

Roads

Master Specification

RD-GM-D1 Road Design

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RD-GM-D1 Road Design

1 General

- 1.1 This Part defines the Requirements for the Design of Roads (excluding tunnels).
- 1.2 The Austroads Guide to Road Design (AGRD) and Austroads Guide to Traffic Management (AGTM) are the primary technical references adopted for road design by the Department for Infrastructure and Transport (the Department).
- 1.3 This Master Specification Part has been developed to clarify or enhance the Austroads Guides and improve consistency of interpretation for State maintained roads in South Australia.

2 Objectives of Road Design (AGRD Part 1)

Jurisdictional Supplements (Section 1.6)

- 2.1 This Master Specification Part is the South Australian jurisdictional supplement to AGRD.
- 2.2 The Department's road design standards and guidelines can be located at <https://dit.sa.gov.au/standards>.

Traffic Control Devices

- 2.3 The South Australian Commissioner of Highways' Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices sets out the mandatory requirements for the use of traffic control devices in South Australia. (reference <https://www.dit.sa.gov.au/standards/tass>.) It includes:
 - a) Part 1 – Legal Responsibilities;
 - b) Part 2 – Code of Technical Requirements.
- 2.4 The design of traffic control devices is to comply with Australian Standards AS 1742 Parts 1 to 15 and the Department's Code of Technical Requirements and Operational Instructions that are available at <https://www.dit.sa.gov.au/standards/tass>.
- 2.5 The design of all pavement markings will comply with the Department's Pavement Marking Manual available at <https://www.dit.sa.gov.au/standards/tass>.
- 2.6 Where the road design incorporates traffic control devices, (e.g. traffic signs, traffic signals), traffic control devices will comply with the provisions of Master Specification Part RD-LM-D1 "Traffic Control Device Design".

Maintenance Agreements

- 2.7 The standard management and maintenance agreements between the Department and Councils is detailed in Operational Instruction 20.1 "Care, Control and Management of Roads by the Commissioner of Highways" available at <https://www.dit.sa.gov.au/standards/tass>.

Road Design across the Transport Management System (Section 2)

Road Safety Audit (Section 2.2.3)

- 2.8 Refer to Department's Master Specification Part RD-GM-02 "Road Safety Audits" for requirements.

Safe System Assessment (SSA) (Section 2.2.3)

- 2.9 The Department has developed Safe System Assessment (SSA) guidelines which specify when a SSA should be conducted and to provide guidance on the assessment process.
- 2.10 The Department's safe system guidelines and templates should be used in conjunction with Austroads "Safe System Assessment Framework". The Department's SSA Guideline and Template are available at <https://www.dit.sa.gov.au/standards/roads-all>.

- 2.11 The SSA will be required for all projects. SSAs are recommended and not mandatory for projects under <\$2M but require documentation of how the project has considered safe system principles.
- 2.12 A safe systems assessment is to be completed on all shortlisted options in the project planning phase and subsequently updated through the detailed design development phases.

Principles and Objectives of Road Design (Section 3)

- 2.13 The Principal has no supplementary requirements for this section.

Road Design Application (Section 4)

Phases of Design (Section 4.2)

- 2.14 The requirements for “Phase 1 – Establish the Preferred Solution” and Phase 2 – “Further Develop the Solution” are detailed in the Master Specification Parts:
- a) PC-PL3 “Concept Design Development”; and
 - b) PC-PL4 “Constructability Assessments”.
- 2.15 The requirements Phase 3 – “Detailed Design” are detailed with Master Specification Parts:
- a) PC-EMD1 “Engineering and Design Management”;
 - b) PC-EDM2 “Safety Management in Design”; and
 - c) PC-EDM3 “Independent Design Certification”.

Normal Design Domain (NDD) (Section 4.4.1)

- 2.16 The designer is to select parameters within the Normal Design Domain (NDD) to develop value for money designs that manage the inherent risk ‘so far as is reasonably practicable’ whilst providing the desired operational and community benefit.
- 2.17 Values within the upper bound and lower bound of NDD (i.e. minimum to desirable) are to be selected based on the road classification, functional hierarchy, location, traffic volumes and topography.
- 2.18 The selection of design parameters shall be documented in the design basis and the design report(s) in accordance with PC-EDM1.
- 2.19 Acceptance of the design basis by DIT Road Design at the short-list concept and preliminary design phases shall constitute a **Hold Point**.

Extended Design Domain (EDD) (Section 4.4.2)

- 2.20 The use of Extended Design Domain (EDD) parameters is classified as a design exception.
- 2.21 Values within EDD may be considered on modifications or upgrades to existing roadways in a constrained location or environment, subject to their acceptance.

