PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

PINE RIVERS

DESIGN STANDARDS

Part 1	**Design Standards for Roadworks**
Part 2	Design Standards for Stormwater Drainage Works
Part 3	Design Standards for Water Supply Works
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DESIGN STANDARDS

PART 1
DESIGN STANDARDS FOR ROADWORKS

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PART 1 - DESIGN STANDARDS FOR ROADWORKS

SECTION 6
NON URBAN ROADS

6.1.0 INTRODUCTION

6.1.1 APPLICATION

The provisions of this section of the manual may apply to roads and streets in the following town plan zones:-

- Park Residential
- Rural Residential
- Rural
- Future Urban
- Special Residential

For design purposes the category of non-urban roads is further subdivided into:-

- **Rural Residential streets**, and
- **Rural roads**

The applicable design category will be advised by the Pine Rivers Shire Council in each case, but in general the relationship between road design category and land use zone will be as follows:-

- **Rural Residential streets**
  - Park Residential zone
  - Rural Residential zone
  - Special Residential zone (or may be classed as Residential, dependent on allotment dimensions)

- **Rural Roads**
  - Rural zone
  - Future Urban zone

6.1.2 GOAL AND OBJECTIVES

The recommendations for **non-urban** street and road design are based on the same philosophy as set out in Section 1.4.1 of the Design Standards for Roadworks, i.e.:-

Goal - street and road design and construction practice which provides an **optimum combination** of:-

- **safety**
- **amenity**
- **convenience**
- **economy**
- **environment**

for subdivision residents, street users, and the community in general.

The optimum solution for each design and construction element is that which provides the most **appropriate balance** between the often conflicting ideals of these five **primary objectives**.

While the basic philosophy remains the same, the physical variations both between residential streets and non-urban streets and roads, and also between the sub-categories of non-urban roads (rural residential and rural) are such that the optimum solution will in most cases be different.

6.2.0 RURAL RESIDENTIAL STREETS

6.2.1 DEFINITION

"Rural Residential Streets" are streets in Rural Residential and Park Residential areas, which primarily serve to provide access to allotments of Rural Residential or Park Residential size.

6.2.2 SIGNIFICANT DIFFERENCES

The physical variations between residential and rural residential development which have most significance in the application of the primary objectives to rural residential street design are:-

- **Allotment frontage**
  The wider frontages (e.g. 50m compared to 18m) result in much greater travel distances for a given number of allotments, and hence the acceptable travel time in a speed-restrictive environment becomes a much more significant limitation.

  The greater distances also result in more reliance on motor vehicles, and less pedestrian and cycle traffic on the street.

- **Allotment area**
  The larger allotment areas (e.g. 6000m² compared to 600m²) generally result in greater set-back of dwellings from the street boundary.

  This reduces the impact of traffic noise on amenity, provides much greater capacity for on-site parking, and encourages parking within the site, rather than on the street. There is also less likelihood of children playing in the street.

- **Street reserve width**
  Street reserve widths tend to be greater (typically 20m or more compared to 15m) resulting in increased verge width. This again reduces traffic noise impact, provides increased safety visibility distance, and, where on-street parking does occur, tends to encourage parking on the verge rather than on the carriageway.

6.2.3 TRAFFIC SPEED

6.2.3.1 EFFECT OF TRAFFIC SPEED

As detailed in Section 2.3.1 of the Design Standards for Roadworks, high traffic speed in streets is detrimental most significantly to the **safety** of residents and street users, and also to the **amenity** of residents from increased noise.

Lower traffic speed results in a reduction both in the number of accidents and in the severity of injuries, particularly where pedestrians or cyclists are involved.

The most effective means of providing a **consistently** lower traffic speed is by restrictive geometric design based on a selected **"design maximum speed"**.

6.2.3.2 SPEED AND SAFETY

In R**ural Residential** streets, some increase in design speed, compared to residential standards, is acceptable without significantly compromising safety, as:-

- **pedestrians and cyclists are few** - due to the generally long travel distances to facilities, resulting in use of the car rather than foot or cycle travel

- **children playing** - on the street are rare, due to the larger allotment areas

- **safety visibility** - of a driver to a child running from a house on to the street, or a car exiting an allotment, is generally greater than in a residential street, due to (typically):-

    - greater setback of houses from the street
    - greater verge widths
    - fewer parked vehicles either on the carriageway or the verge
    - fewer high fences

While recognising that lower design speeds are preferable, in the circumstances, **60 km/h** is considered reasonable as the **highest "design maximum speed" for rural residential streets with allotment access.**

6.2.3.3 TRAVEL TIME

From considerations of **safety** and **amenity** "slowest is best". This ideal, however, must be tempered by the practical limitation of the resulting increased travel times within the speed-restrictive environment - the objective of **convenience**.

For residential streets this manual recommends a maximum low-speed travel time of **60 to 90 seconds**, but for rural residential development the travel distance per allotment is much greater in proportion to the allotment frontages (e.g. 50m compared to 16m - 18m, or about 3:1). Hence, except in a very small development, the travel times in the speed-restrictive environment would become unreasonably long at a design speed of 40 km/h, with the resulting **average** travel speed of about 30 km/h (assuming 20 km/h "slow points").

It is, however, reasonable to assume that the higher the average speed, the longer the travel time is acceptable at that speed, without driver frustration, up to about **60 km/h**, which should be an acceptable speed for a reasonably extended time, being the statutory speed limit usually expected within a frontage access environment.

The relationship between travel distance and approximate number of allotments in the street length, for various average speeds and travel times is shown in **Table 6.2.3.A**.

SPEED/TIME/DISTANCE RELATIONSHIP

AVERAGE TRAVEL SPEED km/h	TRAVEL TIME					
	60 Seconds		120 Seconds		180 Seconds	
	Distance m	Lots No.	Distance m	Lots No.	Distance m	Lots No.
30	500	24	1000	44	1500	64
40	667	30	1333	57	2000	84
50	833	37	1667	70	2500	104
60	1000	44	2000	84	3000	124

Note: · "Number of allotments" assumes average frontage of 50m and 4 allotments at head of cul-de-sac.

Table 6.2.3.A

From this table it is apparent that some increase in design speeds and/or travel time is necessary for practical design of most rural residential development.

