Muswellbrook Shire Council

DEVELOPMENT DESIGN SPECIFICATION

AUS-SPEC (Cot 09)

0041 Geometric road layout

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
0	Customisation for Muswellbrook Council Local Government Area	all	AMOP		24/10/2011

Table of Contents

0041 GEOMETRIC ROAD LAYOUT

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

General: Design a road system to achieve the following:

- Provide convenient and safe access for pedestrians, vehicles and cyclists.
- Provide appropriate access for buses, emergency and service vehicles.
- Provide for a quality road network that minimises maintenance costs.
- Provide a convenient zone for public utilities.
- Provide an opportunity for street landscaping.
- Provide convenient parking.
- Have appropriate regard for the climate, geology and topography of the area.
- Provide for phasing of construction to suit access and funding.

1.2 CROSS REFERENCES

Worksections

General: Conform to *0160 Quality (Design).*

Related worksections: The following worksections are related to this worksection:

- *0021 Site regrading.*
- *0042 Pavement design.*
- *0043 Subsurface drainage (Design).*
- *0044 Pathways and cycleways.*
- *0061 Bridges and other structures.*
- *0074 Stormwater drainage (Design).*
- *0075 Control of erosion and stormwater management.*

Workgroup

11 *Construction - Roadways*

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards

AS 1348-2002	Glossary of terms - Roads and traffic engineering.
AS 2890	Parking facilities.
AS 2890.1-2004	Off-street car parking.
AS/NZS 3845: 1999	Road safety barrier systems.

Other publications

AUSTROADS

AGRD01-2006	Guide to road design - Introduction to road design
AGRD02-2006	Guide to road design - Design Considerations
AGTM05-2008	Guide to traffic management Part 5: Road management.
AGTM06-2007	Guide to traffic management Part 6: Intersections, interchanges and crossings.
AGTM08-2008	Guide to traffic management Part 8: Local area traffic management.
AP-G1-2003	Rural road design—guide to the geometric design of rural roads (superseded)
AP-G34-2006	Design vehicles and turning path templates.

AP-G69-2002	Urban road design - Guide to the geometric design of major urban roads.
AP-G11-2005	Guide to traffic engineering practice.
AP-G11.13-1995	Pedestrians.
AP-G11.14-1999	Bicycles.

Institute of Public Works Engineering Australia

Qld Division—1993 Design Guidelines for Subdivisional Streetworks.

Council's Standard Drawings

Typical road cress section and types.

Typical design of property access

1.4 STANDARDS

General

Standard: Road design To Austroads AGRD01 and AGRD02.

Urban design criteria: To AP-G69.

Rural design criteria: To AP-G1.

1.5 INTERPRETATIONS

Abbreviations

General: For the purposes of this worksection the abbreviations given below apply:

AADT: Average Annual Daily Traffic.

LATM: Local Area Traffic Management.

Definitions

General: For the purpose of this worksection the definitions of terms used to define the components of the road reserve are in accordance with AS 1348 and Glossary of Austroads Terms.

The words 'street' and 'road' are interchangeable throughout all parts of this worksection.

- Carriageway: That portion of the road or bridge devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes.
- Footpath: A public way reserved for the movement of pedestrians and of manually propelled vehicles. The paved section of a pathway.
- Pathway: (see verge).
- Pavement: That portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic.
- Shoulder: The portion of formed carriageway that is adjacent to the traffic lanes and flush with the surface of the pavement.
- Verge: That portion of the formation not covered by the carriageway. It may accommodate public utilities, footpaths, stormwater flows, street lighting poles and plantings.
- Minor road: All roads which become part of the public road system and are supplementary to arterial and sub-arterial roads. Minor roads may include local sub-arterial roads, collector roads, Local roads, and access streets.

The terminology of road hierarchy may be different in different states. Refer to the relevant State road authorities for more information www.australia.gov.au.

2 GENERAL DESIGN CONSIDERATIONS

2.1 CONSULTATION

Council and other authorities

Responsibility: Consult with the Council and other relevant authorities during the preparation of design. In addition to the requirements of this worksection ascertain the specific design requirements of these authorities.

Public consultation

General: Provide Public consultation on designs where such action is required by Council policy.

Utilities service plans

Existing services: Obtain service plans from all relevant utilities and other organisations whose services exist within the area of the proposed development. Plot these services on the relevant drawings including the plan and cross-sectional views.

2.2 PLANNING CONCEPTS

Road hierarchy

Requirement: In new areas, as distinct from established areas with a pre-existing road pattern, ensure each class of route reflects its role in the road hierarchy by its visual appearance and physical design. Routes differ in alignment and design according to the volume of traffic they are intended to carry, the desirable traffic speed, and other relevant factors.

Conformance with Development Control Plan

Pattern and width: Conform with Council's Development Control Plan (DCP).

Legibility

General: The following factors assist in achieving clear legibility:

- Differentiation: Reinforce legibility by providing sufficient differentiation between the road functions (see road classifications in **Urban design criteria**).
- Landmark features: Emphasise distinct landmark features such as watercourses, mature vegetation or ridge lines within the structural layout so as to enhance the legibility.
- Aboriginal Cultural Heritage: Coordinate and maintain good communication with relevant authorities and cultural groups.
- Introduced features: Provide the necessary legibility, by the inherent design and functional distinction of the road network in addition to introduced physical features such as pavement and lighting details.

Integrated design principles

Integrated design: Integrate all relevant design principles in the development of the road network. Provide a careful balance between maximising amenity, safety and convenience considerations and those related to the drivers' perception of driving practice.

Acceptable vehicle speed

Requirement: Determine the vehicle speed deemed acceptable for the particular section of road as a fundamental requirement of the design process.

Intersection turning movements

Requirement: Minimise the maximum number of turning movements at intersections or junctions that a driver is required to undertake to reach a particular address within the development.

