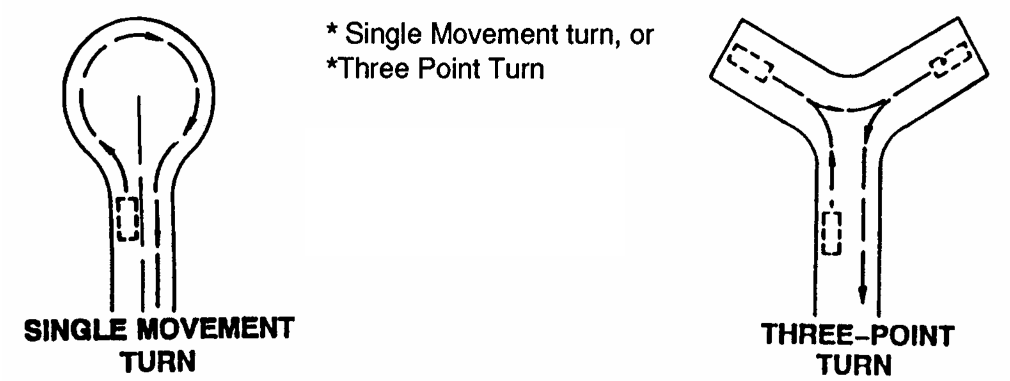


Figure 2.12.A

2.12.4 SINGLE MOVEMENT FACILITY

"Traditional" turning provision is for single movement turns, by means of a turning circle of typically 16m to 18m kerb diameter. This is sufficient for cars and small delivery vehicles to turn in one movement and hence is the Pine Rivers Shire Council preferred option for convenience and safety. However, parking within the turning area can be a frequent occurrence, due to the limited frontage and hence reduced internal parking capacity of the allotments around the cul-de-sac head. When parking does occur, larger vehicles must resort to a "three point turn".

The large area of carriageway required by such a turning circle can be visually unattractive, but the appearance can be improved by the inclusion of landscaping or parking bays in the centre of the circle to reduce the visual expanse of carriageway. The provision of parking bays greatly reduces the incidence of parking within the turning area.

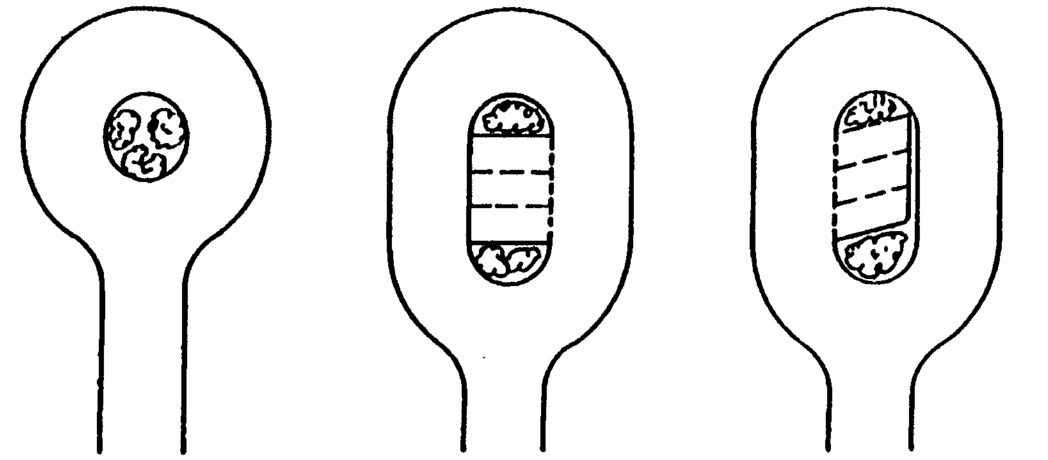


Figure 2.12.B

There are a number of possible **design options** for the single movement turn, all involving a compromise between the land area and paved area requirements on the one hand **(economy and amenity)** and turning **(convenience)** on the other.

Turning Circle for Car Only

A kerb diameter of **18m** will provide for a car or a small van to turn in one movement provided that there is no kerbside parking, but any larger vehicle must always use a three point turn, as must most cars if kerbside parking occurs. Provision of parking bays, to discourage kerbside parking, is necessary with this option which is only to be used with specific approval from the Pine Rivers Shire Council (see Figure 2.12.F).

Turning Circle for Garbage Truck

A kerb diameter of **20.4m** will accommodate the Pine Rivers Shire Council standard garbage truck.

This diameter will allow a car to turn if kerbside parking occurs on one side of the circle, but in such a case the garbage truck will require a three-point turn. One example of this type of design is shown in Figure 2.12.G.

Central Island with Parking

Provision of a **central island** improves visual amenity, but impedes three-point turning, where necessary for larger vehicles, or if there are parked vehicles, prevent a single-movement turn by smaller vehicles.

If, however, sufficient formal parking bays are provided **either within the central island or in close proximity**, kerbside parking can reasonably be disregarded. In this case, an outer kerb diameter of **20.4m** with **6m** carriageway width is appropriate for the Pine Rivers Shire Council standard garbage truck, and provides an island width sufficient to accommodate parking (see Figure 2.12.K).

General Design Points

Parking, where specific provision is required, should be provided at a minimum rate of **0.5 car spaces** for each allotment with frontage less than 17m.

Entry and exit kerb radii into and out of the turning area should be **15m minimum** to allow a turning vehicle to closely follow the kerb line, and thereby fully utilise the turning area.

Offsetting the turning area, as shown in Figure 2.12.H is an option which may facilitate allotment layout.