The following maximum travel times may be considered reasonable:-

Average Travel Speed(km/h)	Total Travel Time
30 or less	60 seconds
30 to 40	90 seconds
40 to 50	180 seconds
60 or more	No limit

Table 6.2.3.B

6.2.4 TRAFFIC VOLUME

6.2.4.1 AMENITY

The most significant effect of **traffic volume** in both residential and rural residential streets is **loss of amenity due to noise**, as the acceptable limit for noise amenity is well below the capacity from traffic engineering considerations.

For residential streets the recommendations of this manual are 3000 v.p.d. maximum, 2000 v.p.d. desirable, as the **"environmental capacity"** traffic volume criteria.

While traffic **volume** is the major factor in the severity of the noise problem, traffic speed, proportion of heavy vehicles, and the street gradient are other factors affecting noise generation.

The severity of the noise impact on residents is a function of the **distance** from the carriageway to the house, as well as the design of the house, type of fencing, and intervening landscaping.

Figure 6.2.4.A shows the required distance from the kerb to the front of house, for various design speeds and traffic volume, for an acceptable noise level at the house.

DISTANCE - KERB TO HOUSE
FOR ACCEPTABLE NOISE LEVEL

Design Speed (km/h)	Traffic Volume (pd)		
	3000	4000	5000
30	7	9	11
40	9	11	13
50	11	13	15
60	13	16	19

Assumes:-
- noise level at house 58dB(A)
- street gradient 5%
- heavy vehicles 5%

Based on Pak Poy-Kneebone background data for AMCORD

Table 6.2.4.A

In rural residential development the typical carriageway to house distances are greater than in conventional residential development, as:-

- verge widths are generally greater
- set-backs of houses from the road boundary are generally greater

Verge widths in rural residential development will typically be **7m to 9m**, assuming a reserve width of 20-25m, and a carriageway width of 6m to 8m.

House set-backs vary greatly, from a minimum of 6m where topographic constraints apply (e.g. a street along a ridge top), to 100m or more in open country. A setback of less than **10m**, however, is unusual except where there is a severe topographic constraint.

A combination of **increased design speed and/or traffic volume**, compared to residential recommendations, hence, is acceptable from amenity considerations.

6.2.4.2 TRAFFIC GENERATION

As noted in Section 2.2.6 of the Design Standards for Roadworks, traffic generation rates from residential development can vary widely, dependent on a number of factors as detailed therein.

Compared to conventional residential development, a higher generation rate could be expected from rural residential development as:-

- schools, shops and services are generally at a considerable distance, requiring the use of a car

- public transport is generally non-existent or at a considerable distance

- two-car households would usually be the norm, due both to necessity and the generally higher economic bracket of residents

In contrast, because of the longer distances involved, trips are more likely to be planned to minimise their number - e.g. combining school pick-up and shopping, sharing school drop-off and pick-up between families.

In fact, these factors apparently average out, as recorded traffic counts, from a number of existing rural residential developments, indicate generation rates closely approximating those commonly used for conventional residential. Recommended design criteria are therefore the same:-

- **daily** **10 trips/allotment/day**
- **peak hour** **1 trip/allotment/hour**

6.2.4.3 ASSESSMENT OF TRAFFIC VOLUME

Assessment of the traffic volume at any point in the street system may be readily made using the method set out in Section 2.2.8 of the Design Standards for Roadworks. In general rural residential street layouts are simple branching layouts with few loop streets, and all traffic generators are usually in the same direction, thus making the assessment process even simpler.

Some planning issues, however, which can affect future traffic volume must be emphasised:-

- **Future resubdivision**

  Rural residential development will not normally be considered as subject to future resubdivision to higher density (e.g. urban residential), because rural residential will **not** be permitted on land identified as being suitable for future urban development.

- **Future extension of traffic catchments**

  Consideration **must** be given to likely future extension of streets which may result from subdivision of adjacent land, and include the estimated future traffic from such development in the design traffic volume.

- **Future traffic generators**

  The probable location and nature of future traffic attractions, such as schools, shopping centres, and community facilities, must be considered in traffic assessment, as well as any existing such generators.

6.2.5 PARKING

6.2.5.1 PARKING DEMAND

One of the major difference in the characteristics of rural residential streets compared to conventional residential streets is the on-street parking demand - in rural residential streets, the **demand is virtually nil**.

6.2.5.2 PARKING SURVEY RESULTS

A recent survey of the occurrence of on-street parking in rural residential developments provided the following results:-

- on-carriageway parking - 1 vehicle per 113 allotments
- on-verge parking - 1 vehicle per 24 allotments

Approximately 50% of on-carriageway parking was within cul-de-sac turning areas, where narrow frontages or access strips to rear allotments limited the availability of on-allotment parking.

When such cul-de-sac parking is discounted, the incidence of on-carriageway parking equates to about **one vehicle per 5km** of street length.

The very low incidence of total street parking can be attributed to the combination of high on-site parking capacity provided by larger allotment areas, and the generally greater walking distance from street to house due to greater verge widths and greater set-back of dwellings.

The high ratio of verge parking to carriageway parking probably results from the combination of perceived narrow carriageway width, and the parking opportunity offered by relatively wide verge widths, with little formal landscaping to inhibit parking.

6.2.5.3 DESIGN CONCLUSIONS

- The very low incidence of **on-carriageway** parking which might occur is quite insignificant from traffic considerations, and hence carriageways may be designed on the basis of the **total width being available for moving traffic**.

- The low incidence of **verge parking** is considered to be **quite acceptable**, in principle, in this type of development, as there tends to be little formal landscaping on the verges, and with the large frontages any parking is unlikely to occur on neighbours' verges.

- The provision of occasional **indented parking bays** as an alternative to verge parking is likely to be impractical due to the large allotment frontages and consequent walking distances.

- Parking bays, however, may be warranted at **cul-de-sac heads**, if narrow allotment frontages and steep topography inhibit on-allotment parking.

6.2.6 CARRIAGEWAY

6.2.6.1 DRAINAGE METHOD

Standard concrete kerb and channel is required on both sides of all rural residential streets in order to minimise future pavement edge and shoulder maintenance, except in the following circumstances:-

- **high side of one-way crossfall streets** - where a standard concrete kerb only, or a concrete flush edge strip, may be used

- **no upstream catchment** - in some situations, where there is no flow from upstream on to the street (e.g. along a ridgeline) the use of a concrete edge strip rather than kerb and channel will avoid the collection and concentration of the stormwater runoff from the carriageway itself, which may be otherwise difficult to convey to an acceptable point of discharge

- **special circumstances** - where, in the opinion of the Pine Rivers Shire Council, there are environmental benefits in providing a swale drain system, rather than kerb and channel

6.2.6.2 CARRIAGEWAY WIDTH

Carriageway width as specified is measured between the bases of the sloping kerb faces – i.e. to the invert of the channel for integral kerb and channel, or to the inner edge of kerb only. In the case of flush concrete edge strips, measurement is also to the inner edge.