Design Exceptions (Section 4.5)

- 2.22 The adoption of road design parameters and elements outside extended design domain are considered a design departure and classified as a design exception.
- 2.23 The Extended Design Domain and Design Departure procedure and form is available at https://dit.sa.gov.au/standards/design_management.
- 2.24 Design exceptions (EDD / departures) requires acceptance by the nominated Engineering Authority.
- 2.25 The acceptance of a Design Exceptions (EDD or Departure) is a **Hold Point**.

Legal Liability (Section 4.6.1)

- 2.26 The Principal owes no duty to the Designer to review or examine any of the designer’s calculations, assessments or documents for compliance to the Austroads Guide to Road Design, the Master Specification, Project Requirements or any applicable legislation.

- 2.27 Notwithstanding any endorsement, approval, acceptance of the design documents or release of Hold Point, by (or on behalf of) the Principal:
- a) the designer is not relieved of its legal liabilities; and
 - b) the Principal has no liability whatsoever to the designer by reason of any errors, deficiencies, defects or omissions in the designer's documents.

The Road Design Process (Section 4)

- 2.28 Further information on the requirements are detailed with Master Specification parts:
- a) PC-EMD1 "Engineering and Design Management";
 - b) PC-EDM2 "Safety Management in Design"; and
 - c) PC-EDM3 "Independent Design Certification".

3 Network Wide Design (AGRD Part 2)

- 3.1 The Department notes Austroads is currently developing an update to AGRD Part 2 to provide guidance on Network Wide Design.
- 3.2 Prior to its implementation designers are to consider the individual design element in the context of the wider network, location, topography, and crash history.

4 Geometric Road Design (AGRD Part 3)

Introduction (Section 1)

- 4.1 The Department has no supplementary comments for this section.

Fundamental Considerations (Section 2)

Location (Section 2.2.1)

- 4.2 The Department has locational classes for each State maintained roads (available on the DIT Road Asset Information Map) in the following location classes: CBD / inner urban / outer urban / rural.
- 4.3 The designer is to confirm the road location classification with DIT Road design.
- 4.4 The area class for rural roads through the built-up areas (townships) are to be classified based on adjacent land use (e.g. inner urban or outer urban).

Road Classification (Section 2.2.2)

- 4.5 The Department has classified State maintained roads (available on the DIT road asset information map) in the following categories: motorway / arterial / collector / local access.
- 4.6 The designer is to confirm the road classification with DIT road design section.
- 4.7 The functional hierarchy of State maintained roads within South Australia is on Location SA (interactive online map <http://location.sa.gov.au/viewer/>).
- 4.8 Roads classified as freight routes are nominated in Location SA. <http://location.sa.gov.au/viewer/>.

Traffic Volume and Composition (Section 2.2.3)

- 4.9 The traffic volume and composition of State maintained roads within South Australia is included in the Location SA interactive online map <http://location.sa.gov.au/viewer/>.
- 4.10 Further information on existing traffic volumes, composition and turn movements is available on the Department Traffic Intelligence Map and available on request.
- 4.11 Traffic modelling is to be completed in accordance with the Master Specification Part RD-GM-D4 "Traffic Analysis and Modelling".

- 4.12 The designer is to confirm with the Principal on the “future year” traffic volumes and composition to be adopted in detailed design.

Design Vehicle (Section 2.2.7)

- 4.13 The selection of the design vehicle for the roadway will be in accordance with:
- AGRDR Part 4, Section 5.2; and
 - the approved heavy vehicle route networks in South Australia, available on RAVnet (an interactive online map system <http://maps.sa.gov.au/ravnet/>).
- 4.14 The design vehicle and checking vehicle to be adopted for intersections, is detailed in AGRDR Part 4A Section 5 and the supplementary requirements of this Master Specification part.
- 4.15 The South Australia routes identified as over dimensional routes are available on the internet https://www.sa.gov.au/data/assets/pdf_file/0010/369082/Freight_class_oversize_overmass_book.pdf.
- 4.16 The designer shall confirm with DIT Network Management Services (NMS) if the roadway operates under a permit system with additional vehicles not listed in RavNET.
- 4.17 The width allowance for over-dimensional vehicles will include:
- a clear pavement width of 4.5m for the prime mover and trailer; and
 - full width allowance 900mm above the pavement for the over-dimensional load.
- 4.18 The design of all roads will enable safe and efficient emergency access for ambulance (SAAS), police (SAPOL), fire (SAMFS / CFS) and emergency (SES) vehicles to adjacent buildings and facilities.

Access Management (Section 2.2.10)

- 4.19 The designer shall consult with the DIT Network Management Services to confirm if the roadway is a “controlled-access road”, (restricting access to adjacent properties) or a “local-access road”.

Drainage (Section 2.2.11)

- 4.20 Road Drainage requirements are documented in Master Specification parts RD-DK-D1.

