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5.0 ROADS

5.1 PURPOSE

This chapter is intended to provide supplementary information to expand on some of the elements specified in the Services, Works and Infrastructure Code and the Operational Works Code of the *Brisbane City Plan*. Therefore **the user must read this chapter in conjunction with the *Brisbane City Plan* to ensure that the development proposal complies in its entirety with the relevant codes, provisions and planning scheme policies**.

5.2 ROAD RESERVES

5.2.1 Performance Statement

Roads must be designed and constructed to adequately provide for:

- Safe and acceptable travel for pedestrians, cyclists and vehicles.
- Access to properties.
- Parking for vehicles.
- Stormwater drainage.
- Installation of service mains.
- Access for refuse collection vehicles and emergency vehicles.
- Aesthetics, improved livability and economic growth.
- Reduction in noise and other pollution.
- A low maintenance asset for Council.

5.2.2 General

The aim of this chapter is to provide Developers with general road design criteria for subdivisions and developments and also broad guidelines for treatment of topographical constraints. All roads must be designed in accordance with the *AustRoads Design Guidelines* unless stated otherwise.

Role of Urban Management

Officers of the Transport and Traffic Program within Urban Management are involved with the functional classification of roads and streets and in particular:

- Road Hierarchy.
- Road Layout and Pavement Width.
- Ensuring safety through limiting of vehicle speeds and composition through geometry and speed control devices.
- Bikeway Networks.
- Site access.
- Pedestrian Networks and access to Public Transport.
- Parking.

- Landscaping/Streetscaping.
- Noise Pollution Control Devices.

Role of Customer and Community Services

Officers of the Development and Regulatory Services within Customer and Community Services approve the functional road network layout of the subdivision prior to engineering drawings being prepared. This approval is confirmation that the layout is in accordance with the Planning Scheme Polices, Standards and Specifications.

Specific design and construction details include but are not limited to the following items:

- Vertical and Horizontal Road Geometry.
- Application and location of Traffic Control Devices.
- Pedestrian Facilities.
- Signs and Pavement Markings.
- Sight Distances.
- Streetscapes.
- Access for Refuse Collection and Emergency Vehicles.
- Pavement Design.
- Site Access.
- Noise barriers and safety fences.
- Service Allocations.
- Street Lighting.

5.2.3 Road Hierarchy

General

The road hierarchy concept adopted by Council is a basis for subdivisional layout design and ensures an appropriate relationship between road function and the needs and general amenity requirements for the residents. It also meets Council's aim of promoting a road network for residents that is convenient, accessible, safe and secure.

Outline of Road Hierarchy Concept

Figure B5.2.1 details the general road hierarchy structure for use in subdivisional road layout.

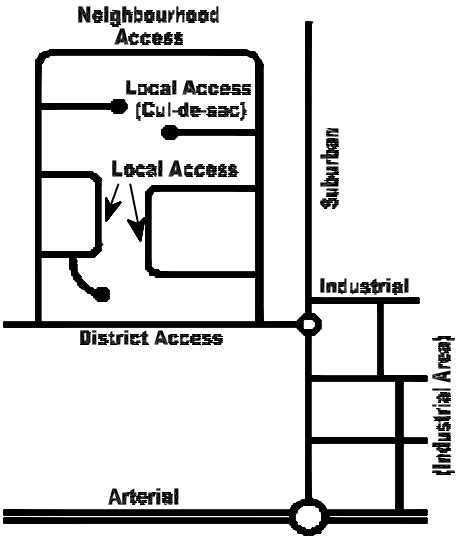


FIGURE B5.2.1
ROAD HEIRARCHY

Road Description under this Hierarchy

Under this hierarchy the following is a brief description of each type of road. Refer to the Transport and Traffic Facilities Planning Scheme Policy of the *Brisbane City Plan* for more detail.

- **Local Access Road - Cul-de-Sac (Type A Pavement)**
  These are minor roads not more than 150 m in length primarily for access to single family dwellings.
- **Local Access Road (Type B Pavement)**
  Local access roads primarily provide access to single family dwellings and cul-de-sacs.
- **Neighbourhood Access Road (Type C Pavement)**
  Neighbourhood access roads primarily provide access to residential buildings and local access streets with an option to carry public transport
- **District Access Road (Type D Pavement)**
  District access roads provide access to neighbourhood access roads and carry through traffic. Direct property access to district access roads is not permitted unless approved otherwise
- **Industrial Access Roads (Type E Pavement)**
  Industrial roads primarily provide access to land developed or intended to be developed for industrial purposes
- **Arterial Roads (Type F & G Pavements)**
  Arterial roads primarily carry high volume through traffic with limited access points.

5.2.4 Road Classification

Table 1 of the Transport and Traffic Facilities Planning Scheme Policy in the *Brisbane City Plan* and Standard Drawings UMS 141 and UMS 142 summarise the design elements applicable to major and minor roads. It should be noted that Council would not accept road reserves less than 14 metres wide and pavements less than 5.5 metres wide.

Roads with one way crossfalls must fall into the high side of the street. Exceptions may be permitted only if the land on the low side falls into the street. This requirement is intended to protect the residents on the low side from stormwater within the road entering the properties.

Provisions made for parking bays within the road reserve are considered a part of the road pavement and must be designed accordingly. This must include the provision of concrete kerb and channel, kerb only, or channel only and service location agreements.

The temporary storage and collection of refuse and recyclables from each dwelling must be considered when planning the layout of the development and subdivision. Refer to Chapter 11.0 of Part B of this document for further details.