6.2.6.3 NUMBER OF LANES

From Section 6.2.5.3 of the Design Standards for Roadworks, no provision need be made for on-carriageway parking, and hence the carriageway width need **only** be sufficient **for moving traffic**.

The options are therefore:-

- **one lane** (plus occasional passing bays)
- **two lanes**

6.2.6.4 TWO LANE CARRIAGEWAY

The practical traffic capacity of a two-lane carriageway, without parking, is well in excess of the traffic volume acceptable from noise amenity considerations (see Section 6.2.4.1 of the Design Standards for Roadworks).

Indicative traffic capacities could be:-

- level terrain - 7900 v.p.d. (Level of Service C)
- rolling terrain - 5200 v.p.d. (Level of Service C)
- mountainous terrain - 3700 v.p.d. (Level of Service D)

Ref: - AUSTROADS - "Roadway Capacity" - 1988

A two-lane carriageway, hence, may be used for **any** rural residential street.

In the case of **residential** streets (with on-carriageway parking) the traffic capacity limits of the "two-lane" and "three-lane" streets provide finite boundaries for **"street hierarchy"** classifications. In the rural residential streets, however, the appropriate carriageway width will vary with the **design speed** (see Table 2.6.D of the Design Standards for Roadworks), and less definitely with **traffic volume** (see Austroads "Rural Road Design" - 2003, Section 11). Hence the division into hierarchical categories must be on the basis of a fairly arbitrary trade-off between **design speed, maximum travel time**, and, to a lesser extent, **traffic volume**.

The appropriate design criteria for two-lane carriageways will vary with the street hierarchy classification (see Section 6.2.9 of the Design Standards for Roadworks).

6.2.6.5 ONE-LANE CARRIAGEWAY

The single-lane carriageway has been identified in Section 2.6.2 of the Design Standards for Roadworks as a possible option for low volume residential streets, **in special circumstances only**. It has not proved popular in practice, however, due to:-

- perceived market resistance
- the need to provide additional parking bays complicates design and construction, and negates any real cost saving from reduction in total paved area

The single-lane configuration may, however, warrant consideration for rural residential streets, as:-

- the much lower traffic volume per length of street means that the occasions of meeting opposing vehicles, and hence potential delay, is much less than for residential streets
- narrower formation width can reduce tree-clearing requirements, and earthworks on steep side slopes, potentially with environmental benefits

While the single-lane carriageway is **not** a "deemed-to-comply" standard, the Pine Rivers Shire Council may consider approving its use in appropriate circumstances.

6.2.7 VERGE

6.2.7.1 FUNCTIONS OF THE VERGE

The verge on rural residential streets fulfils the same functions as detailed for residential streets in Section 2.8.2 of the Design Standards for Roadworks, although the significance and requirements of these functions may differ.

- **Safety visibility**
  Slightly higher design speed warrants increased verge width for safety visibility, although the rarity of parked vehicles and high fences also helps visibility.

- **Parking**
  Informal provision for verge parking is necessary (see Section 6.2.5) in the form of a 2.0m wide strip behind the kerb, at maximum crossfall 1 in 6. This strip need not necessarily be continuous full length, if removal of significant vegetation is involved, as the incidence of parking is intermittent.

- **Landscaping**
  Space for landscaping, and retention of existing vegetation is very important for visual amenity, and to preserve the atmosphere of a "rural" environment.

- **Utility services**
  Major service installations will rarely be required in rural residential streets and normal reticulation services can usually be located within standard reserve widths. The major impact may be the necessary removal of vegetation although every effort should be made to limit such removal.

- **Changes in level**
  While vehicular access to allotment is still essential, at a desirable maximum gradient of 1:6, absolute maximum 1:4, the greater allotment frontages, verge widths and house site setbacks makes this requirement easier to satisfy. On steep side-slopes, additional verge width may be required to accommodate necessary earthworks batters.

- **Pathways**
  The much greater travel distances reduce the incidence of pedestrians and cyclists. Provision of pony trails, however, may be appropriate in rural residential areas. Where specifically nominated by the Pine Rivers Shire Council, pedestrian/cycle pathways or pony trails will be required, and in such cases additional verge width may be necessary.

- **Buffer area**
  While standard verge widths and minimum building setbacks normally provide adequate noise buffering, in some cases the combination of higher traffic speed and volume may require additional verge width (see Section 6.2.4.1 of the Design Standards for Roadworks).

6.2.7.2 MINIMUM VERGE WIDTH

The minimum verge width (i.e. channel invert to reserve boundary) should be **5.0m** at any point. Additional verge width, however, may be required in specific cases, to satisfy the verge functions discussed above.

Verge width may not be constant throughout the street length, as the carriageway alignment may "meander" within the reserve, for improved appearance and/or to minimise earthworks or clearing of vegetation.

6.2.8 RESERVE WIDTHS

6.2.8.1 GENERAL

Since land value is not as significant in rural residential areas, and a spacious "rural" environment is an essential component of the development philosophy, street reserve widths can reasonably be greater than for residential streets.

6.2.8.2 MINIMUM RESERVE WIDTHS

The minimum reserve widths adopted as being reasonable to fulfil the foregoing criteria are:-

- **Access Place and Access Street - 20m**
- **Collector Street - 25m**

Additional reserve width may be required in specific cases, as discussed in Section 6.2.7 of the Design Standards for Roadworks.

For **Collector Streets** a lesser reserve width may be considered by the Pine Rivers Shire Council, if it is shown that a lesser width can satisfy all required criteria.

6.2.9 STREET HIERARCHY

6.2.9.1 GENERAL

As discussed for residential streets (see Section 2.7.1 of the Design Standards for Roadworks), while the ideal is for all streets with frontage access to have low design traffic speed and low design traffic volume, subdivision layout necessitates that this ideal may be compromised to some extent, in some streets.

In the case of **rural residential** development, the principal constraint is the limitation of travel time in a speed restrictive environment, which necessitates accepting a higher design speed in the "trunk" streets to keep total travel times within reasonable limits. Hence a "hierarchy" of streets is inevitable.