Utility Services (Section 2.2.12)

- 4.21 The designer is to assess and coordinate the road design with Utility Services as detailed in the Master Specification Part PC-US1.
- 4.22 The location of SA Water and SA Power Network services is included in the Location SA interactive online map <http://location.sa.gov.au/viewer/>.

Topography / Geology (Section 2.2.12)

- 4.23 The Department has classified the terrain for each State maintained road (available on the DIT Road Asset Information Map) with following types: flat / undulating / hilly / or mountainous.
- 4.24 The designer is to confirm the terrain type with the DIT Road design.

Speed Parameters (Section 3)

- 4.25 The geometric design speed is to be determined from the 85th percentile speed in accordance with Section 3.2.2 and Commentary 1.
- 4.26 The geometric design speed is to be documented in the design basis at the preferred concept and preliminary design stages and endorsed by DIT Road design.

Inner Urban Roads (Section 3.3)

- 4.27 For inner urban Roads with a posted speed limit greater than 60 km/h the geometric design speeds shall be determined in accordance with Section 3.3.2.

- 4.28 The Department has assessed speed profile data in the inner urban area from observed traffic counters over 11 years at 47 different sites mid-block locations with a posted speed limit of 60 km/h or 50 km/h in the Inner Urban area. Analysis determined the median 85th percentile operational speed was very close to the posted speed limit (60.5 km/h and 52 km/h respectively), and consistent with the speed surveys conducted by VicRoads. Speed data information is available on request (ref KNet # 17136041)
- 4.29 For inner urban roads with a posted speed limit of 50 or 60 km/h the adoption of the geometric design speed equivalent to the posted speed limit is considered within the normal design domain.

High Speed - Outer Urban or Rural Roads and Motorways (Section 3.4.1 & 3.4.2)

- 4.30 Design speed for high speed outer urban or rural roads and motorways is to be in accordance with Section 3.5.2 - New Rural Roads.
- 4.31 Design speed for existing high standard outer urban and high speed rural roads is to be in accordance with observed 85th percentile operational speed data. When existing data is not available the design speed is to be determined in accordance with Section 3.3.2 and Section 3.4.

Intermediate and Low Speed - Outer Urban and Rural Roads (Sections 3.4.2 & 3.4.3)

- 4.32 In addition to the description in Section 3.4.3, roads with speed advisory signs on horizontal curves, can be considered as intermediate or low speed roads.
- 4.33 To ensure consistency, uniformity and driver expectation on the road network, the designer is to determine the 85th percentile operating speed for each element of the road using the Operating Speed Model as per Section 3.4 and Appendix E, or observed traffic data (where available).

Cross Section (Section 4)

- 4.34 Selection of cross sections selection will be aligned with the iRAP star rating nominated by the Department for the roadway and road stereotype, in accordance with AP-R619-20, Network Design for Road Safety, Users Guide.
- 4.35 The selection of cross section elements shall accommodate the nominated over-dimensional design vehicle.

Traffic Lane Widths (Section 4.2.4)

- 4.36 The Department measures lane widths to the “kerb line” as shown in Figure 4.8. This corresponds to the “line of kerb” as shown in Figure 4.20 for different kerb profiles.

Inner Urban Road Widths (Sections 4.2.5 & 4.4)

- 4.37 State maintained roads within the inner urban area vary from strategic freight routes to urban connector roads through shopping precincts with high pedestrian activity. The selection of road cross sectional elements shall balance the safety risk to all road users and be commensurate with the:
- location and adjacent land use;
 - pedestrian and cyclist activity; and
 - traffic volumes and vehicle mix.
- 4.38 Provision for cyclist (either on road or off-road facility) are to be included for all inner urban roads.
- 4.39 For inner urban roads with posted speed limit greater than 60 km/h an off road bicycle facility (shared path or separated bike path) should be provided wherever practicable.
- 4.40 The width of cross section elements within the normal design domain are as detailed in Table RD-GM-D1 4-1.

Table RD-GM-D1 4-1 Inner Urban Road Lane Widths within Normal Design Domain

Cross Section Element	Freight routes and Roads > 60 km/h	Urban arterial roads (non-freight routes)	Urban collector or local roads
Urban border (nature strip and footpath)	3.0 - 5.0m	3.0 - 5.0m	3.0 - 5.0m
Bicycle lanes	1.5 – 1.8m (refer Cl 4.38)	1.2 - 1.5m	1.2 - 1.5m
Kerbside lanes (with a bike lane)	3.5m	3.4m	3.3m
Kerbside lanes (with an off-road bicycle facility)	3.7m	3.5m	3.5m
Other through lanes	3.2 - 3.5m	3.0 - 3.3m	3.0 - 3.3m
Exclusive turn lanes	3.1 - 3.3m	3.0 - 3.3m	3.0 - 3.1m
Bus lane / bus only lane	3.3 - 3.5m	3.3 - 3.5m	3.3 - 3.5 m

Outer Urban and Rural Roads and Urban Motorways (Section 4.2.6)

- 4.41 Cross section elements for single carriageways, divided carriageways and urban motorways will be as detailed in Austroads Section 4.2.6 and Table 4.4, 4.5 and 4.6.
- 4.42 Where practical within the project extents, the preferred minimum treatment for upgrades to outer Urban and rural roads is to incorporate a Wide Centre Line Treatment (WCLT).
- 4.43 Cross sections for outer urban and rural roads with a narrow median or wide centre line treatment will be as detailed in Table RD-GM-D1 4-2.