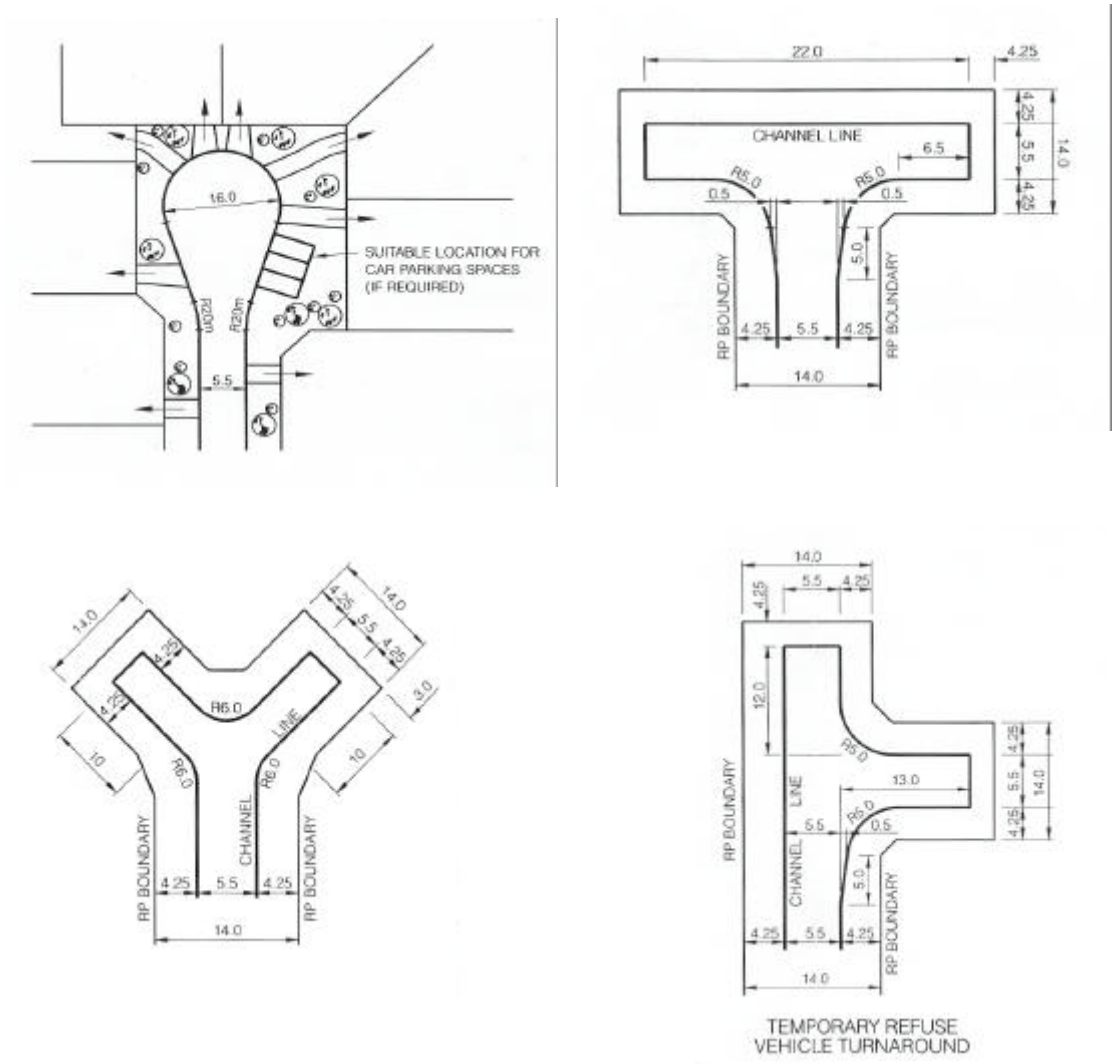
5.2.5 Local Access Treatments

Local Access

The access criteria are defined below:

1. The maximum length of a Local Access Road must not exceed 150 metres. The leg length between traffic control devices or curves must be between 60 and 80 metres.
2. Subject to the land topography, the minimum radius of the pavement within a conventional bulb shape is 8 metres.
3. Local access turning heads may be conventional bulb T or Y shaped. Design must be based on the turning requirements for a refuse vehicle.
4. Parking bays are required in all Local Access Roads.
5. The verge width of Local Access turning heads must be 4.25 m. Under special circumstances Council may permit a 3 m verge width provided pedestrians and service authorities can be accommodated.

Figures B5.2.2 and B5.2.3 show typical configurations that are satisfactory.



DESIGN CRITERIA

These turning areas are based on the following:

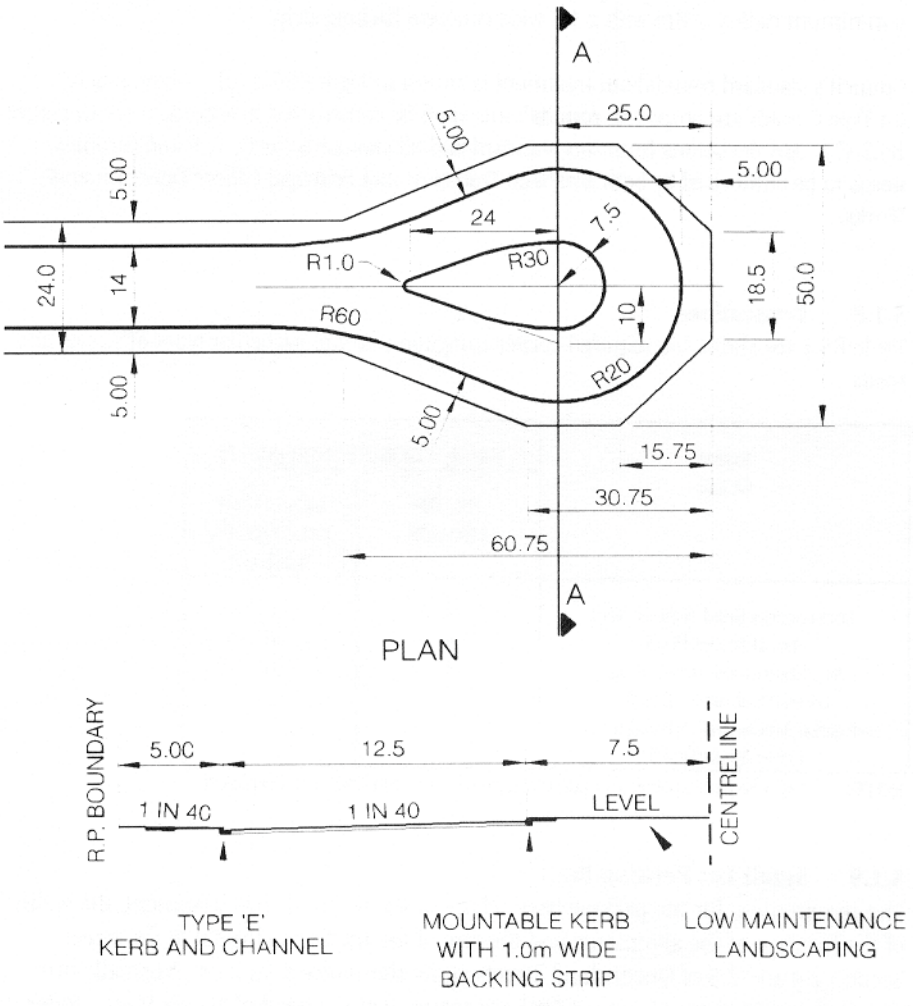
1. Refuse truck able to turn within paved area (11.8 m turn radius).
2. Refuse truck able to turn any direction to enable pick up either side, in each arm.
3. Design may be modified by adding parking bays (verges which have parking bays at the end of the road can be reduced to 2.0 m if approved by the Engineering Officer Development & Regulatory Services).
4. Subject to service requirements the verge may be reduced to a minimum of 3.0 m if approved by the Engineering Officer Development & Regulatory Services.