3 URBAN DESIGN CRITERIA

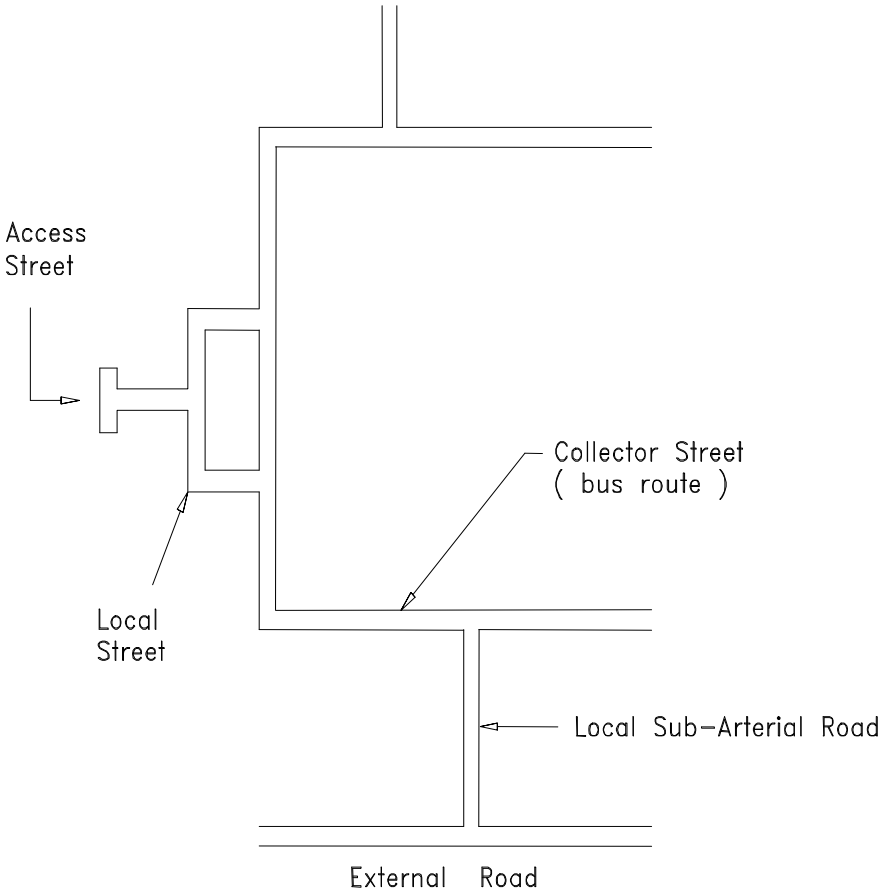
3.1 HIERARCHICAL ROAD NETWORK

Function

Requirement: Design the network such that the predominant function of the road is conveyed to the motorists. Note that each class of road in the network serves a distinct set of functions and a hierarchical road network is essential to maximise road safety, residential amenity and legibility.

Hierarchy

A typical hierarchy is shown below.



Typical road hierarchy

Classification

The four distinct levels of roads are Access Street, Local Street, Collector Street and Local Sub-Arterial Road.

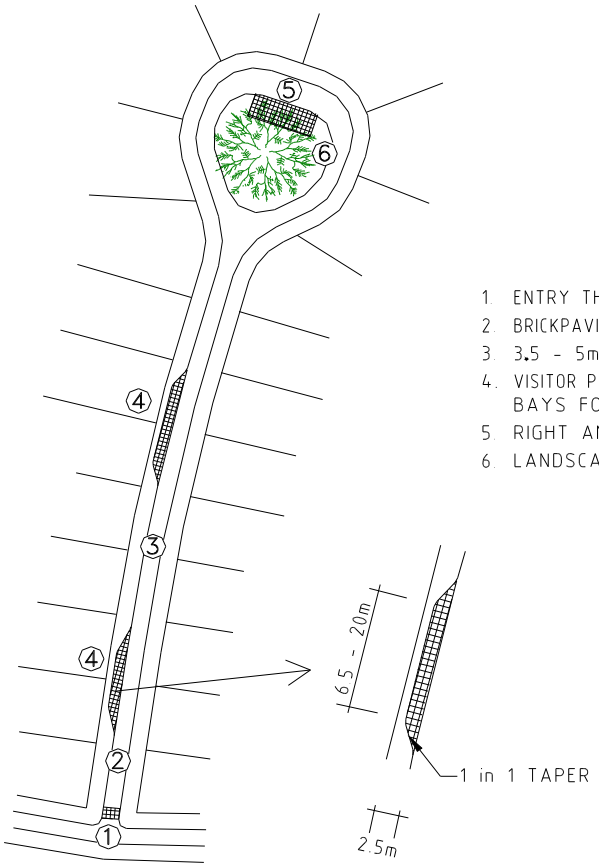
Adopted hierarchy: The generally accepted road hierarchy system adopted is given in **NSW road hierarchy table.**

NSW road hierarchy table

State	**(Lowest Order)**			**(Highest Order)**
NSW	Access Street	Local Street	Collector Street	Local Sub-Arterial Road

Access street

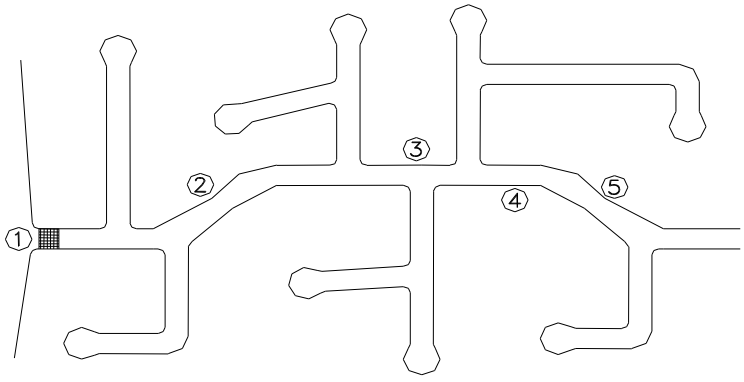
Description: The lowest order road and has as its primary function residential space. Amenity features of access streets facilitate pedestrian and cycle movements, and vehicular traffic is subservient, in terms of speed and volume, to amenity, pedestrians and cyclists. The features of typical access street are shown below.



Typical Access street

Local street

Description: The next level road. As a local residential street, it provides a balance between the status of that street in terms of its access and residential amenity functions. Resident safety and amenity are dominant but to a lesser degree than access streets. A typical local street is shown below.