Table RD-GM-D1 4-2 Roads with Narrow Median or Wide Centre Lines - NDD

Cross Section Element	Width
Narrow median with Wire Rope Safety Barrier (WRSB)	2.2m (plus sight distance widening)
Wide Centre Line Treatment (WCLT)	≤1.4m
Traffic lanes adjacent to a WCLT or WRSB	3.3 - 3.5 m
Auxiliary Lanes (including overtaking lanes)	3.5m
Shoulders	Refer to Austroads Table 4.5 & 4.7

- 4.44 Managed motorways will include a minimum shoulder of 1.0m.
- 4.45 Audio Tactile Line Marking (ATLM) is to be provided in accordance with Operational Instruction 2.13 <https://www.dit.sa.gov.au/standards/tass>.

Table Drains (Section 4.6.1)

- 4.46 Where the table drain cross section complies with Figure 4.19 the minimum bottom width of table drains (refer Figure 4.16) may be reduced to 1.2m.
- 4.47 The adoption of 'V' drains in constrained locations will incorporate appropriate scour protection and subject approval by the Department Technical services section.

Kerb and Channel (Section 4.6.4)

- 4.48 Refer to the Department's standards drawings for kerb profiles used on State maintained roads.

Batters (Section 4.5)

- 4.49 In constrained locations, the Principal may consider batter slopes greater than the maximum if supported by the appropriate geotechnical assessment and / or Network Road Risk intervention Threshold (NRRIT).
- 4.50 The design of batters will be integrated with the landscape design to ensure vegetation is suitable for the environment and the effective management of erosion.
- 4.51 The government architect (ODASA) has developed a guideline "principles of good batter design" to assist in the design of batters. This guideline is available to external parties on request (KNet # 14447689).

Medians (Section 4.7)

- 4.52 The selection of the median treatment and need for a barrier shall be selected using guidance from AP-519-16, "Guidance on median and centre line treatments to reduce head-on casualties" and road stereotypes as detailed in AP-R619-20, "Network Design for Road Safety, Users Guide".
- 4.53 The Department's preference for duplicated outer urban and rural arterial roads is to provide wide medians within the normal design domain. The adoption of narrow medians may be considered in mountainous or hilly terrain or on approaches to overbridges.
- 4.54 Median widths that provide vehicle storage for two stage crossing at intersections are to accommodate the design vehicle in the storage length (S) as detailed in AGRD Part 4A Figure 7.2.
- 4.55 Narrow medians with a Wire Rope Safety Barrier (WRSB) shall be a width of 2.2 m, plus any additional widening where required to achieve horizontal sight distance requirements.

Urban Border and Verge (Section 4.12.3)

- 4.56 The location of footpaths within the urban border (verge) will be as close as practical to the property boundary (refer Figure 4.58) whilst meeting the objectives of Crime Prevention through Environmental Design (CPTED) and visibility of driveways for pedestrians.

Bicycle Lanes (Section 4.9.1)

- 4.57 Refer to Clause 10 for further guidance on paths and connectivity with bicycle lanes.

Bus Stops (Section 4.13)

- 4.58 Bus stop requirements are documented in Master Specification part RD-PT-D1.

Sight Distance (Section 5)

Driver Reaction Time (Section 5.2.2)

- 4.59 The Department's practice is to select reaction times based on the road area classification and speed profile.

Table RD-GM-D1 4-3 Driver Reaction Times

Reaction Time (s)	Application
1.5	Not used in South Australia.
2.0	Inner and outer urban roads.
2.5	Rural Roads with a posted speed limit of 100 km/h or greater.

Longitudinal Deceleration (Section 5.2.3)

- 4.60 A coefficient of deceleration of 0.45 or greater is not considered within the normal design domain.

Sight Distance on Horizontal Curves (Section 5.5)

- 4.61 The designer is to follow the process for assessment of sight distance on horizontal curves in accordance with AGRD Part 3 Appendix H.
- 4.62 For upgrades to existing roads, where the assessment outcome (in accordance with Appendix H) is to "change geometry", the designer shall make a recommendation to the Principal on the "value for money" options available to change the existing alignment to achieve compliant sight distances.