FIGURE B5.2.2
TYPICAL MANOEUVRING AREAS

Industrial Access Road (Cul-de-Sac)

The access criteria are defined below:

1. The minimum radius of the outside kerb alignment must be 20 metres.
2. The treatment for the centre islands can comprise one of the following methods:
   - Low maintenance landscaping with a one metre wide concrete backing strip behind the median kerb.
   - A combination of landscaping and car parking bays as shown in *Queensland Streets*.



HALF SECTION A-A

FIGURE B5.2.3
ACCESS ROAD TURNING PROVISIONS FOR INDUSTRIAL SUBDIVISIONS

5.2.6 Roundabouts

Roundabouts in Local and Neighbourhood Access Roads must be designed with a minimum radius of 8 metres with a 1.5 metre wide concrete backing strip.

Council's design guideline for a typical roundabout treatment is shown in Figure e of the Transport and Traffic Facilities Planning Scheme Policy. Where bus routes on neighbourhood access roads are proposed, roundabouts must be constructed in accordance with Figure a of the Transport and Traffic Facilities Planning Scheme Policy. Any deviations from this guideline must be authorised by the Engineering Officer Development & Regulatory Services.

5.2.7 Truncations

Table B5.2.1 details the minimum corner truncation for the particular types of streets and roads.

TABLE B5.2.1 TRUNCATION REQUIREMENTS

Road Class	Truncation Requirements	
	No. of Chords	Length of Truncation (m)
Local Access Road (Cul-de-Sac)	3	6
Local Access Road	3	6
Neighbourhood Access Road	3	6
District/Suburban Road	*	*
Industrial Access & Arterial Road	*	*
Other Major Road	*	*

* May require special additional treatment. Consult with the Engineering Officer Development & Regulatory Services.

5.2.8 Small Lot Parking Bays

The requirement for the parking bays relates to the width of road pavement, the width of the frontage of the allotments and the size of the traffic catchment to the street. The document, *Queensland Streets* show alternative solutions. Normally two standard parking bays are required at the head of local access roads.

5.2.9 Road Reserve Widening at Speed Control Devices

The road reserve width may require widening at speed control devices to maintain the minimum verge width of 4.25 metres.

5.2.10 Bikeways on Road Reserves

District, suburban and arterial roads will normally require provision for bikeways on both sides of the road. The designer must consult with the Engineering Officer Development & Regulatory Services for the relevant details on bikeway and pavement widths, and whether such provisions must be included on the verge. The width of the bikeway will vary according to its location and the expected use. Refer to Chapter 9 of Part B of this document for further details.

5.2.11 Bus Parking Bays

The minimum verge width must be maintained at the bus parking bays. Also refer to Standard Drawings UMS 263 and UMS 264.

5.2.12 Landscaped Acoustic Fences/Noise Protection Barriers

Landscaped acoustic fences are generally required along all suburban and arterial roads. The proposed noise attenuation measures must comply with the Noise Impact Assessment Planning Scheme Policy.

5.3 HORIZONTAL GEOMETRY

5.3.1 Design Speeds

Design speeds of roads within new subdivisions are listed in Table 1 of the Transport and Traffic Facilities Planning Scheme Policy.

5.3.2 Sight Distance

Refer *Queensland Streets* and the Transport and Traffic Facilities Planning Scheme Policy.

5.3.3 Curve Radii

TABLE B5.3.1 CURVE RADII

Class of Road	Minimum Curve Radii (m)
Local Access Road (Cul-de-Sac)	To suit truncation
Local Access Road	To suit truncation
Neighbourhood Access Road	100
District Road	275
Suburban Road	275
Industrial access Road	40
Arterial Road	400

5.3.4 Intersection Angles/ Kerb Return/ Local Access Radii

Refer to *AustRoads Guidelines* and *Queensland Streets*.

5.3.5 Traffic control devices

Need for Traffic Control Devices

Wherever possible, traffic control must be provided by limiting the 'road leg length' and providing curved alignment. The use of traffic control devices to maintain a low speed environment must be a last resort rather than a routine measure. It is important to design the street layout of the subdivision as a means to control vehicle speed. Capital and maintenance costs, access and parking difficulties must be considered in the design and location of traffic control devices.

Prior to implementing low speed environments within new subdivisions that may affect existing residents of an adjoining older style subdivision, the Developer must contact the local Ward Councillor, residents and community groups to ensure community awareness and 2/3 majority approval prior to construction of the device.

For lower speed streets, the use of curves and bends and limiting the street leg length is the most common means of achieving speed limitation criteria. Traffic control devices are usually not required in rural residential subdivisions, unless specifically requested by the Engineering Officer Development and Regulatory Services.

Allotment Access in Residential Estates

The limitation which devices may impose on access to allotments must be considered, particularly for 'land only' subdivision where driveway location cannot be predicted. In these cases, the location of driveways must be shown on the submitted engineering drawings with the words 'to be constructed by others'. For narrow pavements refer to Chapter 12 of Part B of this document. The number of driveways servicing any single allotment is usually limited to one.

Drainage

Carriageway drainage may require special attention at traffic control devices, in particular, on very flat or steep grades.

Landscaping and Surface Treatments

Substantial landscaping and surface treatment can enhance the effective operation of traffic control devices by increasing the 'visual barrier' and lateral enclosure, to control pedestrian movement, to improve the appearance of the traffic control device and total streetscape. Council's treatment requirements are shown on Figures a, c, d, e and h in the Transport and Traffic Facilities Planning Scheme Policy of the *City Plan*. Also refer to Chapter 7 of Part B of this document, for a list of suitable plant species and particulars of landscaping.