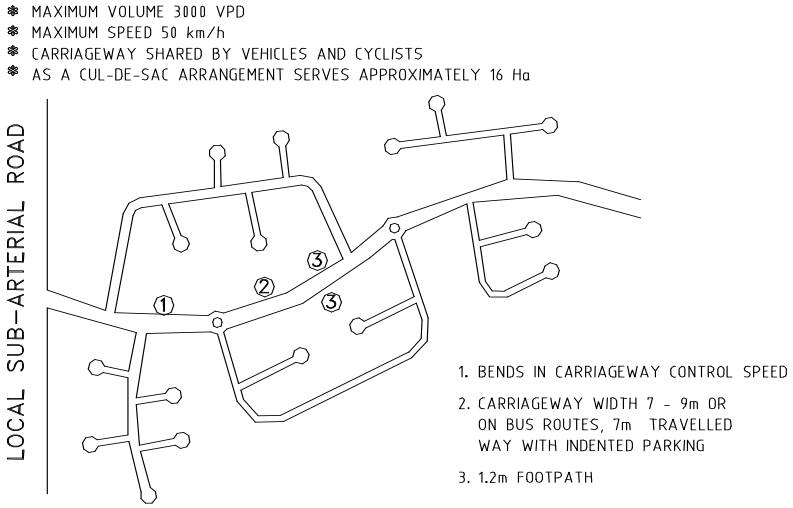
1. BRICK-PAVED ENTRY THRESHOLD SIGNIFIES ENTRY TO LOWER SPEED ENVIRONMENT
2. BENDS IN CARRIAGEWAY CONTROL SPEED
3. SHORT SECTIONS OF STRAIGHT CARRIAGEWAY CONTROL SPEED
4. CARRIAGEWAY WIDTH 7m
5. 1.2m FOOTPATH ON ONE SIDE

Typical local street

Collector street

Description: The second highest order road. It has a residential function but also carries higher volumes of traffic collected from lower order streets.

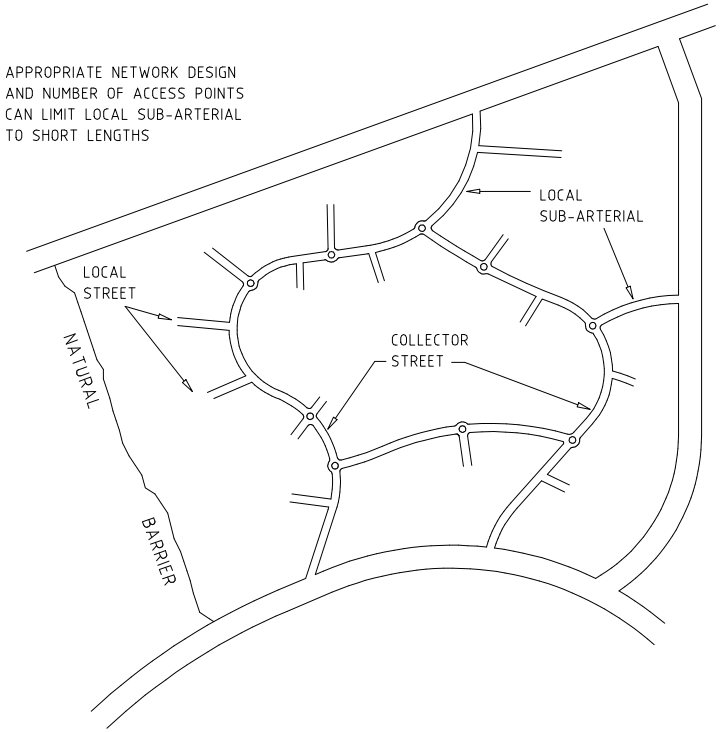
A reasonable level of residential amenity and safety is maintained by restricting traffic volumes and speeds, however, amenity and resident safety do not have the same priority as access streets or local streets. A typical collector street is shown below.



Collector street

Local sub-arterial road

Description: The highest order road within a residential development and its main function is to provide convenient and safe distribution of traffic generated by the development. Provide direct access for single dwelling allotments but access can also be provided to multi-unit developments and non-residential land uses. The local sub-arterial road serves only the development and does not attract through traffic. Typical layout of local Sub-arterial road is shown below.



Local sub-arterial road

3.2 ROAD NETWORK

Design criteria

Routing: Provide routing as follows:

- Do not provide through routes in the internal road system that are more convenient than the external road network.
- Design and locate the external road network to provide routes that are more convenient for potential through traffic within the network.
- Provide major roads at intervals of no more than 1.5km, complete and of adequate capacity to accommodate through network movements.

Road links: Provide road links as follows:

- Do not link one road with another that is more than two levels higher or lower in the hierarchy. In exceptional circumstances roads may link with others that are more than two levels apart.
- Do not provide access from Access streets or Local streets to an access-controlled arterial road.

Traffic volumes and speeds: Ensure that the Traffic volumes and speeds on any road are compatible with the residential functions of that road.

Road layout: Conform the road layout to the requirements of the external road network and satisfy the transport provisions of an outline development plan.

Design features: Ensure that the design features of each type of road conveys to the driver its primary functions and encourage appropriate driver behaviour.

Travel time: Minimise the time required for drivers to travel on all streets within the development.

Internal road connections: Provide connections between internal roads as T-junctions or controlled by roundabouts.

Access street: Maximum length of on Access street ensures that its status as a residential place is retained. Its speed and volume will enable the integration of pedestrian, bicycle and vehicular movements. Make sure that residential convenience is not impaired as a result of speed restraints.

Local sub-arterial road: Minimise the length of local sub-arterial within a development.

Pedestrian or bicycle network: Where Access streets form part of a pedestrian or bicycle network, provide access links suitable connectivity with adjoining Access streets or open space systems so as to ensure such pedestrian and bicycle network are functionally efficient.

3.3 DESIGN SPEED

General

State road authority guidelines: Design speed is generally used as the basic parameter in road design.

Design speed values

Adopt the following design speeds:

- Access Street: 25 km/h.
- Local Street: 50 km/h.
- Collector Street: 50 km/h.
- Local Sub-Arterial Road: 60/80 km/h.

Hazard reduction

Low speeds: Adopt a low design speed to discourage speeding. Avoid, vertical or horizontal curves of low design speed located in otherwise high-speed sections (tangents) to minimise risk or creating a potentially dangerous section of road. Recognise that in low design speed roads, operating speeds will tend to be in excess of arbitrary speed standards.