2.12.5 THREE POINT TURN

Pros and Cons

Compared to the "single movement facility", the "three-point turn" configuration is generally **more economic of carriageway area and land area**. The layout may also be more readily adapted to **rectangular allotment shapes**, rather than the "fan" shapes commonly used with circular turning areas. The rectangular allotment shape is more efficient for small-allotment

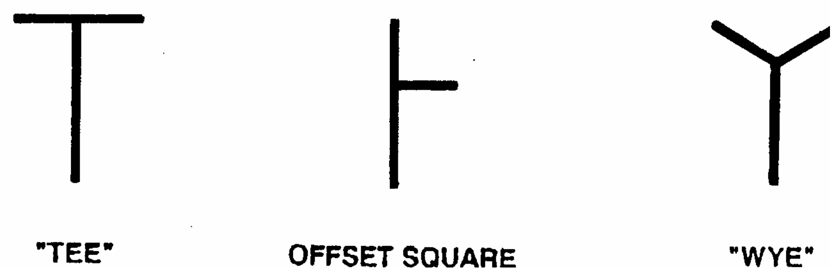
development, particularly with "zero allotment line" housing (see Figure 2.12.J).
The configuration may also be more adaptable to **steep topography**, or to **irregular shaped areas**. In the latter case an option may be to extend one or both "arms" of the turning area to serve a limited number of additional allotments, as shown in Figure 2.12.K.

On the other hand the "three-point-turn" configuration is **less convenient** and potentially **more hazardous**, due to the necessity for vehicles to reverse, and the on-street parking demand frequently found in cul-de-sacs.

Note: -	**Hence the single movement turn is the Pine Rivers Shire Council preferred design option, but the three-point-turn option may be considered where warranted by topography or allotment layout.**

Turning Area Geometry

Possible turning configurations include:-



The angle between the two "arms" should not be less than 90^{o}.

Figure 2.12.C

Turning area dimensions which conform to the design vehicle criteria of Section 2.12.2 of the Design Standards for Roadworks are shown in Figure 2.12.L.

Turning areas with non-standard geometry should be designed using an appropriate computer programme (e.g. Autotrack), and the appropriate vehicle dimensions and criteria shown in the Standard Drawings.

The Pine Rivers Shire Council standard garbage truck picks up from the left side only, and is driven from the left-hand side while collecting. Hence the ideal turning area and allotment layout should allow pickup from all allotments with **one entry only into each arm**, and for safety, with the **backing movement being either straight or turning to the left**. A possible alternative could be provision for grouping of refuse bins at a single location.

The appropriate verge width required to install all services is to be provided along each arm, and at the end of each arm between the kerb and the property boundary. The appropriate verge width is to be selected from the Pine Rivers Shire Council adopted standard drawings for service allocations.

Parking

It is essential to discourage parking in the arms of the turning area. Locating **allotment**

driveways off the ends of the arms together with provision of sufficient **formal parking bays** in close proximity should ensure that the turning area remains clear.

Parking bay provision should be at the rate of **0.5 spaces per frontage allotment**, and location should be in close proximity to the turning area (maximum 25m to allotment served) and in clear view of approaching drivers. Parking bays at the extreme end of a turning arm may be “appropriated” by adjacent allotments (see Figure 2.12.J). The amenity of allotments adjacent to parking bays should be protected by planting and/or mounds.

Large Vehicles

In detailed design, the requirement for a **HRV** to turn within the street reserve by mounting the kerb must be considered in the location of street lighting poles and gully pits.

2.12.6 PROVISION OF ACCESS

Manoeuvring areas shall provide for reasonable access to the allotment, and for reasonable driveway layouts between the roadway and the property boundary.

In situations where the configuration of allotments adjacent to manoeuvring areas is such that, in the opinion of a Pine Rivers Shire Council Engineer it is unlikely a satisfactory individual access can be constructed to each allotment, the Developer shall construct a joint access between the kerb and channel and property boundary of the allotments, to the satisfaction of a Pine Rivers Shire Council Engineer.

HEAVY RIGID VEHICLE
TURNING & MANOEUVRING TEMPLATES
FIGURE 2.12.D

(REFER STANDARD DRAWINGS 8-60012 AND 8-60013)

ARTICULATED VEHICLE
TURNING & MANOEUVRING TEMPLATES
FIGURE 2.12.E

(REFER STANDARD DRAWINGS 8-60018 AND 8-60019)