Staged Construction

Delay to the construction of devices until houses are built or until the following stages are completed to avoid damage will not be permitted.

Design

The geometry and alignment of typical Council's standard traffic control devices are outlined in the Transport and Traffic Facilities Planning Scheme Policy. Any deviation from the geometry of these traffic control devices must be authorised by the Engineering officer Development & Regulatory Services.

5.3.6 Overland Flow Drainage within Road Reserve

When designing the Q_{50} overland flow drainage within the road reserve, attention needs to be given to the impact of traffic control devices and landscaping. The Q_{50} flows through traffic control devices must remain within the road reserve. The designer will need to check that the traffic control device does not redirect flows into either another catchment or downhill properties. Also refer to Chapter 6 of Part B of this document.

5.3.7 Local Widening at Intersections

In cases where a neighbourhood access road intersects a district access road or higher, local widening of the approach at the intersection must conform to Figure g in the Transport and Traffic Facilities Planning Policy.

5.3.8 Grading on Simple Urban Intersection

A typical example of an urban intersection is shown below in Figure B5.3.1. In grading the minor road to intersect with the major crossroad, various principles noted below must be observed.

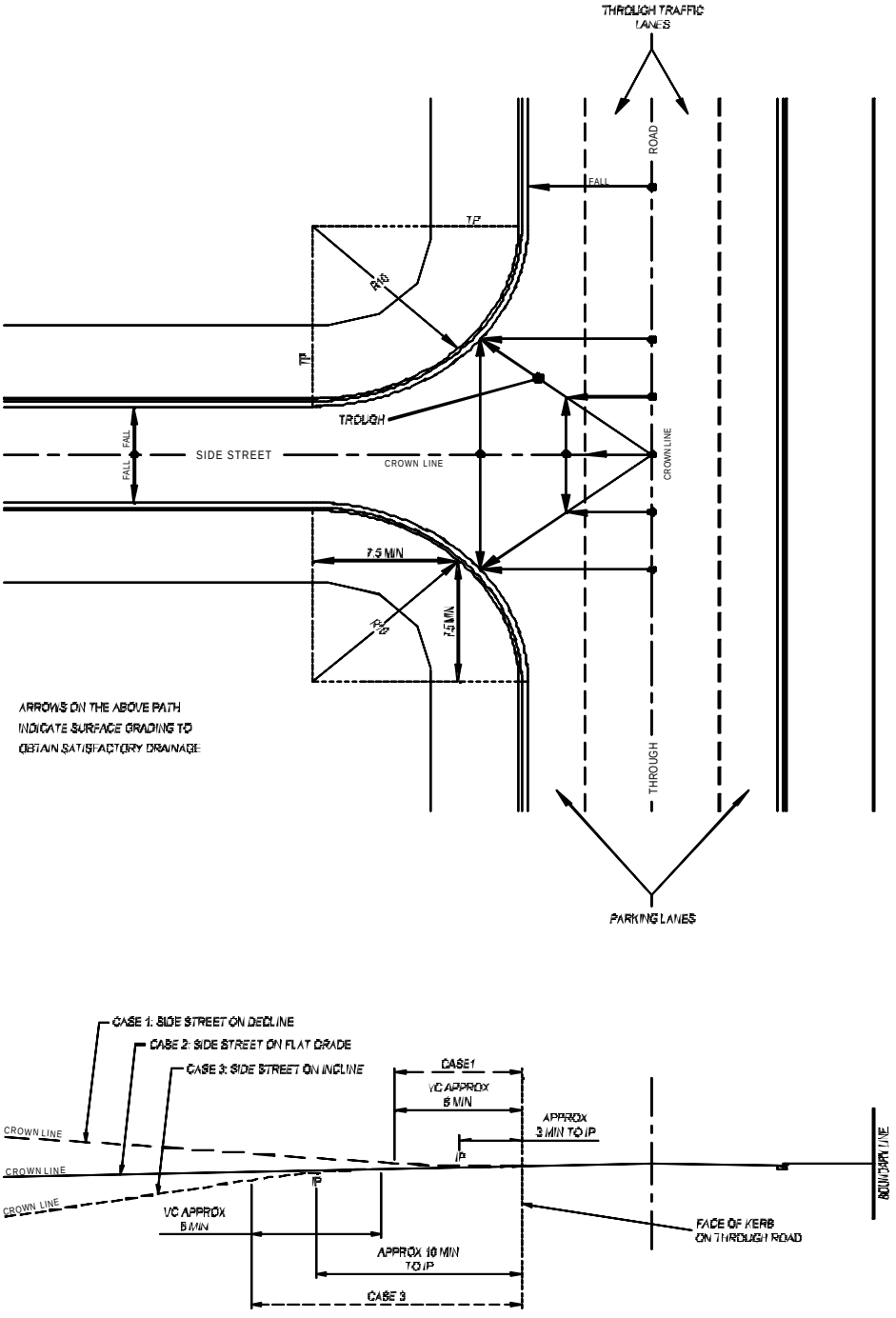


FIGURE B5.3.1
GRADING OF SIMPLE URBAN INTERSECTION

5.3.9 Intersection Turn Slots at Urban Intersections

The requirement for intersection turn slots is shown below in Table B5.3.2.

TABLE B5.3.2 INTERSECTION TURN SLOTS

Class of Road	Intersection Turn Slots
Local Access Road (Cul-de-Sac)	N/A
Local Access Road	N/A
Neighbourhood Access Road	N/A
District Road	Left, Right or Right only (subject to traffic movements)
Suburban Road	Left, Right or Right only (subject to traffic movements)
Industrial access Road	N/A
Arterial Road	Left, Right

NOTE: Additional through lanes may also be required at intersections to provide adequate capacity on roads.

5.4 VERTICAL GEOMETRY

The vertical geometry requirements for various types of roads are summarised in Table B5.4.1 below.