6.2.9.2 CLASSIFICATION

For rural residential streets a nomenclature system similar to that for residential streets is adopted, i.e.:-

- **Rural Residential Access Place** - a single cul-de-sac
- **Rural Residential Access Street** - a "loop" street or a "stem" from which two or more cul-de-sac streets branch
- **Rural Residential Collector Street** - a "branch" which connects to a major street or road

6.2.9.3 ACCESS PLACE

The standard cross-section is a **two-lane** carriageway with design criteria as follows:-

- **Design maximum speed - 45 km/h**
  Speed-restrictive design should be in accordance with Section 2.3.14 of the Design Standards for Roadworks, using any of the methods detailed therein, i.e. alignment, slow points, or combinations thereof.

❖	**Maximum traffic catchment** Based on traffic volume of 500 v.p.d. maximum	**- 50 allotments**
❖	**Maximum length** Based on **average** travel speed of 35 km/h, and maximum travel time of 90 seconds.	**- 900 m**
❖	**Carriageway width** From Table 2.6.F of the Design Standards for Roadworks	**- 6.0 m**
❖	**Crossfall**	**- one-way or centre crown**
❖	**Reserve width**	**- 20 m**

Where, with the consent of the Pine Rivers Shire Council, the **single-lane** carriageway is used, the following design criteria will apply.

❖	**Design maximum speed**	**- 40 km/h**
❖	**Maximum traffic catchment**	**- 6 allotments max.** **- 8 lots absolute max.**
❖	**Maximum length**	**- 150 m** **- 200 m absolute max.**
❖	**Carriageway width** (see Note 1)	**- 3.5 m**
❖	**Crossfall**	**- one way**
❖	**Passing bay spacing**	**- 100m** max and intervisible
❖	**Passing bay type** (see Note 2)	**- central median** (or other approved type)

Notes on Single-Lane Carriageways

- **Carriageway widening**
  On sharp curves, carriageway widening should be provided, such that a standard HRV may track on the surfaced pavement. The required widening will be a function of both the curve radius and the deflection angle.

- **Passing bay design**
  Passing bays should be designed to also act as "slow points", to ensure that a driver slows sufficiently to assess that the street section to the next passing bay is clear of traffic, before entering that section.

  This requirement is less important in open country, where there may be ample visibility for two or more "sections" ahead.

The **"central median"** type device (Figure 2.13.A of the Design Standards for Roadworks is particularly appropriate for this situation, as:-

- traffic speed is controlled
- a passing facility is provided without encouraging parking (as a simple widening might)
- lateral deflection of a vehicle is visible at a distance (indicating, from the other end of a section, that a vehicle is waiting)
- with substantial landscaping, it is readily visible at a distance (both as a speed control, and as a passing location). The "island" may be quite large, to incorporate existing trees.

6.2.9.4 ACCESS STREET

The **Access Street** will generally have a number of access places branching from it, and will connect at its "downstream" end with a Collector Street.

Appropriate design criteria are:-

- **Design maximum speed - 60 km/h**
  Both the Access Street and the Collector Street are necessarily designed to this highest speed recommended on safety grounds, to keep travel time to an acceptable limit.

  Speed restriction should be imposed as much as possible by **curvilinear alignment**, or slightly less restrictive slow-points, thereby increasing the minimum speed and hence the average speed, while maintaining the same **maximum** speed. This will improve safety and assist in preventing driver frustration in the speed-restrictive environment.

- **Maximum total travel time - 180 seconds**
  Since both the Access Street and the Collector Street are designed for 60 km/h maximum speed, this is the **maximum total** travel time from the furthest point in the street system to the "downstream" end of **either the Access Street or the Collector Street**.

  If the Access Place length is the allowable maximum of 900m (90 seconds), the maximum length of the combined Access Street/Collector Street system is about **1200m** (90 seconds at 45/50 km/h average speed).

  If the Access Place length is less than 900m, the Access Street/Collector Street system may be correspondingly longer.

- **Carriageway width - 7.0 m**
  Effectively 2 x 3.0m lanes clear of kerb and channel.

- **Crossfall - two-way, centre crown**

- **Maximum traffic catchment - 100 allotments**
  Based on traffic volume of 1000 v.p.d. maximum for 3.0m lanes (Austroads "Rural Roads Design", Section 11).

- **Reserve width** (minimum) **- 20 m**

6.2.9.5 COLLECTOR STREET

The **Collector** S**treet** will generally have a number of access streets branching from it, possibly access places, or may occasionally be the "downstream" end of a very long single cul-de-sac.

The Collector Street is the highest category of rural residential street providing direct access to allotments. It will connect to a **connecting road** (**"road"** as distinct from **"street"**) at its "downstream" end, which will provide the connection to the external road system.

Design criteria for the Collector Street are:-

- **Design maximum speed - 60 km/h**
  Application of speed-restrictive design as for the Access Street (see Section 6.2.9.4 of the Design Standards for Roadworks)

- **Maximum total travel time - 180 seconds**
  Total time for the whole street system, as detailed under Access Street (see Section 6.2.9.4 of the Design Standards for Roadworks)

- **Carriageway Width - 8.0 m**
  Effectively 2 x 3.5m lanes, clear of kerb and channel, based on traffic volume over 1000 v.p.d. and the likelihood of a collector street being a bus route

- **Crossfall - two-way, centre crown**

- **Maximum allotments in catchment - 350 allotments**
  Based on noise amenity criteria (Table 6.2.4.A of the Design Standards for Roadworks)

  If necessary, capacity can be increased by special measures (see Section 6.2.4.1 of the Design Standards for Roadworks).

- **Reserve width - 25 m**
  If allotment catchment exceeds 350 allotments, additional reserve width may be required for noise buffering (see Section 6.2.4.1), or a lesser width may be considered in special circumstances (see Section 6.2.8.2).

6.2.9.6 BUS COLLECTOR STREET

The Bus Collector classification is not considered necessary in the Rural Residential environment as the size of allotments makes the demand for on street parking low. Thus, the 8.0 m carriageway for the rural residential collector street will adequately provide for the resident traffic and a bus route for the area.

It is the demand for on street parking on the urban streets, and the conflicting demand between parked vehicles, residential traffic and bus operation that requires additional carriageway in the urban environment.

6.2.9.7 CONNECTING ROADS

Connecting "roads", as distinct from the "streets" having direct access to rural residential allotments, link the rural residential development to the external road system. Two general types of connecting road may be identified:-

- **internal** - within the rural residential area, but having no frontage access due to design requirements (generally travel time limitations)

- **external** - generally an existing road forming a boundary of the rural residential development

The "**internal road**" is analogous to the residential "trunk collector" as described in Section 3.7.0 of the Design Standards for Roadworks, while the **"external road"** is comparable to the "Sub-Arterial or Arterial road".