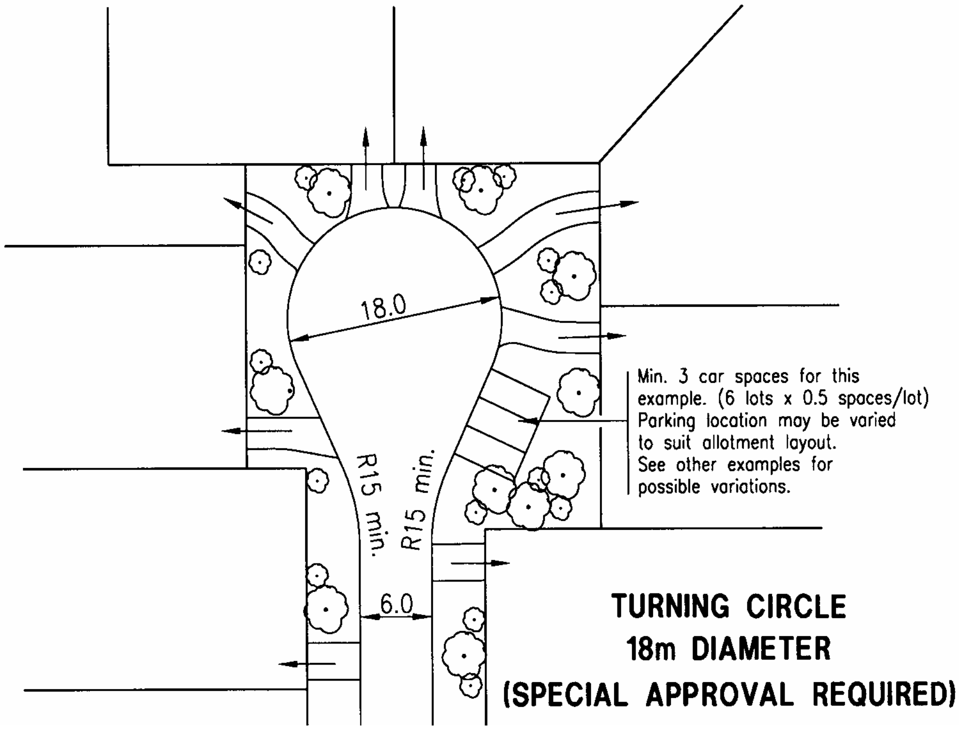


Figure 2.12.F

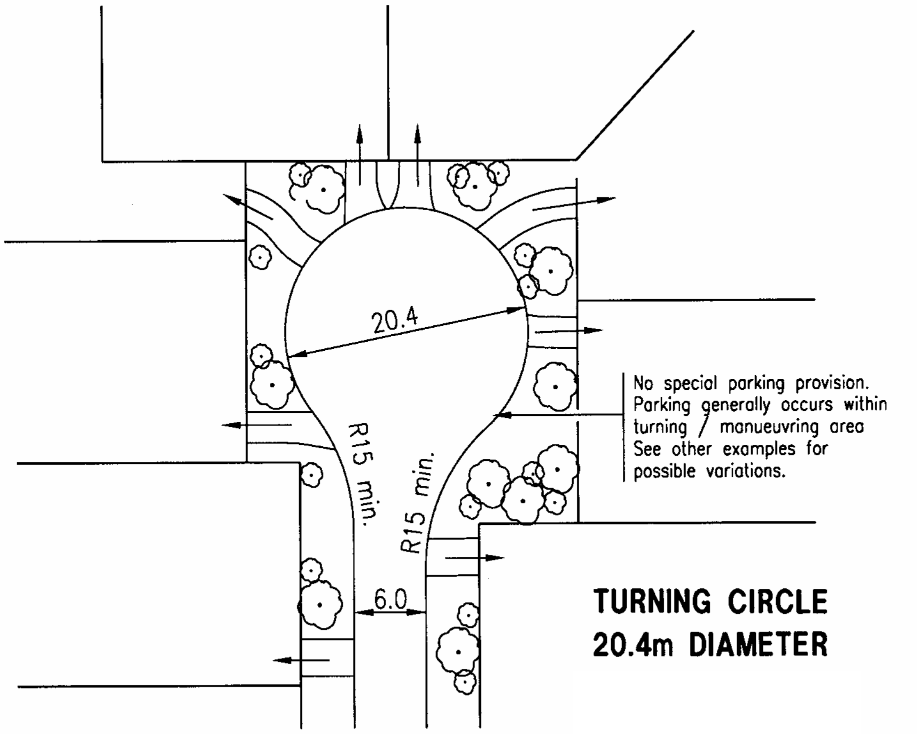


Figure 2.12.G

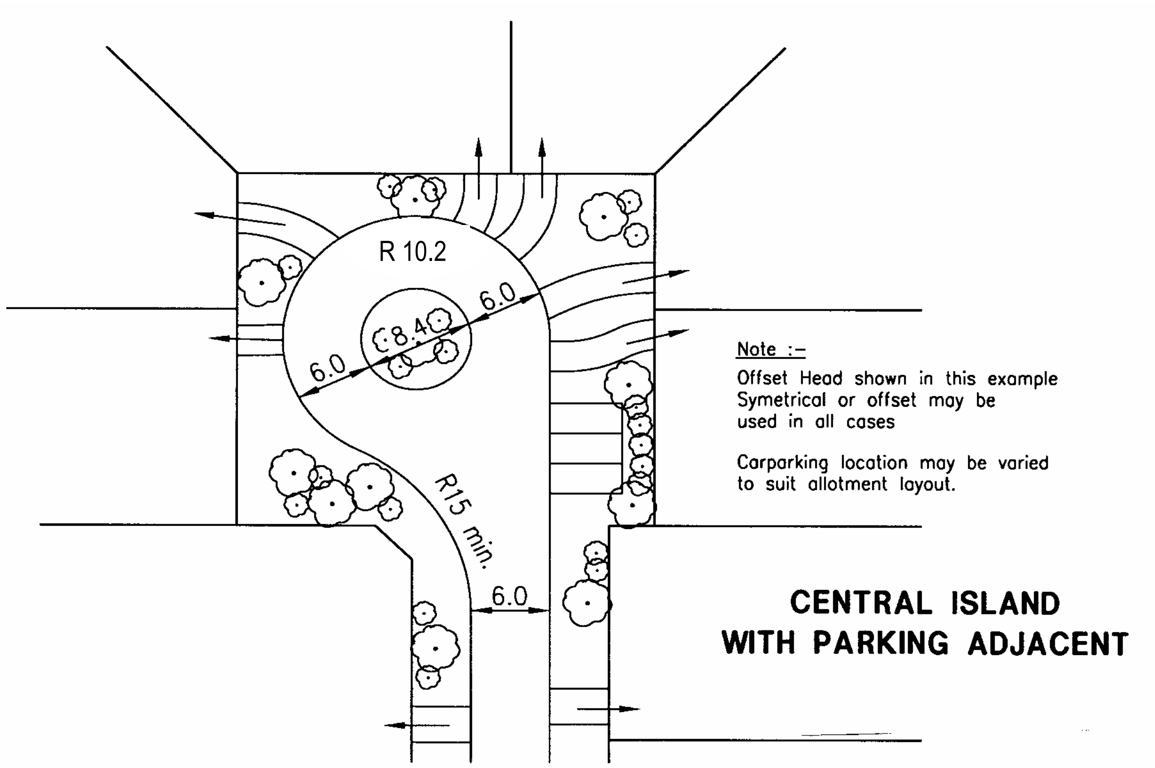