TABLE B5.4.1 SUMMARY OF VERTICAL GEOMETRY

ITEM	CLASS OF ROAD						
	Local Access (Cul-de-sac)	Local Access	Neighbourhood Access	District/ Suburban	Industrial Access	Arterial	Rural
VERTICAL GEOMETRY							
Longitudinal Grading **- desirable max** **- absolute max** **- desirable min** **- absolute min**	 10% (2) 16.7% 1% 0.4%	 10% 16.7% 1% 0.4%	 10% 16.7% 1% 0.4%	 6% 10% 1% 0.4%	 5% 6% 1% 0.4%	 5% 8% 1% 0.4%	 10% 16.7% 1%
Min length between T.P.'s	15m (1)	20m (1)	30m	50m	30m	80m	30m
Desirable V.C.'s **- min length for change grade greater than 1%**	20m (1)	30m (1)	35m	60m	35m	90m	35m
Absolute V.C.'s **- min length for change grade greater than 1%**	15m (1)	25m (1)	30m	50m	30m	80m	30m
CROSS SECTION ELEMENTS							
Crossfall on straights	2.5-3%	2.5-3%	2.5%	2.5%	2.5%	2.5%	2.5%
Super elevation	Normal	Normal	Normal	Full	Full	Full	Normal
Max grades: **- on footpaths** **- driveways in private property**	 16.7% 25%	 16.7% 25%	 16.7% 25%	 16.7% 25%	 16.7% 25%	 16.7% 25%	 16.7% 25%

NOTES:

1. Where the geometry would allow a higher speed, a higher standard is required.
2. The maximum desirable grade in local access cul-de-sac bulb in the longitudinal section should be 8%.

5.5 PAVEMENT DESIGN

5.5.1 General

The aim of this section is to provide Developers with criteria for the design of pavements in the City of Brisbane. The design requirements in this section have been taken and modified from the following documents:

- *Pavement Design. A Guide to the Structural Design of Road Pavements* (AustRoads).
- *Guide to the Design of New Pavements for Light Traffic* (AustRoads)
- *Reference Specifications for Civil Engineering Work* (Brisbane City Council).
- *Pavement Rehabilitation Manual* (Brisbane City Council).
- *Pavement Design Manual* (Queensland Transport).

5.5.2 Subsoil Drainage

Refer to Standard Drawing UMS 261 for details. Sub-surface drains must be used to protect the road structure from moisture ingress. Unless approved otherwise by Council, they must be provided at the following locations:

1. Both sides of all streets and roads under the kerb and channel.
2. Under the kerb around all landscaping areas.
3. Across the end of the road at the stage boundary.
4. Along the line of fill when subsoil water is affected by the compaction of the fill.
5. Where springs are located.
6. Location where moisture can ingress.
7. Under the invert of flat grassed overland flow paths.
8. At the toe of cuttings greater than 2 m high.
9. Along natural watercourses.
10. Blanket courses.

The following points must also be noted:

1. Typical cross section pavement details must show side drains.
2. Panel drains may be used at specific locations subject to Council approval.
3. The Class 400 polyethylene 100 diameter corrugated slotted pipe with polyester sleeve may be used, subject to Council approval.

5.5.3 Pavement Types

Granular/Asphalt

The granular pavement comprises the majority of Council road network. Council prefers this pavement type as it provides the lowest whole of life costs, the best opportunities for rehabilitation in urban situations and good rideability. This pavement is also the most cost-effective pavement to construct. The design of the granular pavement can be taken from Table B5.5.1 below.

TABLE B5.5.1
PAVEMENT DESIGN AND CONSTRUCTION – MINIMUM GRANULAR THICKNESS INCLUDING ASPHALT WEARING COURSE

CBR OF SUBGRADE	MINIMUM TOTAL THICKNESS (mm)					
	A	**B**	**C**	**D**	**E**	**F&G**
1	Subgrade treatment required. Then treat as CBR 3.					Refer all type F and G to the Engineering Officer Development & Regulatory Services.
2						
3	410	440	490	500	540	
4	340	370	410	440	470	
5	290	310	350	410	440	
6	260	290	320	380	420	
7	240	260	290	360	400	
8	230	240	270	340	390	
9	210	220	240	330	380	
10	200	210	240	320	360	
A max CBR of 10.0 must be used for design purposes*						
MINIMUM COURSE THICKNESS						
ROAD TYPE	**A**	**B**	**C**	**D**	**E**	**F&G**
Asphalt	25	25	25	50	50	100
Light Primer Seal	Yes	Yes	Yes	Yes	Yes	Yes
Top and Second	100	100	100	125	125	125
Sub-base (Class)	As required to obtain minimum thickness					

Source References:

A,B,C,D Type: *Guide to the Design of New Pavements for Light Traffic* (AustRoads).
E,F,G Type: *Pavement Design. A Guide to the Structural Design of Road Pavements* (AustRoads).

Notes:

1. CBR is the 4-day soaked CBR value.
2. If 2nd Course minimum thickness cannot be achieved, then Class One material is used for full pavement depth.
3. A minimum of 75 mm crushed rock bedding material is required under the concrete kerb and channel.
4. Pavement is to extend 75 mm past the concrete kerb and channel to ensure stability of the Pavement edge.

* Granular subgrade with CBR values greater than 10 and which have a known insitu service life may be accepted if accompanied by a satisfactory Geotechnical Report.

Concrete

Full depth concrete roads are generally used only at heavily trafficked roads. However, a full depth concrete road can be designed for local streets. Refer Table B5.5.2. The concrete pavement must be designed in accordance with *Pavement Design. A Guide to the Structural Design of Road Pavements* (AustRoads). Special attention must be paid to the jointing details in regard to rideability and the provision of additional conduits for future services.

TABLE B5.5.2 PAVEMENT DESIGN AND CONSTRUCTION, MINIMUM CONCRETE THICKNESS

CBR OF SUBGRADE	MINIMUM CONCRETE THICKNESS (mm)				
	A	B	C	D	E,F,G
1	Sub-base of 100 mm of fine crushed rock. Then treat as CBR 5.			Subgrade treatment required. Then treat as CBR 5.	Refer all type E, F, G to the Engineering Officer Development & Regulatory Services.
5	170	180	190	200	
10	160	170	170	180	

Source Reference:

Pavement Design. A Guide to the Structural Design of Road Pavements (AustRoads).

Notes:

1. A minimum of 75 mm of crushed rock bedding material must be provided under the concrete kerb and channel and extending past the kerb and channel by 75 mm. Refer Standard Drawing UMS 261.
2. Minimum flexural strength of concrete 4.25 MPa at 28 days.

Full Depth Asphalt

This pavement is not generally used for local streets. However, it is used in areas where the speed of construction is critical, such as on major roads or narrow pavement widening. Full depth asphalt must be underlain by a minimum of 100 mm thick granular working platform.