Coordination of Horizontal and Vertical Alignment (Section 6)

- 4.63 The Department has no supplementary comments for this section

Horizontal Alignment (Section 7)

Transitional Spirals & Curves (Section 7.5.4)

4.64 Transition curves in horizontal design are generally not used in South Australia, but may be adopted on roads on rural roads when coordinating with existing road alignments.

Side Friction and Maximum Curve Size (Section 7.6)

4.65 The desirable maximum values of side friction in Table 7.5 “for cars” shall be used as the normal design domain parameter.

Maximum Superelevation (Section 7.7.3)

4.66 The designer shall consider the types of vehicles using the road and speed profile in determining the maximum super elevation.

4.67 The maximum superelevation (e_{max}) for new high speed rural roads and motorways shall be 5%.

Pavement Widening on Horizontal Curves (Section 7.9)

4.68 Pavement widening as detailed in Table 7.13 does not apply to widening of less than 0.2m.

Vertical Alignment (Section 8)

Vertical Clearances (Section 8.4.4 & Table 8.1)

4.69 Over-dimensional routes in South Australia may incorporate additional vertical clearances than included in Table 8.1. Guidance on over dimensional routes on South Australia is provided in Sections 4.14 and 4.16.

4.70 The measurement of vertical clearance for the over-dimensional routes is from the pavement surface to a bridge soffit or vertical obstruction (e.g. gantry or sign).

4.71 Vertical clearance shall be provided for all individual lanes.

Minimum Grades (Section 8.5.6)

4.72 The minimum grade for roads with kerb and gutter in flat terrain is 0.3%. Refer to RD-DK-D1 for drainage requirements resulting from minimum grades.

Auxiliary Lanes (Section 9)

Overtaking Lanes (Section 9.4)

4.73 Overtaking provisions and sight distances for PBS level 3 and 4 routes will comply with the requirements as detailed in the PBS Scheme – Network Classification Guidelines Section 2.3 <https://www.nhvr.gov.au/files/0018-pbsnetwrkclassglines.pdf>.

4.74 The normal design domain for overtaking lanes is to incorporate widening on the left-hand side of the direction of travel with the road crown between directions of travel.

4.75 Overtaking lanes shall incorporate a Wide Centre Line Treatment (WCLT) as the minimum treatment between carriageways within the normal design domain.

4.76 Merge and diverge tapers for overtaking lanes are to be determined in accordance with Figure 9.4.

4.77 Signs and Pavement marking for overtaking lanes is to be in accordance with Operational Instruction 2.15 <https://www.dit.sa.gov.au/documents/tass>.

Rest Areas

4.78 The Department has developed a guideline supplement for rest areas (KNet # 16023127) available on request, which provides guidance on auxiliary lanes for rest areas.

Bridge Considerations (Section 10)

4.79 The Department has no supplementary comments for this section

5 Intersections and Crossings: General (AGRD Part 4)

Introduction (Section 1)

5.1 The Department has no supplementary comments for this section.

Types of Intersections (Section 2)

5.2 The Department has no supplementary comments for this section.

Road Design Considerations for intersections (Section 3)

Road Users (Section 3.1)

5.3 For pedestrian kerb ramps refer to standard drawing S-4074 sheets 6 & 7 <https://www.dit.sa.gov.au/documents/roads-all>.

Design Process (Section 4)

5.4 DIT Network Management Services shall be consulted on the intersection types and function layout in the short list concept design phase of projects and endorse the preferred concept layout.

5.5 Acceptance of the intersection type and function layout at the preliminary design phase for inner urban and outer urban intersections by DIT Network Management Services, constitutes a **Hold Point**.

Traffic Lanes (Section 4.5.2)

5.6 The Department measures kerb lane widths from the kerb face to the centre of adjacent lane line marking.

Design Vehicles (Section 5)

General (Section 5.1)

5.7 The approved heavy vehicle route networks in South Australia are available on RAVnet (an interactive online map system <http://maps.sa.gov.au/ravnet/>.)

5.8 The designer is to confirm largest operational vehicle that can make each movement through the intersection (without requiring a vehicle specific permit), based on the nominated RAVnet routes.

5.9 The designer shall confirm with the DIT Network Management Services (NMS) if the intersection movement is to accommodate provision for future increases in the largest Operational Vehicle over the current nominated RAVnet routes.

Design Vehicles (Section 5.2)

5.10 The general design vehicle for intersections will be in accordance with AGRD Part 4, Section 5.2 and Table 5.1.

5.11 The design vehicle for turn movements at intersections with operational vehicles of a PBS level 2A or greater will be as detailed in Table RD-GM-D1 5-1.