Figure 2.12.H

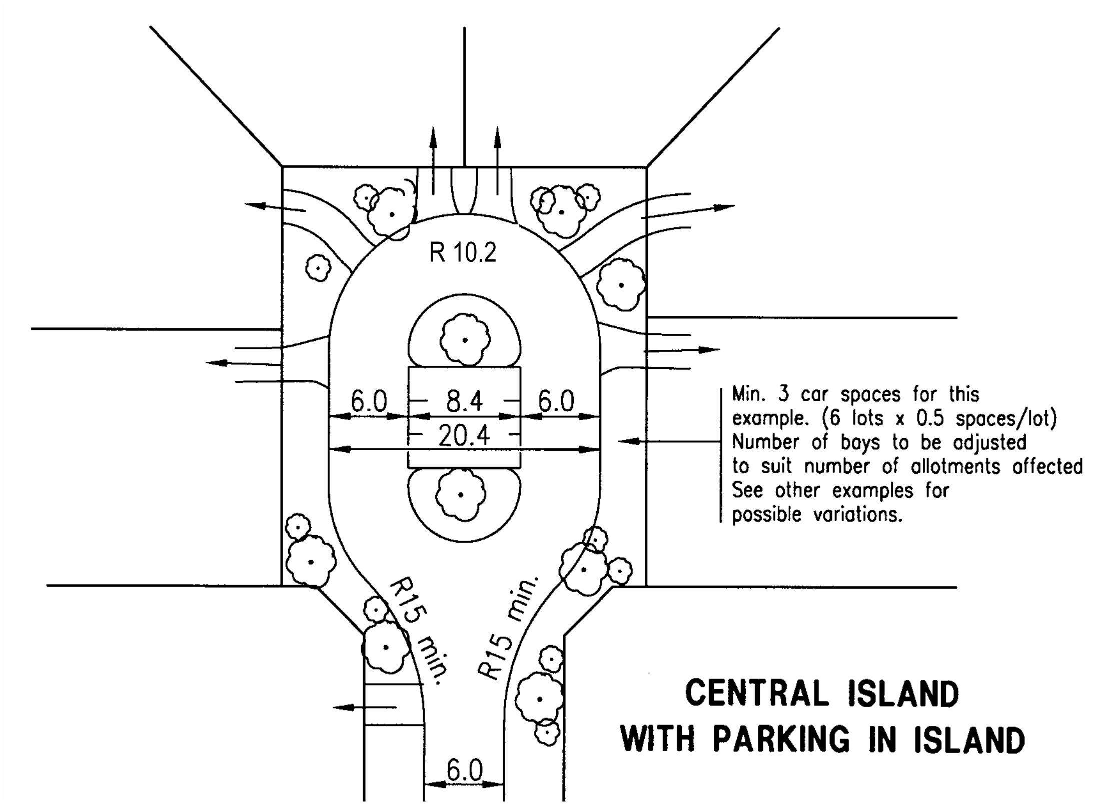


Figure 2.12.I

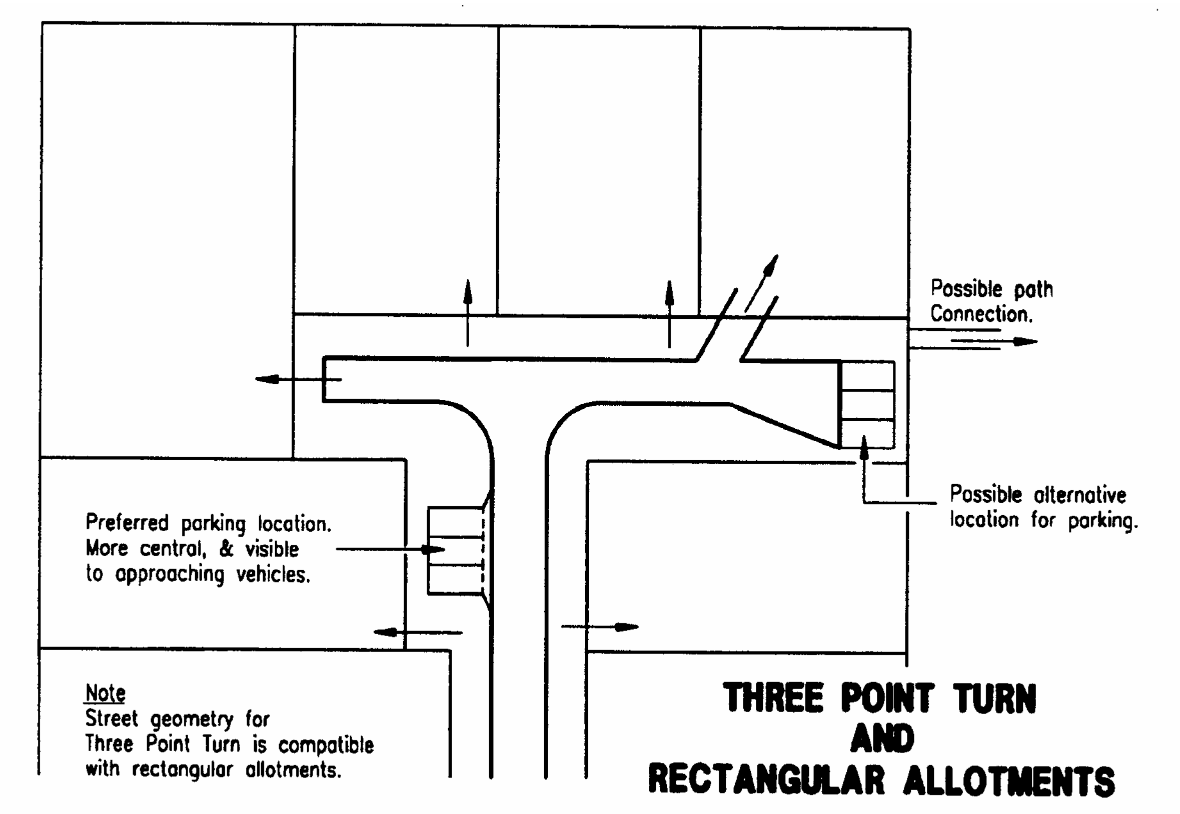