The following reference publications must be used when determining detailed design pavement depths:

- *Pavement Design Guide for Lightly Trafficked Road* (AustRoads).
- *Pavement Design. A Guide to the Structural Design of Road Pavements* (AustRoads).
- *Pavement Design Manual* (Queensland Transport).

Full depth pavement designs must be submitted to the Engineering Officer Development & Regulatory Services for approval. The values of modulus and fatigue constant would vary with a number of factors including:

- Weighted mean annual pavement temperature.
- Representative traffic speed.
- Type of binder.

As a guide, the following typical design values are applicable for Brisbane region.

- Asphalt modulus 2000 MPa for Class 170 bitumen binder.
- Asphalt modulus 2800 MPa for Class 320 bitumen binder.
- Asphalt modulus 3500 MPa for multi grade (Class 1000/320) bitumen binder.

Treated Pavement Materials

Treated pavements, which include cement stabilisation of sub-base material and cement treatment of imported base course material, are acceptable to Council. However, full details of the proposal must be submitted to the Engineering Officer Development & Regulatory Services for approval. A NATA registered laboratory must undertake all the required testing.

5.5.4 Pavement Design

Determination of Design Traffic

Design traffic for the various road classifications is defined in Table B5.5.4. Higher ESA values may need to be used on existing arterial roads.

TABLE B5.5.3 DESIGN TRAFFIC BY ROAD CLASS

CLASS OF ROAD	PAVEMENT TYPE	DESIGN TRAFFIC ESA (Upper Limit)	DESIGN TRAFFIC DTN (Upper Limit)
Local Access Road (Cul-de-Sac)	A	1.5×10^4	2
Local Access Road	B	3.7×10^4	5
Neighbourhood Access Road	C	1.5×10^5	20
District Road	D	7.5×10^5	100
Suburban Road	D	7.5×10^5	100
Industrial access Road*	E	1.5×10^6	200
Arterial Road - Minor	F	3.7×10^6	500
Arterial Road - Major	G	$>1.0 \times 10^7$	

* Designer must consider traffic generated by potential industries in the estate as a minimum standard.

Determination of Subgrade Strength

The design parameter for the subgrade is the California Bearing Ratio (CBR). A design CBR must be determined for each identifiable unit defined on the basis of topographic, geological and drainage conditions at the site. It must be related to the soaked condition in the subgrade at a compaction of 100% standard.

In determining the design CBR, account must also be taken of the variation of the subgrade strength with depth below subgrade level. The critical layer of material should be established to ensure each layer has adequate cover.

Laboratory determination of CBR

When the subgrade CBR is particularly sensitive to changes in Moisture Content, adequate testing of the CBR over a range of MC's and densities should be provided and CBR interpolated at the design MC and density conditions. Also refer to the following reference documents:

1. *APRG Report Number 21* (AustRoads Pavement Reference Group).
2. *A Guide to the Design of New Pavements for Light Traffic – Section 13 Subgrade Evaluation* (AustRoads).

Determination of Pavement Depth

The pavement design should be based on the CBR tests being representative of the subgrade over the various lengths of road at the box depth. This is subject to confirmation by the Consultant during the Construction Phase. The Consultant must verify on site and certify that the subgrade tests are representative of the subgrade on which the pavement was designed.

Pavements with Low Subgrade CBR

If the design CBR determined for the subgrade is less than the minimum CBR given in Tables B5.5.1, B5.5.2, B5.5.3; then one of the following approaches should be taken:

1. If the subgrade is not expected to be at or near its design strength at the time of construction (ie cannot take construction traffic) some form of treatment will be required in order for construction to proceed. The material should be treated as a soft subgrade and some form of working platform or improvement provided. For design purposes, the subgrade improvement or working platform should be ignored and a CBR of 3 used for the subgrade. The thickness of the working platform is not part of the designed pavement thickness.
2. If the subgrade is expected to be of sufficient strength at the time construction for pavement construction to proceed, an improved subgrade layer of material with a soaked CBR of at least 15 should be used. This layer should be at least 150 mm thick for a design CBR of 1. After applying this selected subgrade layer, the design should be based on a design subgrade CBR of 3 for all roads.
3. Carry out stabilisation treatment in accordance with methodologies set out in Section 5.5.5.

5.5.5 Treated Pavements

Lime Stabilisation

Lime Stabilised base, sub-base and subgrade is generally not acceptable as a pavement treatment although it can be used to expedite construction.

Cement Treated Materials

The properties of a cement treated layer are influenced by the nature of the material to be stabilised, percentage and type of additive, and the efficiency of the mixing process.

Cemented materials will inevitably crack due to thermal and shrinkage stresses. Hence, it is considered the main use of this type of treatment would be to improve the characteristics of existing road material such that a nominal 100 mm layer of base course material overlaying such treated material would be adequate and prove more economical than constructing a traditional boxed pavement.

Cemented materials must be designed in accordance with the *Queensland Main Roads Design Manual*. The proposed design together with the results of tests to be undertaken in determining the design and proving adequacy of the material to satisfy design requirements, must be submitted to the Engineering Officer Development & Regulatory Services at least two weeks prior to undertaking the work.

Although not mandatory, it is considered that the maximum cement content should be limited to 4.5% by weight to prevent reflective cracking of shrinkage cracks in the treated layer through the base course and asphalt surfacing. The charts in *Pavement Design. A Guide to the Structural Design of Road Pavements* (AustRoads) must be used to determine the required thickness of the treated layer.

5.5.6 Pavement Widening

On existing road frontages of a proposed development site where the full pavement width and kerb and channel are not constructed, the Developer must construct a road pavement between the lip of the new channel and the edge of the existing bitumen with a minimum taper of 1 in 10 out to the existing pavement. The pavement must be designed to the requirements set out in Tables B5.5.2, B5.5.3 and B5.5.4.

5.6 KERB AND CHANNEL

5.6.1 General

Concrete kerb and channel must be provided along the full frontage of every site fronting a dedicated road.

5.6.2 Type of Kerb and Channel

The required kerb and channel profiles are shown in Standard Drawing UMS 211.

5.6.3 Park Frontage

The kerb and channel fronting parks must be the standard type E. A log barrier fence may also be required along the frontage of the park. This kerb and log barrier fence is required to deter vehicles from entering the park. Also refer to Chapter 13 of Part B of this document.

5.6.4 Minimum Grade

The grade of kerb and channel must not be less than 1V in 250H. The following maximum vertical radii must be adopted to reduce the length of possible pondage in the channel:

- Crest Curves - maximum radius 3000 metres.
- Sag Curves - maximum radius 1250 metres.