Table RD-GM-D1 5-1 Design and Checking Vehicles

Largest Operational Vehicle	Checking Vehicle	Design Vehicle
PBS Level 1A	Refer Section 5.2 and Table 5	
PBS Level 2A (PBS) / B-Double (commodity)	PBS Level 2A	Refer Cl 5.2 & Table 5
PBS Level 2B	PBS Level 2B	PBS Level 1A
PBS Level 3A (PBS) / Road Train (commodity)	PBS Level 3A	PBS Level 2A
PBS Level 3B (PBS)	PBS Level 3B	PBS Level 2B
PBS Level 4A	PBS Level 4A	PBS Level 3B

5.12 Notwithstanding the requirements in Table RD-GM-D1 5-1, the design will maintain existing vehicular access provisions to existing road and properties.

5.13 Refer to AGRD Part 4, Section 6 and this supplement for public transport design vehicle requirements.

Checking Vehicles (Section 5.3)

5.14 The checking vehicle for turn movements at intersections is to be the largest operational vehicle.

Restricted Access Vehicles (Section 5.4)

5.15 The Department refers to restricted access vehicles as over-dimensional vehicles.

5.16 Guidance on over-dimensional routes on South Australia is provided in Sections 4.14 and 4.16.

Design Vehicle Swept Path (Section 5.6)

5.17 The Department considers the swept path to be the dynamic envelope traversed by the outer extremities of the vehicle body. Mirrors and other devices fitted to vehicle bodies or wheels are assumed to be accommodated in the swept path offset.

5.18 The designer shall undertake computer analysis (e.g. Autoturn) of the design and check vehicle swept paths and provide sketches of the assessment within the design report.

5.19 The road design shall accommodate the design vehicle within marked lanes.

5.20 The application of check vehicle swept path analysis for BAL treatment will be in accordance with Section A 8.2.

5.21 Turn movements from a single turn lane into a multilane carriageway, may allow the design vehicle to enter the adjacent lane (on the departure side), where it can be demonstrated that the current access conditions are maintained.

5.22 Right turn movements from a main road to a side road for:

- a) the design vehicle should not encroach over the centre line of the side road; and
- b) the checking vehicle, may encroach over the centre line of the side road roads with low turn volumes subject to acceptance of DIT Traffic and Access Standards.

5.23 The design of left turns at unsignalised intersections and high entry angle left turn slip lanes may allow the design vehicle to encroach on the second lane of a multi-lane carriageway, where it can be demonstrated that:

- a) the manoeuvre is a legal movement for the design vehicle; and
- b) current access conditions are maintained.

Radius of Turn (Section 5.6.2)

5.24 The minimum turning radii used will be not less than the recommended turning radii in AGRD Part 4, Table 5.

5.25 Designer must adopt the following methodology when assessing swept paths:

- a) "Lock to Lock Time" of 6s must not be altered;
- b) "Articulation Angle" of 70° (if applicable) must not be altered; and

- c) vehicles are set to minimum “Kerb to Kerb” radii, as per the values in AGRD Part 4 Table 5.1.

Clearance to Swept Paths of Turning Vehicles (Section 5.6.3)

- 5.26 The design vehicles adopted for double right and left turns shall provide for simultaneous movements of the design vehicle and an 8.8 m service vehicle, with the service vehicle using the right hand lane of the approach.
- 5.27 Where 3 simultaneous turns are provided for left and right turns, the design vehicles shall comprise the specified design vehicle for the left-hand lane, a rigid 14.5 m (equivalent to a bus) in the centre lane, and an 8.8 m Service vehicle in the right hand lane of the approach.
- 5.28 At constrained locations the Department may consider within extended design domain, the adoption of the Main Roads WA methodology to determine the design vehicle for additional turn lanes <https://www.mainroads.wa.gov.au/globalassets/technical-commercial/technical-library/road-and-traffic-engineering/guide-to-road-design/technical-note-two-heavy-vehicles-turning-methodology-to-determine-which-vehicle-types-to-design-for.pdf>.
- 5.29 Swept paths for right turns, including double lanes, shall ensure a minimum clearance of 2 m to opposing right turn swept paths (i.e. left side of vehicle to left side of vehicle).

Public Transport at Intersections (Section 6)

- 5.30 The design of Public Transport is to comply with the Master Specification Part RD-PT-D1 Bus Operational Guidelines and the Pavement Marking Manual.

Design Vehicle (Section 6.2)

- 5.31 All intersections on existing or proposed SAPTA bus routes will include a bus in the design vehicle swept path assessment.
- 5.32 The designer is to confirm with South Australian Public Transport Authority (SAPTA) the bus type to be used in the assessment.
- 5.33 The Department notes the dimensions of the SAPTA buses vary from Austroads standard turn paths. Information on SAPTA bus dimension are available on request (refer KNet # 1678866).

Bus Facilities (Section 6.3)

- 5.34 Bus facilities are to be in accordance with the Pavement Marking Manual.

Property Access and Median Openings (Section 7)

- 5.35 The Department has no supplementary comments for this section.