Figure 2.12.J

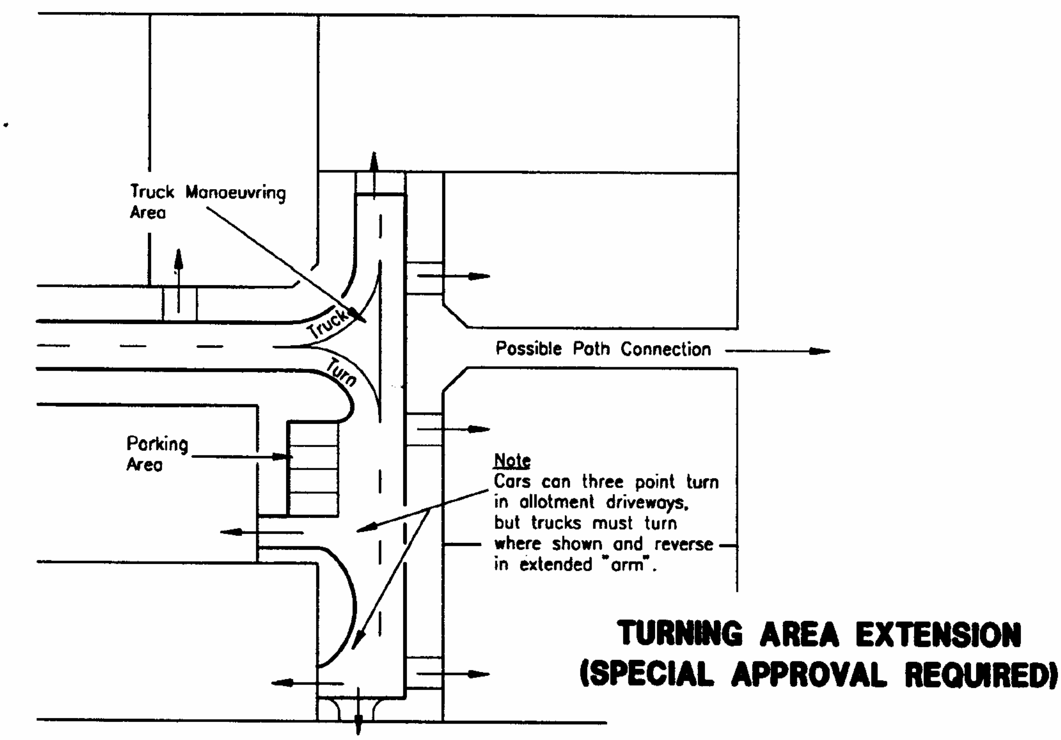
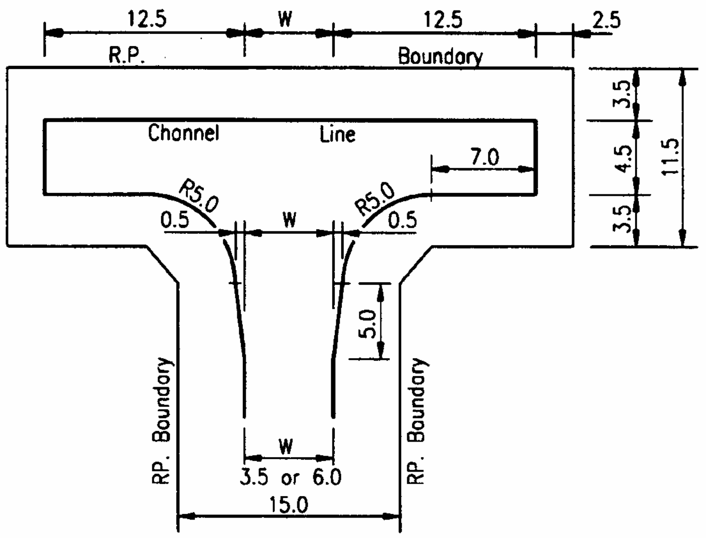
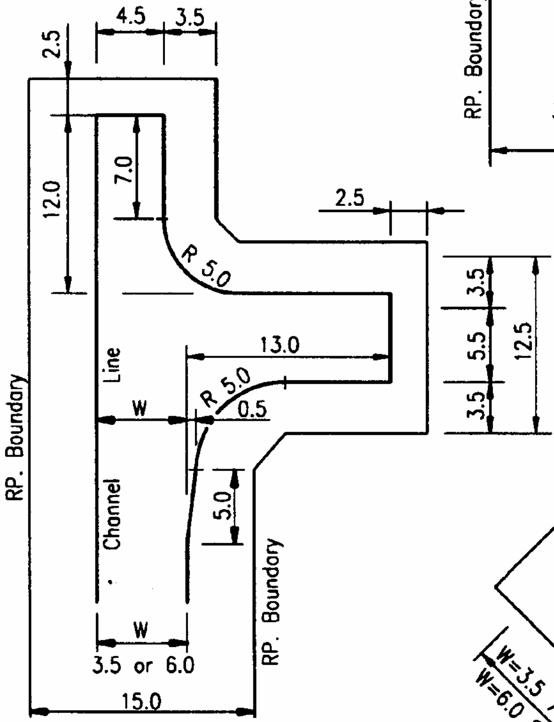