Hazardous features: Ensure hazardous features are made visible to the driver. Adopt traffic engineering measures that help a driver avoid errors of judgement.

Road safety barriers: Assess and design road safety barriers to AS/NZS 3845.

3.4 GEOMETRIC DESIGN

Longitudinal gradient

General: Adopt the following:

- Minimum gradient of 0.5%.
- In very flat conditions reduce it to 0.3%.
- Where underground drainage with gully pits or other special works are used consider near level grades rather than reverting to the unsatisfactory device of introducing artificial undulations. Provide variable crossfall to achieve the required grade in the gutter.

Intersections: Adopt the following and ensure that:

- Longitudinal grade of the minor street on the approach to an intersection: < 4%,
- The actual gradient is dependent on the type of terrain.
- The design of the road alignment and the grades used are interrelated.
- A steep grade on a minor side street is avoided if vehicles have to stand waiting for traffic in the major road.

Cul-de-sacs: Turning circles in cul-de-sacs on steep grades: < 5 %.

Horizontal curves and tangent lengths

Note the following:

- The horizontal alignment of a road is normally a series of tangents (straights) and curves connected by transition curves.
- The choice of the horizontal alignment is normally determined from the design speeds for a particular street within the road hierarchy (see **Design Speed**).

Speed/radius relation: Make allowance for the following:

- Ensure that, for a given design speed, the minimum radius of curvature utilised is such that drivers can safely negotiate the curve.
- Curves that progressively tighten (e.g., parabolic curves) produce an uncomfortable sense of disorientation and alarm.
- Sudden reverse curves that drivers cannot anticipate also have a potential to cause similar conditions.

Speed restriction: Where speed restriction is provided by curves in a street the relationship between the radius of the curve and the desired vehicle speed is to be derived.

Appropriate lengths for tangents between speed restrictions, which may be curves, narrow sections or other obstructions, is to be derived.

Sight distance on curves is determined by formula, values of which are tabulated in State Road Authorities' *Road Design Guides*.

Vertical curves

Criteria: Design vertical curves such that:

- Vertical curves like simple parabolas are used on all changes of grade exceeding 1%.
- The desirable minimum design speed is 60 km/h.
- The length of the crest vertical curve for stopping sight distance should conform with State Road Authorities' Road Design Guides.

These standards are based on 2.5 second's reaction time that provides a reasonable safety margin for urban conditions.

Riding comfort: Provide the lengths of sag vertical curves to conform with the State road authorities' road design guides.

Sag vertical curves: As residential roads are usually lit at night, the criterion for designing sag vertical curves is a vertical acceleration of:

- 0.05 g for desirable riding comfort.
- 0.10 g for minimum riding comfort.

Side road junctions: Locate junctions of roads at a safe distance from a crest, determined by visibility from the side road. Only locate junctions of a side road where a crest occurs if there is no suitable alternative.

Sag curves: Drainage poses a practical limit to the length of sag curves. Conform to the following:

- A maximum length (in metres) of 15 times the algebraic sum of the intersecting vertical grades (expressed as a percentage) is suggested. This will avoid water ponding in excessively flat sections of kerb and gutter.
- Maintain a minimum grade of 0.5% in the kerb and gutter. This may require some warping of road cross sections at sag points.

Horizontal and vertical alignment coordination

Principles: The three dimensional coordination of the horizontal and vertical alignment of a road aims to improve traffic safety and aesthetics. Economic considerations often require a compromise with aesthetic considerations, whilst traffic safety is fundamental. Apply the following principles:

- The design speed of the road is of the same order in both horizontal and vertical planes.
- Consider three dimensional combined horizontal and vertical stopping sight distance and minimum sight distance.
- Do not introduce sharp horizontal curves at or near the crest of a vertical curve. Ensure that a horizontal curve leaves the vertical curve and is longer than the vertical curve.
- A short vertical curve on a long horizontal curve or a short tangent in the grade-line between sag curves may adversely affect the road's symmetry and appearance.
- A crest vertical curve or a sharp horizontal curve should not occur at or near an intersection or rail crossing.
- Sharp reverse horizontal curves are undesirable in association with a crest vertical curve. The crest can obscure the reverse alignment.
- A small movement in one dimension should not be combined with a large movement in the other.
- A crest can obscure the horizontal alignment and the severity of a horizontal curve. Minimum radius horizontal curves should not, therefore, be used with crest vertical curves.

Superelevation

Criteria: Where possible use curve radii larger than the minimum and superelevation rates less than the maximum.

The minimum radius of curves is determined by the following:

- The design speed.
- The minimum superelevation (or maximum adverse crossfall) at any point on the circular portion of the curve.
- The maximum coefficient of side friction which allows safe lane changing is:
  - 0.15 where there is positive superelevation and
  - 0.12 where there is adverse crossfall.

Low design speed and crowned pavement: Adopt to the following:

- The use of superelevation in association with horizontal curves is an essential aspect of geometric design of roads with design speeds in excess of 60 km/h.
- Access and Local streets are designed for speeds of 50 km/h or less, and with curves of 60 m radius or less, generally have the pavement crowned on a curve instead of superelevation.
- Design standards for such curves have little meaning as drivers usually cut the corners and rely on friction to hold them on a curved path. As the radius of the curve falls, friction becomes more important than superelevation.

High design speed: Conform to the following:

- The maximum superelevation for urban roads of higher design speeds to be 6%.
- Consider with caution any increase in the longitudinal grade leading to excessive crossfall at intersections.
- While it is desirable to superelevate all curves, limit negative crossfall to 3%.

Curve radii: Conform to recommendations for minimum curve radii (tabulated in AUSTROADS AP-G69).

Transitions, offset crowns: Conform to the following:

- Planning: Plans of transitions are desirable on superelevated curves for appearance and to provide a convenient length in which to apply the superelevation.

- On urban roads: Superelevation may be conveniently applied to the road cross section by shifting the crown to 2 m from the outer kerb.
- Access to adjacent properties: The axis of rotation of the cross section for urban roads will normally be the kerb grading on either side which best enables access to adjacent properties and intersections.
- On the outside of superelevation, or where the longitudinal grade of the gutter is < 0.5%, adopt a crossfall of 63 mm in a 450 mm wide gutter.