Pedestrian Crossings (Section 8)

- 5.36 Pedestrian crossing facilities are to be provided at all intersections in the inner and outer urban areas.
- 5.37 Pedestrian crossings are to be in accordance with the Code of Technical Requirements and the Pavement Marking Manual and comply with the Master Specification Part PR-PF-D1 Designing for accessibility.

Mid-block Crossings on Roads (Section 8.2)

- 5.38 Refer to [DIT standards](#) and Pavement Marking Manual for details on mid-block pedestrian crossings.

Cyclists Crossing (Section 9)

- 5.39 Cycling crossing facilities (bike lanes or separate paths) are to be provided at all intersections in the inner and outer urban areas.
- 5.40 Cyclist crossing details are to be in accordance with the Pavement Marking Manual and DIT standard drawings.

- 5.41 The adoption of a cyclists crossing treatment that has not previously been installed by the Department and / or accepted as a Traffic Control Device by Traffic Engineering and Standards (at Norwood) will be deemed a "New and Emerging Treatment" and subject to a **Hold Point** as per Clause 11.3.

Railway Crossing (Section 10)

- 5.42 The Department has no supplementary comments for this section.

6 Unsignalised and Signalised Intersections (AGRD Part 4A)

Introduction (Section 1)

- 6.1 The Principal has no supplementary comments for this section.

Layout Design Process (Section 2)

Superelevation at or Near Intersections (Section 2.2.4)

- 6.2 The designer shall undertake a review of superelevation of turn movements at intersections in accordance with this clause and AGRD Part 4A Appendix B (to assess heavy vehicle instability risk).

Sight Distance (Section 3)

Safe Intersection Sight Distance (SISD) (Section 3.2.2)

- 6.3 The Department's normal practice is to calculate the SISD based on the driver of the vehicle being 3.0m from the stop or give way line.

Pedestrian Crossing Sight Distance Requirements (CSD) (Section 3.3)

- 6.4 The designer shall assess the CSD and the Approach Sight Distance (ASD) for every pedestrian crossing.
- 6.5 At crossing adjacent to sensitive users (e.g. elderly, vision and mobility impaired, pedestrians under 12 years old) the average walking speed should be reduced to 1.0 m/s.

Sight Distance at Property Entrances (Section 3.4)

- 6.6 The designer shall assess sight distances on existing property entrances on State maintained roads.
- 6.7 Where the existing property access does not currently achieve Extended Design Domain (EDD) SISD (Table A9 to A14), the designer shall assess the movements and crash history at the existing property entrance and recommend to the Principal potential treatments to reduce the inherent risk.

Types of Intersections and their Selection (Section 4)

General (Section 4.1)

- 6.8 Traffic modelling of intersections will be in accordance with RD-GM-D4 Traffic Analysis & Modelling.

Intersection Types (Section 4.2)

- 6.9 Warrants for BA, AU and CH turn treatments at outer urban and rural un-signalised intersections will be assessed in accordance with AGTM Part 6 Section 3.3.6.

Auxiliary Lanes (Section 5)

- 6.10 Diverge and merge tapers (excluding overtaking lanes) will be in accordance with AGRD Part 3 Equation 27 and 28.

Determination of Deceleration Turn Lane Lengths (Section 5.2.2)

- 6.11 Auxiliary turn lanes at inner urban intersection, the Department's "practical application of this procedure" to determine the total length of auxiliary lane Figure 5.1 based on the greater value of either:
- Storage length required for the future year design traffic volumes (S) plus the physical taper Length (T) = (S+T); or
 - Length of deceleration (D) using comfortable deceleration (including Taper length (T)).

Auxiliary through lanes (Section 5.5)

- 6.12 The length of auxiliary through lanes at intersections shall be determined from the length required to achieve the specified operational performance.
- 6.13 The length of auxiliary through lane on departure side of an intersection shall be the greater value of either:
- length required to achieve the specified operational performance; or
 - 4 sec of travel time on the departure side of the intersection, plus the taper.

Traffic Island and Medians (Section 6)

Raised High Entry Left Turns and Free Flow left turn islands (Section 6.1.3)

- 6.14 Raised High Entry Left Turn Treatments (HELT) at signalised intersections are to be in accordance with DIT standard drawings S-4076 sheets 1 & 2, (replacing Figure 6.3, 6.4 and 6.5).
- 6.15 Free flow left turn islands (ref Figure 6.7 and 6.9) will include a provision for cyclist to travel across the island and cross the acceleration lane at 90 degree as per AGRD Part 4 Figure A14 and the Pavement Marking Manual.

Painted Medians (Section 6.2)

- 6.16 Painted medians will be in accordance with the Pavement Marking Manual <https://www.dit.sa.gov.au/documents/tass>.