Figure 2.12.K

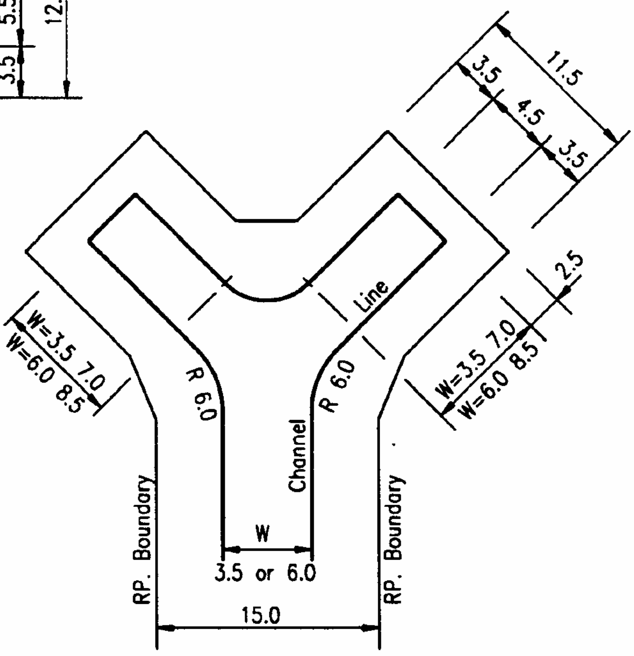




DESIGN CRITERIA

These turning areas are based on the following :-

1. Standard PRSC garbage truck able to turn within paved area (8.5m turn radius 4.85m wheelbase)
2. Truck able to turn any direction, to enable pick up either side, in each arm.
3. Standard HRV able to turn within street reserve by driving over kerbs where necessary.
4. Design may be modified by adding parking bays or extending arms as access driveways (maximum length 30m)
5. Maximum grade in manoeuvring areas
   5% – Desirable
   7% – Absolute



TYPICAL MANOEUVRING AREAS

Figure 2.12.L

2.12.7 MANOEUVRING AREAS

Design Criteria

Objectives

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

Specific Outcomes

- Area for either single movement turn (or three-point-turn when approved by the Pine Rivers Shire Council) to be provided at the end of every cul-de-sac.

- Turning area to accommodate design vehicles as specified in Section 2.12.2 of the Design Standards for Roadworks.

- Turning area to have minimum necessary area of carriageway and require minimum necessary area of land.

- Design to discourage parking within the area for turning movement.

- Design to limit potential for vehicles to overturn during turning movements.

Probable Solutions

- **Standard Single Movement turning areas** as illustrated in Section 2.12.0 of the Design Standards for Roadworks:-

  - 20.4m kerb diameter; or
  - 18m kerb diameter, with formal parking (special approval required); or
  - with central island, 20.4m kerb diameter, 6m carriageway width and formal parking.

- **Three-point turning areas**, as illustrated in Section 2.12.0 of the Design Standards for Roadworks, **where specifically approved by the Pine Rivers Shire Council**, in consideration of topography or allotment layout.

- **Other designs**, conforming to the criteria of Section 2.12.0 of the Design Standards for Roadworks, **where specifically approved by the Pine Rivers Shire Council**.

- **Parking provision** to be in accordance with the criteria of Section 2.12.0 of the Design Standards for Roadworks and to the Pine Rivers Shire Council approval.

- Maximum gradient manoeuvring area - 5% desirable
  - 7% absolute

2.13.0 SPEED CONTROL DEVICES

2.13.1 DEFINITION

Speed control devices are construction features within the street carriageway for the purpose of controlling the speed of traffic.

2.13.2 NEED FOR DEVICES

One of the basic principles of residential street design is the limitation of vehicle speed at every location to an acceptable **maximum design speed**.

The principal means of limited speed is by restricting the length of straight (or nearly straight) street to the length in which a vehicle can reach the selected design speed (see Section 2.3.7 of the Design Standards for Roadworks).

The standard method of street leg length limitation should be **subdivision layout**, by sharp bends or continuous curves in the horizontal alignment of the street. **Speed control devices should be regarded as a last resort rather than a routine measure**, due both to their capital and maintenance costs and potentially intrusive nature.

Note: -	**Speed control devices are therefore only to be used with the specific approval of the Pine Rivers Shire Council, in consideration of the special circumstances of each case.**

2.13.3 FACTORS IN SELECTION

There are a number of traffic control devices currently in use in local area traffic management schemes for the purpose of limiting traffic speed and/or volume in existing streets.

In some cases these devices are less than ideal, due to limitations resulting from existing street width or driveway locations, but in new developments, without such limitations, street designers can be more selective in their choice of control devices.