Road reserve characteristics

Cross section: The cross section of the road reserve is to provide for all functions that the road is expected to fulfil such as:

- including the safe and efficient movement of all users,
- provision for parked vehicles,
- acting as a buffer from traffic nuisance for residents, the provision of public utilities and streetscaping.

Characteristics: Refer to the **Characteristics of roads in residential road networks table**.

Operational aspects: Conform to the following:

- Allow vehicles to proceed safely at the operating speed intended for that level of road in the network with only minor delays in the peak period.
- Take into consideration the restrictions caused by parked vehicles where it is intended or likely that this will occur on the carriageway.
- Vehicles include trucks, emergency vehicles and, on some roads, buses. (Refer to Hierarchical road network for bus routes).

Pedestrians and cyclists: Ensure the safety of pedestrians and cyclists where it is intended they use the carriageway by providing sufficient width.

Access to allotments: Adopt a carriageway width to provide for unobstructed access to individual allotments. Drivers to be able to comfortably enter or reverse from an allotment in a single movement, taking into consideration the possibility of a vehicle being parked on the carriageway opposite the driveway.

Refer Typical road cross section SD #### for detail.

Discourage speeding: Design the carriageway such that it discourages drivers from travelling above the intended speed by reflecting the functions of the road in the network. In particular the width, horizontal and vertical alignment not to be conducive to excessive speeds.

Verge width: Provide appropriate verge to enable the safe location, construction and maintenance of required footpaths and public utility services (above or below ground) and to accommodate the desired level of streetscaping. Wherever possible locate services in common trenches.

Sight distance across verge: Provide appropriate sight distances on the verge when considered in conjunction with the horizontal alignment and permitted fence and property frontage treatments, taking into account expected speeds and pedestrian and cyclist movements.

Base stopping sight distances and junction or intersection sight distances, provided by the verge, on the intended speeds for each road type.

Crossfall

General: Desirably, crown the roads in the centre. Pavement crossfalls on straight roads are discussed in AUSTROADS – AP-G69. Recommended minimum crossfall to be 3%.

Offset crown lines: Consider the following factors affecting levels in urban areas that force departures from these crossfalls.

- Differences in level between road alignments can be taken up by offsetting crown lines or adopting one way crossfalls.
- Sustained crossfalls not to exceed 4%, although up to 6% may be used where unavoidable.

Rate of change: Do not exceed the rate of change of crossfall in the following conditions:

- 6% per 30 m for through traffic;
- 8% per 30 m for free flowing turning movements; or

Precedence of crossfall over grade:

- The crossfall on a Collector street or Local sub-arterial road will take precedence over the grade in minor side streets. Standard practice is to maintain the crossfall on the major road and adjust the minor side street levels to suit.
- The crossfall in side streets to be warped quickly either to a crown or a uniform crossfall depending on the configuration of the side street.
- A rate of change of grade of 2 % in the kerb line of the side street relative to the centre line grading is a reasonable level. dint

Verges and property access

Criteria: A suitable design for the verge will depend on utility services, the width of footpath, access to adjoining properties, likely pedestrian usage and preservation of trees. Low level footpaths are undesirable but may be used if normal crossfalls are impracticable. Refer Council's Standard drawing for a Typical design of property access.

Crossfalls in footpath paving: < 2.5%, to AUSTROADS AP-G11.13 *Guide to traffic engineering practice - Pedestrians* (Also in AP-G69).

Longitudinal grade: To be Parallel to that of the road and may be steeper than 5%.

Level differences across the road: Differences in level across the road between road reserve boundaries may be accommodated by:

- Cutting at the boundary on the high side and providing the verge at normal level and crossfall.
- Battering at the boundary over half the verge width with the half against the kerb constructed at standard crossfall.
- A uniform crossfall across the carriageway.
- The lower verge being depressed below the gutter level.

The above measures can be used singularly or combined.

Verge formation: Extend with a 0.5 m berm beyond the road reserve boundary.

Driveway profile: Design such that:

- A vehicular driveway centreline profile for the property access is provided.
- Check this design using critical car templates, available from Council,
- The design ensures that vehicles can use the driveway satisfactorily.

Intersections

Intersection design to be in accordance with Austroad AGRD04-09 Intersections and if the intersection is part of RTA road, then it shall comply with relevant RTA specification.

Criteria: Locate intersections in such a way that:

- The streets intersect preferably at right-angles and not less than 70º.
- The landform allows clear sight distance on each of the approach legs of the intersection.
- The minor street intersects the convex side of the major street.
- The vertical grade lines at the intersection do not impose undue driving difficulties.
- The vertical grade lines at the intersection will allow for any direct surface drainage.
- Where a left turn, two minor side streets intersecting a major street in a staggered pattern to have a minimum centreline spacing of 40 m.
- Right turn manoeuvre between the staggered streets is likely to occur frequently.

Traffic volumes: The design of intersections or junctions to be such that it allows all movements to occur safely without undue delay. Use projected traffic volumes in designing all intersections or junctions on Local sub-arterial roads.

State roads and national highways: Intersection design for the junction of Council's roads with existing state rural or urban roads and national highways: To AUSTROADS *AGTM 06/07 Guide to traffic management.*

Approval of State road authority: Design, approve and construct intersections with state roads or national highways in accordance with the requirements of the State road authority.

Sight distance: Provide adequate stopping and sight distances for horizontal and vertical curves at all intersections.

Parking: Where required, make appropriate provision for vehicles to park safely.

Drainage: The drainage function of the carriageway and/or road reserve is to be satisfied by the road reserve cross-section profile.

Turning movements: All vehicle turning movements to be accommodated utilising AUSTROADS AP-G34 *design vehicles and turning templates*, as follows:

- For intersection turning movements involving local sub-arterial roads, the 'design semi-trailer' with turning path radius 15.0 m.
- For intersection turning movements involving local streets or collector streets, but not local sub-arterial roads, the 'design single unit' bus with turning path radius 13 m.
- For intersection turning movements on access streets but not involving local sub-arterial roads, collector streets or local streets, the garbage collection vehicle used by the local authority.
- For turning movements at the head of cul-de-sac access streets sufficient area is provided for the 'design single unit' truck to make a three-point turn or, where the length of the cul-de-sac is less than 60 m for the 'design car' to make a three-point turn. Where driveway entrances are used for turning movements, the required area is designed and constructed to withstand the relevant loads.