While the connecting roads cannot have rural residential allotments directly fronting them, larger allotments of "rural" size, may generally be allowed to have direct frontage, provided that the traffic volume is not unduly high, and allotment accesses are appropriately located. Hence Connecting roads will generally be **rural roads** in character, and appropriately designed in accordance with the provisions of **Section 6.3.0** of the Design Standards for Roadworks, the road classification being dependent on the total traffic volume.

In some cases, where the rural residential development abuts urban development, the "external road" could be a **major urban road** (e.g. Sub-Arterial or Arterial, with no frontage allotments), in which case the road would be classified and designed in accordance with **Section 3.0** of the Design Standards for Roadworks

6.2.10 OTHER DESIGN ASPECTS

6.2.10.1 GENERAL

Design requirements for other aspects of rural residential streets are generally in accordance with the relevant provisions for residential streets, unless otherwise noted.

6.2.10.2 GEOMETRIC DESIGN

The following design elements are to be in accordance with the referenced **residential** street provisions, using the relevant **design maximum speed** (see Section 6.2.9 of the Design Standards for Roadworks.

- **Sight distance - Section 2.10.2**
- **Horizontal alignment - Section 2.10.3 and 2.3.14**
- **Gradients - Section 2.10.4**
- **Vertical alignment - Section 2.10.5**
- **Crossfall - Section 2.10.6**

6.2.10.3 INTERSECTIONS

Location, type, and detailed design are to be generally in accordance with **Section 2.11.0**.

Where **roundabouts** are not required to have a speed-limiting function, design will appropriately be to normal AUSTROADS standard.

6.2.10.4 TURNING AREAS

Since land area will not usually be a significant constraint, and as cul-de-sacs may be of considerable length, the appropriate turning area will generally be the **"circular head"** type. Detailed design of turning areas is to conform to **Section 2.12.0** of the Design Standards for Roadworks.

6.2.10.5 SPEED CONTROL DEVICES

Design of speed control devices is to conform generally to Section 2.13.0 of the Design Standards for Roadworks.

A slight variation of the geometry may be appropriate in some cases, increasing the transit speed from the normal 20 km/h to (say) 25 or 30 km/h. The "street length" must then be adjusted appropriately in accordance with Table 2.3.D of the Design Standards for Roadworks.

6.2.11 SUMMARY OF RURAL RESIDENTIAL DESIGN CRITERIA

A summary of the **criteria** for design of rural residential streets is provided in **Table 6.2.11.A**, and the **standard Rural Residential cross-sections**.

RURAL RESIDENTIAL STREETS
SUMMARY OF PROBABLE SOLUTIONS

		Access Place	Access Street	Collector Street
Traffic Catchment	- max	50 (i)	100	350 (ii)
Street Length	- max	900	1200m (iii)	1200m (iii)
Design Speed	- max	45 km/h	60 km/h	60 km/h
Carriageway	- Lanes - Width	2 (iv) 6.0m (iv)	2 7.0m	2 8.0 m
Verge Width	- min	5m	5m	5m
Reserve Width	- min	20m	20m	25m
Kerbing		Layback Type (v)	Layback Type (v)	Layback Type (v)
Parking		No provision (vi)	No provision	No provision
Foot / Cycle Paths / Pony Trails		As required (vii)	As required (vii)	As required (vii)
Gradient (General)	- max - min	16% (viii) 0.4%	16% 0.4%	12% (ix) 0.4%
Sight Distance	- min	70m	110m	110m
Crossfall	- Type - max - min	One-way/C.crown 1:33 1:40	Centre crown 1:33 1:40	Centre crown 1:33 1:40

Notes:-

(i) Theoretical limit only. Maximum length controls in most cases.
(ii) May be increased by widening reserve.
(iii) Maximum street lengths are inter-dependent. Essential criterion is a maximum total travel time of 180 seconds.
(iv) Single lane, 3.5m width, with the Pine Rivers Shire Council approval only. Maximum 6 allotments / 150m long. Absolute maximum 8 allotments / 200m long.
(v) Unless otherwise approved.
(vi) Parking bays may be required at cul-de-sac heads.
(vii) As required by the Pine Rivers Shire Council network planning.
(viii) Maximum 20% under special circumstances.
(ix) Maximum 16% under special circumstances.

Table 6.2.11.A

RURAL RESIDENTIAL STREETS
TYPICAL CROSS-SECTIONS

(REFER STANDARD DRAWINGS 8-10017 TO 8-10020)

6.3.0 RURAL ROADS

6.3.1 DEFINITION

"Rural Roads" are roads in rural areas which may serve both a traffic route function, and also provide access to allotments of rural size.

6.3.2 DESIGN PHILOSOPHY

6.3.2.1 SIGNIFICANT CHARACTERISTICS

The characteristics of the rural road environment which are significant in determining design criteria are:-

- **large allotment frontages** - relatively infrequent vehicular accesses and low generation volume, minimising "friction" on through traffic from vehicles entering or leaving allotments

- **large allotment areas** - generally considerable set-back of dwellings from the road, minimises the safety and noise amenity effects of traffic volume and speed, and negates the requirement for parking provision on the road

6.3.2.2 DESIGN PRINCIPLES

The design principles resulting from these characteristics are:-

- **"mixed function" design**, providing for both traffic route and allotment access is acceptable, (except perhaps for very high traffic volume roads)

- **moving traffic** requirements only need be considered, as the parking requirement is negligible

- **minimum design speed** is the appropriate basis of design, as speed restriction from consideration of frontage allotment safety and amenity is not a significant factor

6.3.3 ROAD CLASSIFICATION

This manual recognises the following classifications of rural roads:-

- **Rural Access road**
- **Rural Collector road**
- **Rural Sub-Arterial road**
- **Rural Arterial road**

The principal distinguishing characteristic is a gradual increase in traffic volume, and hence an increasing significance of the **traffic function**, from the access road to the arterial road.

Since the increase in traffic volume is gradual, the division points between the various classifications are to some extent arbitrary. The "steps", however, in carriageway width appropriate for the traffic volume to be carried, provide a reasonable basis for classification limits.

In general, the design speed and other design criteria are a function of the traffic volume carried by the road, modified if necessary by topography and other location-specific factors.