Devices can be categorised according to their geometry as:-

- **horizontal deflection** e.g. roundabouts, angled slow points, central medians
- **vertical deflection** e.g. road humps, raised thresholds

It is considered that **horizontal deflection** devices are more appropriate for new developments as they are:-

- highly visible and hence:-
  - more likely to mitigate speed at a distance
  - fewer warning signs are required, preserving visual amenity
- readily landscaped to:-
  - enhance effectiveness
  - enhance visual amenity

- less “aggressive” in their effect on traffic
- less noise generating

Note: - The design of traffic control devices shall comply with Part 13 of the Manual of Uniform Traffic Control Devices and the Pine Rivers Shire Council Design Guideline **DG 04 - “**Local Area Traffic Management “

The extent of signing necessary is to be assessed for each situation subject to the Pine Rivers Shire Council approval.

2.13.4 DESIGN REQUIREMENTS

From Section 2.3 of the Design Standards for Roadworks, the approximate maximum street leg length for an Access Place, Access Street Collector Street or Bus Collector Street is 120m, assuming an “end condition” speed of 20 km/h. An increase in end condition speed to 25 km/h reduces the allowable street leg length to approximately 80m.

To be effective, a speed control device must have a very low negotiation speed, preferably 20 km/h, requiring a geometric design which is quite restrictive.

It is rarely feasible to design a device which will accommodate larger vehicles within the carriageway and still effectively control the speed of cars. Hence the general design principle is to design the kerblines to restrict cars to the design speed, necessitating larger vehicles to mount a kerb and run on an appropriately paved area behind the kerb.

Kerbs which may be mounted by larger vehicles require to be of a height and profile which is a compromise between keeping cars to the carriageway while providing an acceptable ride for larger vehicles. The profile for mountable kerb sections is to be approved by the Pine Rivers Shire Council.

In general, such devices are **not** acceptable on bus routes, due to discomfort and possible injury to bus passengers. This highlights the desirability of locating bus routes only on Bus Collector streets designed specifically for these vehicles. (Refer Section 3.5 of the Design Standards for Roadworks).

2.13.5 APPROPRIATE DEVICES

The most appropriate devices for use in new development are considered to be:-

- roundabout
- central median
- driveway link
- intersection channelling

2.13.6 ROUNDABOUT

At an intersection between a through street and a minor street, a roundabout may be provided as a speed control device for the through street where otherwise a T-intersection would be acceptable.

When used as speed control devices, roundabouts will typically be similar to Figure 2.11.E.

2.13.7 CENTRAL MEDIAN

This device is appropriate to any residential street and to access places and access streets, it also provides a "designated passing place."

The design should provide for maximum deflection of entry vehicle paths, easier exit and maximum restriction of through visibility. Hence the centre island must be large enough for significant landscaping (3m minimum width is suggested). The use of this type of device is subject to special approval by the Pine Rivers Shire Council. Figure 2.13.A shows a typical example.

2.13.8 DRIVEWAY LINK

These are appropriate on access streets or access places only. A typical example is shown in Figure 2.13.B.

It should be noted that offsetting the carriageway using this device can block visibility, thereby ensuring slower speeds on approach which enhances its effectiveness. Detailed design and effective landscaping should result in a spot speed of approximately 20 km/h.

Paired driveways provide passing areas at each end of the device.

The designer should consider the position of drainage structures, driveway locations and general topography prior to positioning driveway links.

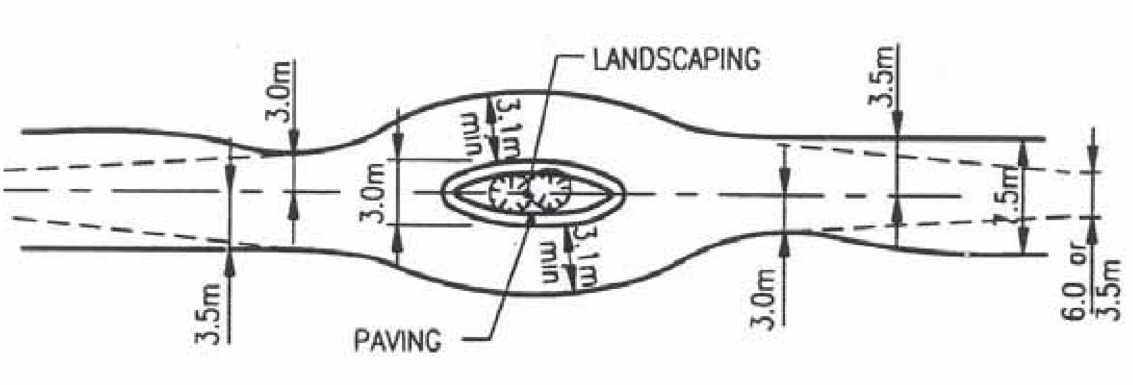
2.13.9 INTERSECTION CHANNELING

This device is appropriate on any residential street and provides a means of limiting speed on the through street at a T-intersection.

A typical example is shown in Figure 2.13.C. But, the detailed design must be site specific.