Turning radii: Turning radii at intersections or driveways on local sub-arterial road accommodate the intended movements without allowing desired speeds to be exceeded.

Bus routes: On bus routes 3-centred curves with radii 7.0 m, 10.0 m, 7.0 m are used at junctions and intersections.

3.5 ROAD NETWORK ELEMENTS

Roundabouts

Criteria: Design roundabouts to the requirements of the publication (AUSTROADS *AGTM 06/07 Guide to traffic management)* Designs adopting alternative criteria will be considered on their merits.

Design roundabouts to conform to the following:

- Functional design to achieve safety of all users and traffic performance.
- Entry width to provide adequate capacity.
- Adequate circulation width, compatible with the entry widths and design vehicles eg. buses, trucks, cars.
- Central islands of diameter sufficient only to give drivers guidance on the manoeuvres expected.
- Deflection of the traffic to the left on entry to promote gyratory movement.
- Adequate deflection of crossing movements to ensure low traffic speeds.
- A simple, clear and conspicuous layout.
- Design to ensure that the speed of all vehicles approaching the intersection will be less than 50 km/h.

Approval: Approval of roundabouts is required by the Counci

Traffic calming

Criteria: Design calming devices such as thresholds, slowpoints, speed humps, chicanes and splitter islands to AUSTROADS AGTM08 *Guide to traffic management--Local area traffic management.*

Comply devices: Design to the following:

- Streetscape:
  - . Reduce the linearity of the street by segmentation.
  - . Avoid continuous long straight lines (e.g. kerb lines).
  - . Enhance existing landscape character.
  - . Maximise continuity between existing and new landscape areas.
- Location of devices/changes:
  - . Locate devices other than at intersections to be consistent with streetscape requirements.
  - . The exact location of devices to be compatible with existing street lighting, drainage pits, driveways, and services.
  - . Locate slowing devices optimally at spacings of 100 m–150 m.
- Design vehicles:
  - . Ensure emergency vehicles are able to reach all residences and properties.
  - . Local streets with a 'feeding' function between arterial roads and minor local streets might be designed for a AUSTROADS *Design vehicles and turning path templates.*

  - Where bus routes are involved, allow buses to pass without mounting kerbs and with minimised discomfort to passengers.
  - Provided for building construction traffic in newly developing areas where street systems are being developed in line with local area traffic management (LATM) principles.
- Control of vehicle speeds: Adopt to the following
  - Maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowings have only minor effects on average speeds, and usually little or no effect on maximum speeds.
  - Speed reduction can be achieved using devices which shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platform pedestrian/school/bicycle crossings).
  - Speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 300 m), using appropriate devices, streetscapes, or street alignment to create short sight lines.
- Visibility requirements (sight distance): Adopt the following:
  - Provide adequate critical sight distances such that evasive action may be taken by either party in a potential conflict situation. Relate sight distances to likely operating speeds.
  - Consider sight distance to include those of and for pedestrians and cyclists, as well as for drivers.
  - Ensure night time visibility of street features is adequate. Locate speed control devices particularly near existing street lighting if practicable, and delineate all street features/furniture for night time operation. Provide additional street lighting at proposed new speed control devices located away from existing street lighting.
- Critical dimensions.
- Dimensions: Many devices to be designed for their normal use by cars, but with provision (such as mountable kerbs) for larger vehicles. Some typical dimensions include:
  - Pavement narrowings.
  - Single lane 3.50 m between kerbs.
  - 3.75 m between obstructions.
  - Two lane 5.50 m minimum between kerbs.
  - Bicycle lanes (including adjacent to pavement narrowings): 1.2 m absolute minimum (1.0 m in special circumstances in accordance with *AUSTROADS AP-G11.14 Guide to traffic engineering practice—Part 14. Bicycles*).
  - Plateau or platform areas: 75 mm to 150 mm height maximum, with 1 in 15 ramp slope relative to road grade.
  - Width of clear sight path through slowing devices:1.0 m maximum (i.e. the width of the portion of carriageway which does not have its line of sight through the device blocked by streetscape materials, usually vegetation).
  - Dimensions of mountable areas required for the passage of large vehicles to be determined by appropriate turning templates.

Approval: Approval of traffic calming devices is required by the Council.

Parking

On-site: Conform to the following:

- Accommodate on-site parking requirements for normal levels of activity associated with any land use.
- Locate all on-site parking of dimensions that allow convenient and safe access and usage.
- The number of on-site parking spaces for non-residential land uses conforms to parking standards as determined by the relevant authority.
- The layout and access arrangements for parking areas for non-residential land uses: To AS 2890.1.

On-site residential spaces: Conform to the following: Provide two car parking spaces (which may be in tandem) are on-site for each single dwelling allotment. Provide three spaces on-site for each two dwelling units for multi-unit residential developments.

Dimension: Include in the on-site parking one space for each residential unit within the allowable building area and with a minimum dimension of 5.0 m by 3.0 m.

Road reserve parking: Provide adequate parking within the road reserve for visitors, service vehicles and any excess resident parking since a particular dwelling may generate a high demand for parking.

Future spaces: On single lane carriageways provide one space for each two allotments on the verge within 25 m of each allotment, with scope to provide one additional space for single dwelling allotments or for each two units in a multi-unit development if required at a future time.

Short term truck parking: On single lane carriageways combine a number of verge spaces are combined to provide for short term truck parking within 40 m of any allotment.

Verge and carriageway parking: On single lane access streets provide parking spaces within the verge. Provide verge and carriageway parking such that it is:

- Of adequate dimensions.
- Convenient and safe to access.
- Well defined with traffic control devices.
- Provided with an all-weather surface.
- Does not restrict the safe passage of vehicular and pedestrian traffic.

Obstruction due to cars on the opposite side of the street: Provide adequate available parking to minimise the possibility of driveway access being obstructed by cars parked on the opposite side of the street.

Joint use: For non-residential land uses provide the opportunity for maximum joint use of shared parking by a number of complementary uses.

Road reserve space dimensions: Conform to the following:

- Single (car) space: 6.5 m x 2.5 m
- Combined spaces for two cars:13.0 m x 2.5 m and
- For truck parking: 20 m x 2.8 m with adequate tapers at both ends to allow the necessary parking manoeuvres determined by using *AUSTROADS AP-G34 Design vehicles and turning path templates*.