6.3.4 DESIGN SPEED

6.3.4.1 DEFINITION

A selected **design speed** provides the basis for consistent design of all the geometric elements which comprise the road geometry, e.g. horizontal alignment, vertical alignment, sight distance, superelevation, etc.

In the case of **rural roads** the design speed is a design **minimum** speed, as conventionally used in road design, **not** a design **maximum** speed as used for speed-restrictive residential and rural residential street design.

6.3.4.2 APPROPRIATE DESIGN SPEED

An appropriate design speed is dependent on a number of factors, including:-

- **Traffic importance of the road**
  A road of greater importance should have a higher design speed.

- **Topography**
  More rugged topography greatly increases the cost of achieving higher speed design.

- **Intersection type and spacing**
  Reduced traffic conflict (e.g. gradient separations at infrequent intervals) enables higher speed to be safely provided.

- **Driver expectation**
  Design speed should reflect reasonable driver expectation, based on the above factors.

6.3.4.3 MINIMUM DESIGN SPEEDS

For rural roads, the minimum design speed, which should generally be provided at any location along the road, is:-

- **Access road - 60 km/h**
- **Collector road - 60 km/h**
- **Sub-Arterial road - 80 km/h**
- **Arterial road - 100 km/h**

In rugged topography, or constrained situations, a lower design speed may be adopted, subject to the Pine Rivers Shire Council approval, the **minimum** design speed being **20 km/h** less than the above speeds.

6.3.4.4 VARIATION IN DESIGN SPEED

Uniformity of vehicle operating speed over long lengths enhances both safety of operation and roadway capacity. Variations, however, in the **"speed environment"** may occur due to varying topography or intersection conditions.

In such cases the design speed may need to be varied throughout the road length. For example, while an arterial road may have a general design speed of 100 km/h, the design speed may be varied between 80 km/h and 120 km/h in some sections, to reflect variations in terrain or other conditions.

Reductions in design speed should be gradual, e.g. horizontal alignment reduced from 100 km/h to 90 km/h to 80 km/h, rather than a sudden reduction from 100 to 80 km/h.

Increases in design speed should be provided where the alignment and grading are such that speeds well in excess of the general design speed will be attained, e.g. a long level straight on a generally 80 km/h road may result in operating speeds of 100 to 120 km/h. The potential higher operational speed of this section should be assessed and a gradual reduction in design speed employed at the end of the section, such that the operational speed is gradually reduced to the general design speed.

6.3.5 TRAFFIC VOLUME AND CAPACITY

6.3.5.1 TRAFFIC VOLUME

The traffic volume on an **access road** or **collector road** may be readily calculated using the method given in Section 2.2.0 of the Design Standards for Roadworks.

Traffic catchment assessment must include not only the number of allotments in the subject development, but any likely future extensions or connecting roads to serve possible development of adjoining lands in accordance with the Pine Rivers Shire Council Planning Scheme. Allowance should also be made for possible future excision of smaller allotments in accordance with the subdivision provisions.

Traffic generation from rural allotments is the subject of further investigation, but in default of specific traffic count information, the same generation rate as for residential and rural residential development is considered reasonable, i.e. **10 vehicle trips/allotment/day**.

In the case of S**ub-Arterial and Arterial roads** traffic is likely to include a **"through traffic"** component, as well as local traffic from the subject development, assessed as above.

Assessment of the resultant traffic volume and composition on the various sections of road will generally require the services of a specialist **traffic engineer**. Assessment of the through traffic component should generally be based on **ultimate development** of land uses and the road network, in accordance with the Pine Rivers Shire Council Planning Scheme. Where no better information is available, however, an assessment based on existing recorded traffic volume, extrapolated to a 15 year design horizon, at an annual increase of 5% compounding, may be accepted by the Pine Rivers Shire Council.

6.3.5.2 ROAD CAPACITY

For **Access roads and Collector roads** the upper limits of road capacity are based on the factors of driver convenience and pavement edge maintenance requirements, and hence are somewhat arbitrary. Recommended limits are:-

- **Access road** (3.5m carriageway) - **150 v.p.d.** (15 allotments)
- **Collector road** (6.0m carriageway) - **1000 v.p.d.** (100 allotments)

For **Sub-Arterial and Arterial roads** the capacity limits are dependent on a number of traffic and site characteristics, and require assessment by a traffic engineer (see Sections 3.8.2 and 3.8.3 of this Design Standards for Roadworks). Final traffic analysis is subject to approval of a Pine Rivers Shire Council engineer, including appropriate level of service.

As a general guide for preliminary planning purposes only, however, standard road cross-sections may be assumed to have the following capacities:-

- **Sub-Arterial (two-lane) - 12,000 v.p.d.**
- **Arterial (four-lane) - 30,000 v.p.d.**

6.3.6 CROSS-SECTION ELEMENTS

6.3.6.1 DEFINITION

Cross-section elements are the individual components which together make up the complete road cross-section.

Recommended dimensions and other criteria in respect of each of these elements follow.

6.3.6.2 DRAINAGE METHOD

In general the **swale drain system** is preferred for rural roads, rather than concrete kerb and channel, as:-

- **removal of water is quicker and more positive** - with kerb and channel, pondage may occur in the moving traffic lanes, creating a hazard for traffic at higher design speeds
- **pavement protection is less significant** - due to infrequent property accesses and virtually no roadside parking demand
- **disabled vehicles can readily clear the traffic lanes** - in the absence of a kerb

Concrete kerb and channel may possibly be required, or be a valid option, at some locations, e.g.:-

- **in cuttings** - to ensure positive drainage from the pavement and as an economic alternative to lined table drains
- **preservation of vegetation** - to enable preservation of existing vegetation by restricting the required formation width
- **intersections** - generally extending over the length of all acceleration, deceleration and passing lanes, to delineate the edges of auxiliary lanes
- **bus stops** - extending over the length of the stopping bay (see Section 3.12.1 of the Design Standards for Roadworks)

Stormwater drainage design is to conform to the Pine Rivers Shire Council Design Standards for Stormwater Drainage.

Where maintenance problems occur, due to pondage on very flat gradients, or erosion on steep gradients and/or in friable material, a concrete invert is to be provided to swale drains to the Pine Rivers Shire Council requirements.

6.3.6.3 CARRIAGEWAY AND SHOULDER WIDTHS

The standard widths for the following cross-section elements are set out in Table 6.3.6.A and illustrated in Figure 6.3.6.A.