5.6.5 Rural Subdivisions

Construction of concrete kerb and channel is required on new rural residential roads and on existing roads fronting the estate. In some cases the existing and ultimate alignment of the kerb and channel may not be known until a road survey is undertaken as many of these roads commenced as bush tracks. Before the engineering plans are submitted to Council, the Developer must carry out this survey which extends a minimum of 5 m along the road beyond the frontage of the subdivision and a minimum of 5 m onto the adjacent land. This is to determine the alignment for kerb and channel and the extent of cut and fill batters. The road pavements may not need to be centrally located within the road reserve.

5.7 TRAFFIC ISLANDS

5.7.1 Types of Traffic Islands

Types of islands are broadly categorised as:

- Roundabouts.
- Channelised Intersection.
- Traffic Control Devices.
- Divided Roads Islands.
- Splitter Islands.
- Pedestrian Refuge Islands/Safety Zones.

5.7.2 Traffic Islands/Kerbs/Surface Treatment

General

When traffic islands are required in an existing dedicated road the Developer must advise the Councillor, residents, property and business owners adjacent to the proposed work of the traffic islands as part of the functional layout of the design and prior to final design. Functional layout approval will be subject to evidence that the proposal has been accepted by a 2/3 majority of all concerned.

Median Kerbs (islands not to be driven over)

Mountable kerb should conform to the profile shown in Standard Drawing UMS 211 and the finished height of the kerb should be 150 mm above the adjoining road surface. A 300 mm wide concrete backing strip must be placed behind the mountable kerb if no rigid surfacing is proposed for the median or where damage to the median is considered likely without such backing strip, eg Industrial subdivisions or major roads subject to heavy vehicles, island noses or roundabouts. Contraction joints within the concrete infill must align with the contraction joint in the median kerb.

Concrete and Paving Infills (medians not to be driven on)

In general, coloured surface, exposed aggregate, broomed concrete, or stencilled concrete treatments are preferred to paver bricks, due to maintenance considerations. 20 mm wide expansion joints in concrete infill to medians must be placed generally at 6 m centres. Expansion joints must also be placed between the median kerb or the backing strip to the kerb when used and the infill where the width of the median exceeds 3 m.

Medians Kerbs and Islands (to be driven on)

When traffic is intended to regularly mount islands eg traffic control devices, the lower mountable kerb must be installed and infills must be designed in accordance with approved treatments.

Side Drains

For turfed and landscaped medians, side drains must be installed under the median kerb (ie on both sides of the median unless the median is less than 2 metres wide). An outlet must be provided for these side drains to an existing manhole, gully or other functional side drain.

5.8 TRAFFIC SIGNS AND PAVEMENT MARKINGS

5.8.1 General

The Developer has the option of either to accept Council's quotation to undertake the works or to engage a private contractor to install traffic signs, pavement markings and street name signs to Council's satisfaction. All traffic signs, pavement markings and street name signs must be in place on site before a subdivision or development is accepted 'On Maintenance' or 'Works Clearance' given.

The following construction order is generally on existing roads:

- Construct widening.
- Remove existing pavement marking and signs, and reinstate as required.
- Add concrete islands/medians.

5.8.2 Standards

Signs and Pavement Marking designs must be prepared generally in accordance with:

- *Manual of Uniform Traffic Control Devices (MUTCD)*.
- Figure B5.8.1 below.

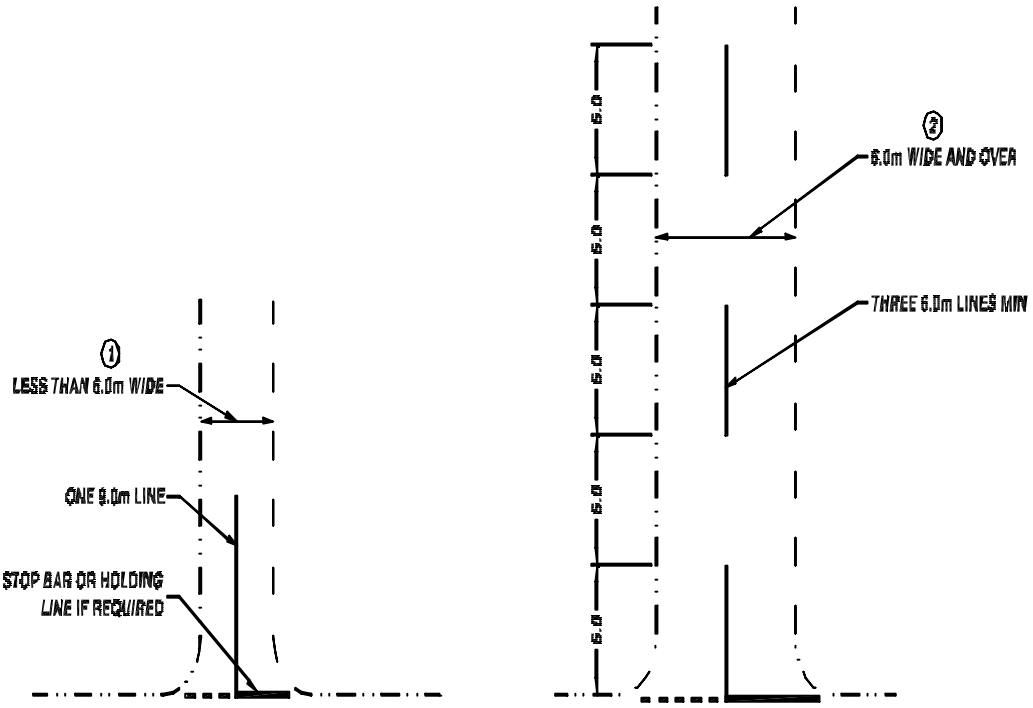


FIGURE 5.8.1
TYPICAL MINOR RURAL ROAD SEPARATION LINE DETAIL

5.8.3 Signals

The Developer has the option to either accept Council's quotation for the design and preparation of drawings associated with the installation of traffic signals or to engage a private contractor to do the design and prepare drawings to Council's satisfaction. Contact the Engineering Officer Development & Regulatory Services for more details.

5.8.4 Temporary Traffic Guidance

The construction staging must also include the temporary traffic guidance schemes for each stage.