Verge spaces, indented parking: Construct all verge spaces and indented parking areas of concrete, interlocking pavers, lawn pavers, bitumen with crushed rock or other suitable base material and designed to withstand the loads and manoeuvring stresses of vehicles expected to use those spaces.

Right-angled parking: Provide right-angled parking only on access streets and local streets where speeds do not exceed 40 km/h.

Bus routes criteria

General: Conform to the following:

- Bus routes will normally be identified by Council. It is important that the road hierarchy adequately caters for buses.
- The main criteria in determining the location of bus routes is that, no more than 5% of residents have to walk in excess of 400 metres to catch a bus.
- Normally roads above the local street in the hierarchy are designed as bus routes.

Bus route design: to the **Bus route criteria table**.

Bus route criteria table

Road	**Carriageway Width (min)**	**Stops (Spacing)**	**Bays**
Collector*	9 m	400 metre **	Single
Local sub-arterial	11 m	400 metre	Shelters***
Arterial	13 m	400 metre	Shelters and bays
* Collector roads not identified as bus routes may have 7 m carriageways (see Table 2.5) ** Loop roads with single entry/exit only require stops and bays on one side road. *** Shelters are subject to Council's requirements.			

4 RURAL DESIGN CRITERIA

4.1 GENERAL

Classifications
Road: Rural classification: To *AUSTROADS AP-G1*.

Application
General: In addition to the foregoing sections this section specifically applies to all those sites identified as being suited to rural subdivisions inclusive of rural home sites and hobby farms types of developments.

4.2 DESIGN SPEED

General
Criteria: Design speed is used as the basic parameter of design standards and the determination of the minimum design value for other elements for Council Works is to be based on the concept of a 'speed environment' as outlined in AUSTROADS *AP-G1.*

Superelevation: Where appropriate, superelevation, widening and centreline shift and their associated transitions will comply with the relevant State Road Authorities' *Road Design Guide* or *AUSTROADS AP-G1.*

Restricted access to major roads: Design all rural subdivisions to minimise access to major roads.

Limit access to one point on to local, collector, local sub-arterial or arterial road networks.

Kerb and gutter: Kerb and gutter on both sides of roads and piped drainage will generally be required in all rural residential subdivisions.

Table drain: Provide a dish drain, or similar structure along the invert of table drains where scour is likely to occur. Also, for grades of less than 0.8%, the inverts of the drain are to be lined to prevent siltation.

Sight distances
Stopping and sight distance: Provide stopping and sight distance at all points on the road such that:

- The stopping distance is measured from an eye height of 1.15 m to an object height of 0.20 m, using a reaction time of 2.5 seconds.
- A minimum sight distance measured from a height of 1.15 m to a height of 1.15 m is preferable for speeds of 60 km/h and over.

Tables are provided in the relevant State road authorities' *Road Design Guide*.

Stopping and braking distance
Calculation: Stopping distance is the sum of the braking distance and the distance the vehicle travels during a reaction time of 2.5 seconds, and may be calculated using the formula or tables in AP-G1 section 8.3:

(Source: AUSTROADS *AP-G1 Rural road design-Guide to the geometric design of rural roads*.)

4.3 GEOMETRIC DESIGN

Horizontal and vertical alignment
Criteria: Design horizontal and vertical curves to *AUSTROADS Guide to geometric design of rural roads*. These requirements are essential to satisfy the safety and performance of proper road design. Design roads having both horizontal and vertical curvature to conform with the terrain to achieve desirable aesthetic quality and being in harmony with the landform.

Intersections
Criteria: Design intersections to *AUSTROADS AGTM06 Guide to traffic management--Intersections, interchanges and crossings*. The type of intersection required depends on existing and planned connecting roads. Generally intersections with main and local roads will conform to the layouts shown below.

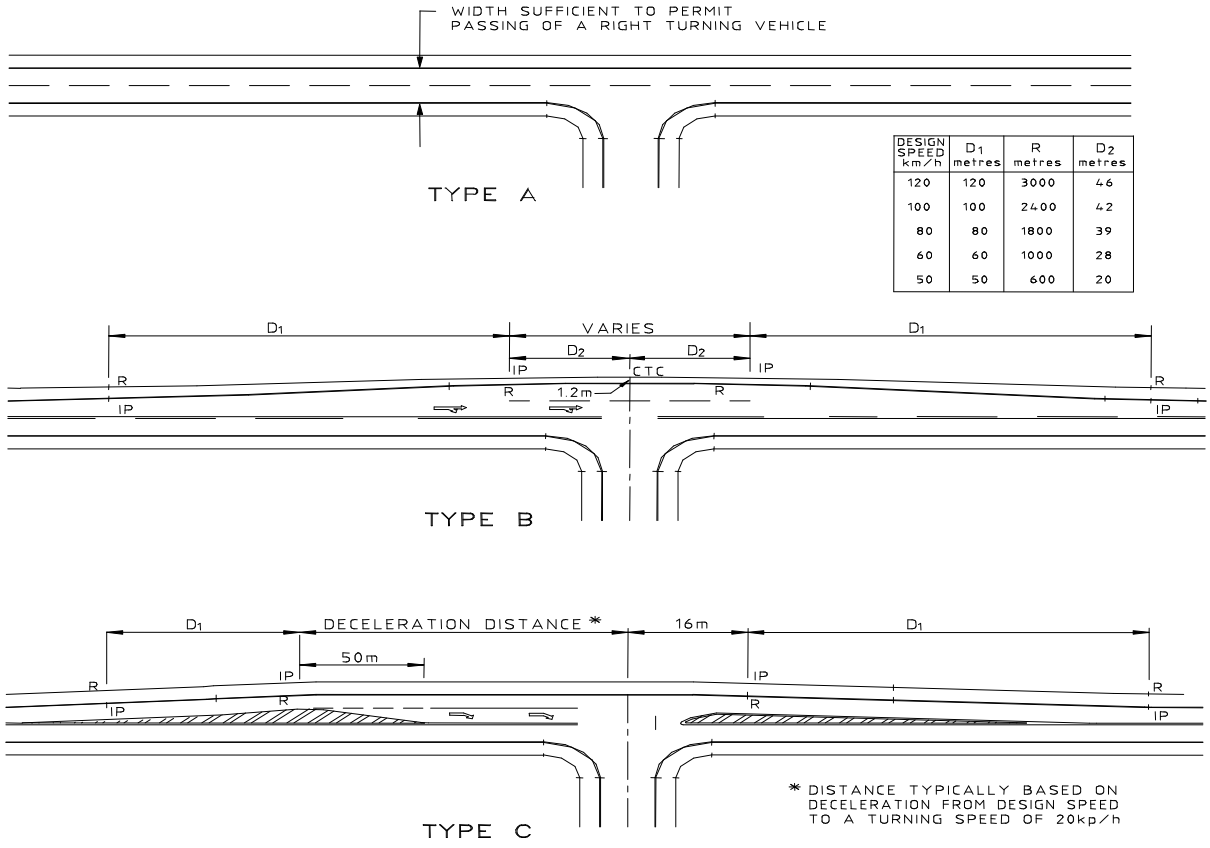
Sight distance: Provide adequate sight distance at intersections both horizontally and vertically. Examine each intersection location for conformance with the criteria for Approach Sight Distance (ASD), Entering Sight Distance (ESD) and Safe Intersection Sight Distance (SISD).