- **traffic lane**
- **carriageway**
- **shoulder**
- **seal**
- **formation**

Where kerb and channel is constructed, the minimum width of sealed shoulder, from the outer lane line to the channel invert, is **1.5m** i.e. the minimum width between kerbs is the appropriate carriageway width plus 3.0m. **Additional** shoulder width may be required, however, to satisfy stormwater flow width criteria.

An additional 1.0m is to be provided between the face of kerb and start of batters. This area shall be concrete surfaced.

For Sub-Arterial and Arterial roads the minimum total width available for breakdown parking, clear of the outer lane, should be the normal shoulder width, **2.5m**.

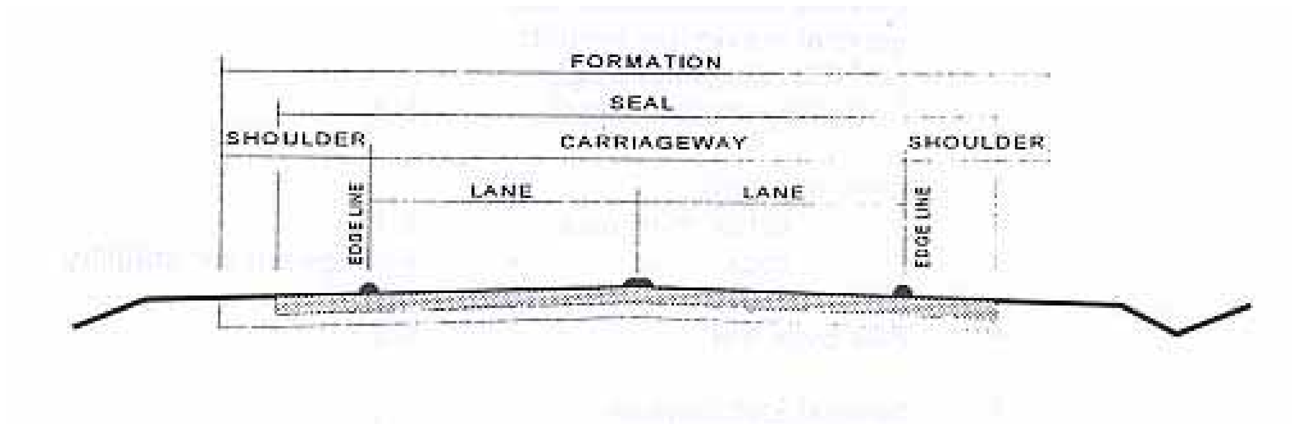
In some cases, a road may be functionally an **Arterial road**, but the ultimate traffic volume may be such that a two-lane carriageway will provide adequate capacity. If such a road is identified by the Pine Rivers Shire Council, the cross-section may generally be the same as a Sub-Arterial road and the geometric design the same as an Arterial road.

STANDARD WIDTHS
FOR CROSS-SECTION ELEMENTS

	Access	Collector	Sub-Arterial	Arterial
Lanes (No.)	3.5 (1)	3.0 (2)	3.5 (2)	3.5(4)(i)
Carriageway	3.5	6.0	7.0	2 x 7.0
Shoulder (Sealed)	2.5 (-)	1.5 (0.5)	2.5 (1.0)	2.5 1.0
Total Seal	3.5	7.0	9.0	2 x 8.0 with median 2 x 9.0 without median
Formation	8.5	9.0	12.0	25.0(ii)

Notes:-
(i) See Section 6.3.6.3 of the Design Standards for Roadworks for possible variations
(ii) With standard 6m median

Table 6.3.6.A



CROSS-SECTION ELEMENTS
Figure 6.3.6.A

6.3.6.4 MEDIANS, ISLANDS AND AUXILIARY LANES

Medians on Arterial roads, and auxiliary lanes, islands or other ancillary cross-section elements where required, shall be in accordance with the provisions of Section 3.10 of the Design Standards for Roadworks.

6.3.6.5 CROSSFALLS

❖ pavement (straight)		- 1:33 (3.0%) for flush seal
❖ pavement (curves)		- superelevation in accordance with Sections 6.3.7.2 and 6.3.7.3
❖ shoulders	- straight	- 1:25 (4%)
	- curves	- superelevation as for pavement

6.3.6.6 BATTER SLOPES

❖ desirable maximum for mowing maintenance, and general maximum for cuts and fills up to 1m height (including swale drains)		- 1:4
❖ cuts over 1m		
	- other than rock	- 1:1.5
	- rock	- as required for stability
❖ fills over 1m		- 1:2
❖ special stabilisation measures shall be applied to all fill batters steeper than		- 1:4

6.3.6.7 CLEARANCE FROM EARTHWORKS

- top or bottom of cut or fill batter to road reserve boundary - 3.0m minimum

6.3.6.8 PEDESTRIAN AND CYCLIST FACILITIES

Pathways for pedestrians and/or cyclists are not generally required within rural road reserves.

Where the requirement for such pathways, or for pony trails, is advised by the Pine Rivers Shire Council, however, the cross-section must provide sufficient width for their location (refer to Standard Verge Profiles - Drawing No. 8-10025 and 8-10026).

6.3.6.9 UTILITIES

Rural road reserves may provide a location for major utility service mains.

Such services may generally be located adjacent to the road reserve boundary without the need for additional reserve width, but such additional width may be required in some circumstances.

6.3.6.10 LANDSCAPING

Provision should be made within the road reserve for sufficient width for effective landscaping, for the amenity of both road users and adjacent property.

Flatter batter slopes (e.g. 1:4 or flatter) may be utilised for planting.

6.3.6.11 RESERVE WIDTH

The total reserve width required for a rural road will be the sum of the width requirements for the various elements previously detailed.

The minimum reserve widths below are adequate in most circumstances. Additional width may be required, however, either throughout the length of a road or at particular locations, to provide additional width for batters where earthworks are heavy, for auxiliary lanes adjacent to intersections, or for bus-stops, pathways, pony trails or services.