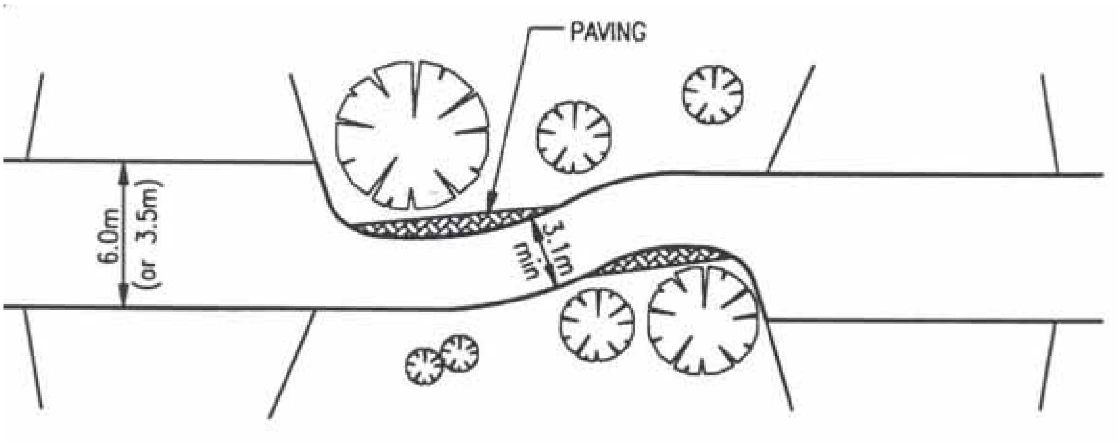
2.13.10 STREET LIGHTING

All speed control devices are required to be effectively lit, in accordance with the criteria of Australian Standard AS.1158 "Code of Practice for Public Lighting - Part 1" for channelised intersections.



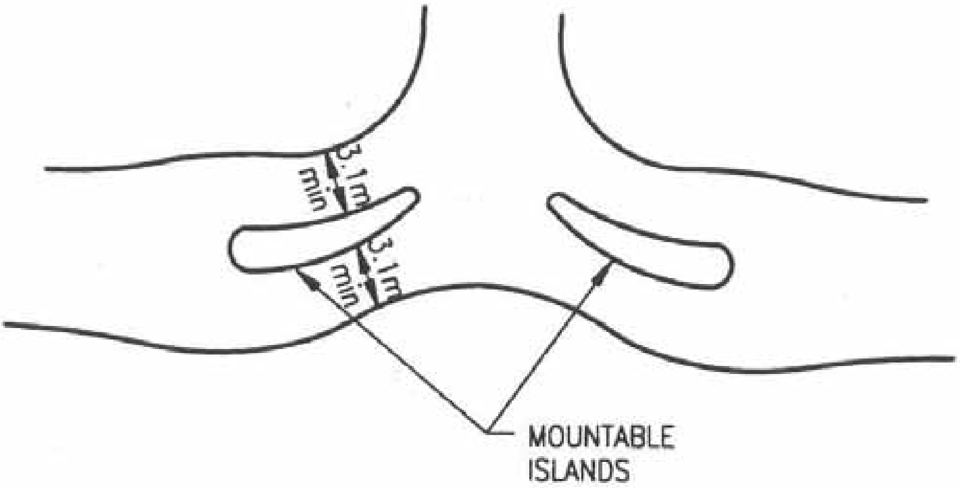
CENTRAL MEDIAN

Figure 2.13.A



DRIVEWAY LINK

Figure 2.13.B



INTERSECTION CHANNELLING

Figure 2.13.C

2.13.11 SPEED CONTROL DEVICES

Design Data

Objectives

- To safely restrict maximum traffic speed at any point in the street to an appropriate limit.

Specific Outcomes

- Restriction of vehicle speed at any point in the street to the maximum design speed appropriate to the street classification.

Probable Solutions

- Conformity with the principles of Section 2.13 of the Design Standards for Roadworks.
- Detailed design to reduce vehicle negotiation speed to 20 km/h.
- Compliance with relevant sections of the Manual of Uniform Traffic Control Devices.

2.14.0 RESIDENTIAL STREETS – Summary

	Access Place (1) and Access Street (1)	**Collector Street**	**Bus Collector Street**	**Trunk Collector Street**
Traffic Catchment (max.)	20 allotments Access Place 50 allotments Access Street	300 allotments (2) (3)	Not subject to minimum allotment catchment 300 allotments (2) (3)	900 allotments (2)
Design Speed (max)	40 km/h	40 km/h	40 km/h	60 km/h
Carriageway (i)				
No. of lanes	2 (4)	3	3	2
Width (m)	6.0	7.5	9.5	9.0
Verge Width (m) minimum	3.5	3.5	3.5	5.0
Reserve Width (m) minimum	15.0	18.0	20.0	24.0 (5)
Kerb Type	Layback	Layback	Layback	Layback
Pathways	Not required (6)	Pedestrian path one side (6)	Pedestrian path one side (6)	Pedestrian or Shared Use Path both sides (6)
Parking	Carriageway and/or indented bays	Carriageway and/or indented bays	Carriageway and/or indented bays	No provision (9)
Gradient - Max - Min	16% (8) 0.4%	12% (9) 0.4%	12% (9) 0.4%	12% (9) 0.4%
Sight Distance (general min.)	60m	60m	60m	110m
Carriageway - Type - Gradient	One or Two Way 1:40 min 1:33 max	Two Way 1:40 min 1:33 max	Two Way 1:40 min 1:33 max	Two Way 1:40

Notes:-

1. Difference is in subdivision layout only, not in street design.
2. Based on 10 v.p.d. per single dwelling residential allotment. Traffic generated for other uses **must** be assessed in accordance with Section 2.2.6 of the Design Standards for Roadworks.
3. Absolute maximum 350 allotments – see Sections 1.5.5 and 2.2.7 of the Design Standards for Roadworks.
4. Single lane with the Pine Rivers Shire Council approval, maximum 12 allotments.
5. Greater width required at intersections. See Section 3.7.6 of the Design Standards for Roadworks.
6. Pedestrian pathway (minimum) required where "catchment" exceeds 40 allotments. Other requirements may vary dependent on pedestrian/cyclist network design.
7. Since no direct frontage of residential allotments permitted.
8. 20% absolute maximum may be permitted in Access Place and Access Streets under special circumstances.
9. 16% general maximum may be permitted in Collector and Trunk Collector Streets under special circumstances.

TYPICAL STREET CROSS-SECTIONS

(REFER STANDARD DRAWINGS 8-10001 & 8-10002)