5.9 SURFACE TREATMENTS

5.9.1 Asphalt

Asphalt is generally the most accepted material for road surfacing. All roads within the Road Hierarchy can be surfaced with this material.

5.9.2 Pavers

General

Concrete pavers may be used, although future maintenance considerations must be taken into account when approval is sought for their use on roads and footpaths. The use of concrete pavers should generally conform to the *Guidelines for the use of Concrete Segmental Pavers in Subdivisional Roadways* (Concrete Masonry Association of Australia) except where the Council requirements differ from these Guidelines.

Limitation of Use

Council's preference is that the use of pavers be limited to landscaping features in traffic control devices, traffic medians and on footpaths in commercial areas. As a guide, paved areas should not make up more than 10% of the total road pavement area. Types of paver, colour, manufacturer, product number, etc must be shown on the engineering plans. Edge restraints must be provided along the perimeter of all paved areas. Pavers must not be used as road surface treatments on district access routes or greater.

Treatment of Obstructions (Manholes, Gullies, etc)

The preferred method for treatment of pavers around gullies, manholes, service pits and like obstacles is to use specifically manufactured pavers, designed to be placed around these obstructions. Pavers adjacent to these obstructions or the lip of the kerb and channel must have the arris reduced to a 5 mm radius to narrow the gap between the pavers and the adjacent structures.

Pavement Design

The pavers must not be considered as part of the structural pavement. The detail of the pavement design must be shown on the engineering drawings. The pavement must comprise:

- 80 mm thick concrete pavers.
- 20 mm of cement stabilised bedding sand.
- Full concrete pavement (depth to be designed by a Consultant with a minimum thickness of 160 mm).

Drainage

Outlets for roofwater drains on the high side of one way crossfall paved streets are not permitted in the kerb. Roofwater reticulation is required in this situation with the outlet into the main underground drainage stormwater system.

Sub-Surface Drainage

Particular attention needs to be paid to the design and construction of road drainage for paved roads, in particular sub-surface drainage. Refer to Council's Standard Drawings UMS 261 and UMS 262. No-fines concrete blocks or PVC tubes placed over side drains to drain the bedding sand are not an acceptable design. Full details of the sub-surface drainage, incorporating drainage of the sand bedding layer, must be shown on the engineering drawings.

Bedding Sand

Finished pavement must be prepared with a crown, the design crossfall grade, and an even surface. A weedicide must be used on the bedding sand to control weed growth. The weedicide must be environmentally friendly, as water will penetrate through the bedding sand to the stormwater system. The 20 mm thick cement stabilised (3% by mass of cement) bedding sand must be spread loosely and screeded in a uniformly thick layer within the specified limits.

Restraining Strips

An edge restraint may be in the form of a kerb, combined kerb and channel, established structure or rigid abutment. Edge restraints must be provided along the perimeter of all paved areas. They should be able to support traffic loads and to prevent the escape of the bedding sand from beneath the paved surface. The minimum dimension for edge restraints is 230mm x 230mm with two (2) Y12 reinforcing bars. An isolation joint is required at the junction of the channel. Strip drains must be installed alongside the upstream edge restraint and connected to the side drains.

Transverse Restraints

Use of cross beams and/or restraints are required for inclined areas and roadways, and also for surfaces where heavy vehicular braking may cause shoving of pavers. Details must be included in the engineering drawings.

Pavers on Footpaths

In general, segmental pavers will not be accepted on footpaths in residential subdivisions. Approval may be given by the Engineering Officer Development & Regulatory Services for use in commercial areas or suburban shopping centres. Within the Central Business District the Developer must contact Local Asset Services and ascertain the preferred footpath treatment.

All applications for construction of paved footpaths or other specialised surface treatments of footpath fronting developments must be made in writing to the District Manager, Local Asset Services. The application must be accompanied by:

- A full specification and details of the proposed treatment.
- Where required, a full specification of the footpath construction.
- Working drawings at appropriate scales to indicate clearly the layout of proposed footpath and details in plan and cross section.

5.9.3 Pattern Concrete

General

Pattern concrete provides a decorative wearing surface on a concrete pavement and can be used on local access and neighbourhood access roadways as an alternative to pavers. The pattern concrete finish must provide a hard wearing surface and a minimum skid resistance in accordance with the *British Road Research Laboratory Road Note 27, 1969.*

Limitation of Use

Pattern concrete is an approved alternative to pavers and may be used where pavers are approved.

Pavement Design

The pavement must be designed with pavement thickness in accordance with Table B5.5.2, reinforcing mesh and grade N40 concrete.

5.9.4 Coloured Pavement Treatments

Refer to Council's *Reference Specifications for Civil Engineering Work*.

5.9.5 Service Conduits

Spare service conduits 100 mm diameter must be installed in the road formation prior to paving to reduce any future needs for disturbing the pavement and surface. The number of spare conduits must be determined for each estate individually. Kerb markers (minimum number is two) must be provided and must be located at:

- Intersections
- Head or neck of Local Access Road
- At each alternative property boundary at maximum 100 metre spacings
- Shown on engineering plans including the depth

5.9.6 Guide Posts

Guide posts must be installed by the Developer in accordance with Standard Drawing UMS 131.

5.9.7 Flexible Guardrail

Flexible guardrail should conform to the requirements shown in Standard Drawings UMS 132 and UMS 133, and the *MUTCD*. It must be shown on the engineering drawings. Flexible guardrails must provided at locations where the consequences of a vehicle leaving the road pavement would be worse than the vehicle hitting the guardrail. These locations would generally include:

- At steep road embankments.
- At roadside obstacles.
- At structures, ie bridges and culverts.
- At sudden narrowing of road pavement in addition to the use of hazard markers.
- Where pedestrians are vulnerable.
- Median barriers.
- Adjacent to water features.

5.10 QUEENSLAND DEPARTMENT OF MAIN ROADS

For developments or submissions fronting roads controlled by the Queensland Department of Main Roads (Main Roads), Council will require a certificate from Main Roads stating that they are satisfied with the proposal and list any additional requirements they may have.

Council may require the following requirements, in addition to Main Roads requirements:

- Kerb and channel along full site frontage.
- Concrete footpath along full site frontage.
- Road dedication.
- Bus stop set backs/bus bays including bus shelters.
- Concrete bikeways along full site frontage.
- Signage and pavement markings.
- Driveway access restrictions.
- Easements.
- Pedestrian linkages.
- Noise fences/barriers.