Standard minimum reserve widths are:-

- **Access road** - **20m**
- **Collector** - **20m**
- **Sub-Arterial** - **26m**
- **Arterial** - **40m** (30m for 2-lane arterial, see Section 6.3.6.3 of the Design Standards for Roadworks)

TYPICAL RURAL ROAD CROSS-SECTIONS

(REFER STANDARD DRAWINGS 8-10021 & 8-10024)

6.3.7 GEOMETRIC DESIGN

6.3.7.1 GEOMETRIC ELEMENTS

Geometric design includes a number of inter-related design elements, including:-

- sight distance
- horizontal alignment
- superelevation
- curve transition
- vertical curves
- gradients
- curve widening

6.3.7.2 BASIS OF DESIGN

Unless otherwise specified in this manual, the detailed design of the above elements should be in accordance with **AUSTROADS "Rural Road Design - 2003",** using the appropriate design speed as selected by the criteria of Section 6.3.4 of the Design Standards for Roadworks..

Single lane roads shall have curve widening applied as for the minimum two lane pavement width.

6.3.7.3 VARIABLE CRITERIA

The following values for variable criteria in the above reference should be used:-

- **Reaction time** (for stopping distance)
  - Access and Collector roads - 2.0 seconds
  - Sub-Arterial and Arterials - 2.5 seconds
- **Maximum superelevation**
  - Access and Collector roads - 6% (1:16.7)
  - Sub-Arterial and Arterials - 4% (1:25)
- **Maximum vertical acceleration** (riding comfort)
  - Access and Collector roads - 0.10 g
  - Sub-Arterial and Arterials - 0.05 g

6.3.8 INTERSECTIONS

6.3.8.1 NETWORK REQUIREMENTS

Intersections are a potential source of both traffic accidents and traffic congestion, and are costly to construct.

All these factors increase in significance with traffic speed and traffic volume.

Intersections between roads of widely different status are undesirable due to the potential traffic hazard resulting from the considerable difference in design speed between the roads.

The following principles must therefore be recognised:-

- total number of intersections should be reduced to the reasonable minimum
- the higher the road category the greater the desirable distance between intersections
- roads should, if possible, intersect only with roads of equal status, or of the category immediately above or below

6.3.8.2 SPACING OF INTERSECTIONS

Generally the minimum distance between intersections (including any accesses to major developments) should be:-

- **Access - 100 m**
- **Collector - 100 m**
- **Sub-Arterial - 300 m**
- **Arterial - 500 m**

In the case of sub-arterial roads, existing landholdings may require intersections at lesser spacing. In such cases the **minimum** spacings shall be:-

- **intersections on the same side - 100 m**
- **intersections on opposite sides**
  - left/right stagger - 100 m
  - right/left stagger - 30 m +

\+ Special channelling may be required to obviate an "offset four-way" intersection.

6.3.8.3 TYPE OF INTERSECTION

The types of intersection appropriate on rural roads are:-

- **T-Junction (three way)** - appropriate for intersections of lower status roads.
- **Roundabout (three, four or more ways)** - particularly appropriate between roads of comparable status and traffic volume, and where heavy right-turning traffic is evident.
- **Signalised** - may be the most appropriate treatment for intersections of arterial roads.
- **Gradient separation** - may be required at the intersection of two arterial roads, but rarely used due to the very high cost. The design of arterial roads, however, may need to provide for future full or partial gradient separation, and road reserves planned accordingly.

Table 6.3.8.A summarises requirements for provision of intersections and appropriate intersection type.

RURAL ROADS
APPROPRIATE INTERSECTION TYPE

	Access	**Collector**	**Sub-Arterial**	**Arterial**
Access	T	T	__	__
Collector	T	T RBT	T RBT	__
Sub-Arterial	__	T RBT	T RBT SIG	SIG RBT
Arterial	__	__	SIG RBT	SIG RBT (GS)

Notes: - T - T-Junction; SIG - Signalised; __ - Intersection generally not permissible; RBT - Roundabout; GS - Gradient Separated; ( ) - Less likely alternative

Table 6.3.8.A

6.3.8.4 INTERSECTION DESIGN

STANDARDS

The detailed design of intersections should conform to the following relevant standards, (or as revised):-

Gradient Separated

NAASRA / AUSTROADS	Grade Separated Interchanges (1984)	- Ref. 1
Qld. DMR	Queensland Department of Main Roads Road Planning and Design Manual	- Ref. 2

Signalised

Qld. DMR	Queensland Department of Main Roads Road Planning and Design Manual	- Ref. 2
NAASRA / AUSTROADS	Guide to Traffic Engineering Practice Part 5 - Intersections at Grade (1988)	- Ref. 3
NAASRA / AUSTROADS	Guide to Traffic Engineering Practice Part 7 – Traffic Signals (1993)	- Ref. 4

Roundabouts

NAASRA / AUSTROADS	Guide to Traffic Engineering Practice Part 6 - Roundabouts (1993)	- Ref. 5

Uncontrolled Tee-Intersections

NAASRA / AUSTROADS	Guide to Traffic Engineering Practice Part 5 - Intersections at Grade (1988)	- Ref. 3
Qld. DMR	Queensland Department of Main Roads Road Planning and Design Manual	- Ref. 2

6.3.8.5 CHANNELING AND AUXILIARY LANES

All **signalised** intersections shall have full channelling and auxiliary lanes (deceleration - left turn; right turn; acceleration lane or taper) designed in accordance with Reference 3 above.

Uncontrolled T-Intersections shall have full channelling and auxiliary lanes as above, except that with the Pine Rivers Shire Council approval, minor intersections and accesses on to **sub-arterial roads** may be unchannelised, with Type B right-turn lanes and Type B left-turn lanes in accordance with Reference 3 above (see **Figure 3.7.B** of **Section 3** of this manual).

6.3.9 SUMMARY OF RURAL DESIGN CRITERIA

RURAL ROADS
SUMMARY OF PROBABLE SOLUTIONS

	Access Road	Collector Road	Sub-Arterial Road	Arterial Road
Traffic Catchment	15 allotments	100 allotments	12,000 v.p.d.	30,000 v.p.d.
Design Speed (km/h)	60	60	80	100
Carriageway (i)				
No. of lanes	1	2	2	4 (ii)
Width (m)	3.5	6.0	7.0	2 x 7.0
Formation Width (m)	8.5	9.0	12.0	25.0
Verge Width (m) minimum	5.0	5.0	7.0	7.0
Reserve Width (m) minimum	20	20	26	40 (ii)
Maximum Gradient (General)	10%	10%	8%	6%
Crossfall				
Type	One way or Centre Crown	Centre Crown	Centre Crown	Centre Crown
Gradient (max.)	1:33	1:33	1:33	1:33

Notes:-
(i) See Table 6.3.6A for further detail of cross-sections
(ii) See Section 6.3.6.3 of the Design Standards for Roadworks for possible variation

Table 6.3.9.A