ASD, ESD and SISD relate as follows:

- ASD relates to the ability of drivers to observe the roadway layout at an anticipated approach speed.

- ESD relates to the driver entering the intersection from a minor road and ability to observe the roadway layout and assess traffic gaps.
- SISD relates to an overall check that vehicles utilising the intersection have sufficient visibility to allow reaction and deceleration so as to provide adequate stopping distance in potential collision situations.

Tabulated speed/sight distance requirements together with detailed explanations for each of the sight distance criteria are given in *AUSTROADS AGTM06 Guide to traffic management--Intersections, interchanges and crossings*. Repositioning of an intersection may be required to obtain conformance with the sight distance criteria.



Typical rural intersection treatments

Staggered-T intersections: Staggered-T arrangements proposed for rural cross-intersections can be ‘right to left’ or ‘left to right’ type. Each type has either safety or cost advantages and selection should consider traffic volumes and available width.

Figures and discussion on staggered-T treatments are given in *AUSTROADS AGTM06 Guide to traffic management--Intersections, interchanges and crossings*.

Plan transitions

Widening and shift on curves: A plan transition is the length over which widening and shift is developed from the ‘tangent-spiral’ point to the ‘spiral-curve’ point; i.e., the length between the tangent and the curve.

Restrictions: In urban road design it is often impracticable to use plan transitions as kerb lines are fixed in plan and any shift requires carriageway widening. Widening on horizontal curves compensates for differential tracking of front and rear wheels of vehicles; overhang of vehicles; and transition paths. Where proposed roads are curved, consider the adequacy of carriageway width.

Crossfall changes: Abrupt changes in crossfall, can cause discomfort in travel and create a visible kink in the kerb line. Conform to the following:

- Ensure a rate of change of kerb line of no more than 0.5 % relative to the centreline to avoid this. The wider the pavement the longer the transition.
- Use superelevation transitions at all changes in crossfall, not just for curves. Drainage problems can arise with superelevation transitions which may require extra gully pits and steeper gutter crossfalls.
- Where crossfalls change at intersections, draw profiles of the kerb line. Calculated points can be adjusted to present a smooth curve.

Carriageways

General: Provide single carriageway widths for rural roads to the **Single carriageway road width table** . Refer to AUSTROADS AP-G1 for detailed requirements.

Single carriageway road widths table

Road type	**Carriageway width**
Major road over 1,000 AADT	7 metre seal with 2 × 1 metre shoulder
Minor road up to 1,000 AADT	6.2 metre seal with 2 × 1 metre shoulders
Minor no-through road up to 150 AADT	3.5 metre seal with 2 × 1 metre shoulders
Rural residential street with kerb and gutter —up to 250 AADT —over 250 AADT	 5 metre 7 metre

Superelevation design speed

General: Consider the use of maximum superelevation where the radius of the curve in approaching the minimum speed environment. See *AUSTROADS AP-G1 Rural road design-- guide to the geometric design of rural roads.* At low and intermediate ranges of design speed (i.e. below 80 km/h) it is desirable to superelevate all curves at least to a value equal the normal crossfall of straights.

Scour protection

Scour protection of roadside drainage and table drains: Scour protection of roadside drainage and table drains is required. The level of protection will depend on the nature of the soils, road gradients and volume of stormwater runoff.

Protection: Protection works may involve concrete lined channels, turfing, rock pitching, grass seeding, individually or any combination of these. Carry out geotechnical investigations to determine the level and extent of any protection works prior to proceeding to final design stage.

5 EXECUTION

5.1 DOCUMENTATION

Design calculations

Calculations: Provide results and cite software used for relevant distance or curvature calculations. Where friction is a factor in layout/geometry then cite the pavement type assumed for surface conditions and noise minimisation. Provide a design development document to council with design drawings.

Drawing requirements

General: Reduction ratios: The reduction ratios for plans will be as follows:

- All plans for council works 1:500, however, rural plans may be 1:1000.
- Longitudinal Sections 1:500 Horizontal and 1:100 Vertical.
- Cross Sections 1:100 Natural.

Drawing sheets

Scope: Comply with Annexure B of 0160 *Quality (Design)* for the scope and sequence of drawing sheets. Provide separate sheets for the following:

- Cover sheets.
- Plan views.
- Longitudinal sections.
- Cross sections.
- Structural details.
- Standard drawings.

Drawing presentation

Presentation: Drawings form part of the permanent record and are legal documents. Keep terminology in 'plain English' where possible, enabling drawings to be easily read and understood by those involved in the construction of the Works.

Drawings: Present drawings on A3 sheets unless otherwise authorised. Prepare drawings such that they are clear and legible and in consistent lettering and style and clearly referenced with notations and tables as appropriate.

Longitudinal Sections: Scales of 1:500 Horizontal and 1:100 Vertical.

Compliance

Consistency: The scope and sequence of drawing sheets are to be consistent with the example provided in Annexure B of 0160 *Quality (Design).*

Certification

Approval: Drawings are signed by an engineer who is qualified to do so as detailed in 0161 Quality (Design))

Certificate: Format the certificate as detailed in 0160 *Quality (Design).*