Right-turn Treatments (Section 7)

Rural Right-turn Treatments (Section 7.3)

- 6.17 Rural seagulls will be in accordance with AGRD Part 4 Section A.7.5, Figure A11 or A12, with an acceleration length determined for passenger cars from the hold line.
- 6.18 Hold lines (give way and stop) will be located within 3.0m of the through lane and as per the Pavement Marking Manual unless agreed otherwise by Traffic Assess Standards.

Left –Turn Treatments (Section 8)

- 6.19 The designer shall refer to AGTM Part 6 for guidance on the selection of left turn treatment (e.g. kerb return, HELT or free-flow left turn). Selection of the treatment will be based on site specific features and risks, cognisant of:
- pedestrian demand, adjacent sensitive users and potential for crowding;
 - sight distances;
 - cyclist facilities; and
 - traffic operational benefit.
- 6.20 Assessment of left turn treatments shall consider the new Section 8.2.5 "Offset Rural Channelised Left turn treatment (CHL)" as detailed in AP-R661-21, Minor Amendments to the Austroads Guide to Road Design.

- 6.21 High Entry Left Turn Treatments (HELT) are to be in accordance with the DIT Pavement Marking Manual and Standard Drawings S-4076 sheets 1 & 2.
- 6.22 Provision for cyclists at left-turn treatments will be in accordance with AGRD Part 4 Section A.8.

Signalised intersections (Section 9)

- 6.23 In addition to AGRD Part 4A, Austroads provides further guidance on the design of signalised intersections in AGRD Part 4 Appendix B.

Traffic Lanes (AGRD Part 4 Section B.4)

- 6.24 A minimum of two lanes will be provided at all signalised intersection approaches. A left turn slip lane can be counted as one lane of the two lanes.
- 6.25 The Department's preferred practice is to avoid shared lanes (through and turn) at intersections.

Pedestrian Treatments (AGRD Part 4 Section B.5)

- 6.26 Pedestrian crossing facilities will be provided at all signalised intersections.

Pedestrian Facilities – Mid Block (AGRD Part 4 Section B.5)

- 6.27 Mid-block pedestrian (or cyclists) crossing facilities will be in accordance with the DIT Pavement Marking Manual and Standard Drawings.
- 6.28 Pedestrian crossings are to comply with the Master Specification Part PR-PF-D1.

Cyclist Facilities at Signalised Intersections (AGRD Part 4 Section B.6)

- 6.29 Cyclist facilities will be provided at all signalised intersections.
- 6.30 Cyclist facilities will be in accordance with the DIT Pavement Marking Manual.
- 6.31 The Department does not support the use of right-turn bicycle facilities that require cyclist to weave across traffic to continue their journey (e.g. Figure B10-4 waiting (a) and Figure B12-example a & c).
- 6.32 The Department does not support the use of left-turn bypass bicycle treatments as detailed in Figure B14.

7 Roundabouts (AGRD Part 4B)

Introduction (Section 1)

- 7.1 The Department has no supplementary comments for this section.

Design Principles and Procedures (Section 2)

- 7.2 The Department has no supplementary comments for this section.

Sight Distances (Section 3)

- 7.3 The Department has no supplementary comments for this section.

Geometric Design (Section 4)

Left-turn Slip Lanes (Section 4.3.5)

- 7.4 High entry angle left-turn lanes at roundabouts shall be in accordance with AGTM Figure 4.3 and have a minimum offset of 20m from the circulating carriageway.

Central Island Radius (Section 4.4.3)

- 7.5 In addition to the requirements in AustRoads, the initial selection of the central island radius for roundabouts on State maintained roads shall be increased based on the largest operational vehicle as detailed in Table RD-GM-D1 7-1.

Table RD-GM-D1 7-1 Recommended Central Island Radii

Largest Operational Vehicle	Single Lane Roundabout				Dual Lane Roundabout (on at least who approaches)	
	Single Lane Roundabout	Single Lane Roundabout		Dual Lane Roundabout (on at least who approaches)		
PBS Level 1A	Refer Section 4 and Table 4.1				Refer Section 4 and Table 4.1	
PBS Level 2A	Refer Section 4 and Table 4.1				Refer Section 4 and Table 4.1	
PBS Level 2B	14m min	15 – 25m des	15 – 25m des	18m min	19 – 30m des	
PBS Level 3A & 3B	20m min	21 – 30m des	21 – 30m des	26m min	27 – 35m des	
PBS Level 4A	26m min	27 – 35m des	27 – 35m des	30 m min	31 – 40m des	

Approach and Entry Treatments - Approach Treatments for High Speed Areas (Section 4.5.2)

- 7.6 Reverse curves may be adopted on roundabouts with a posted speed limit greater than 80 km/h prior to the roundabout approach (to encourage drivers to reduce speed prior to the roundabout).
- 7.7 Where reverse curves are adopted a short straight is to be provided to transition superelevation between the curves to reduce the risk of instability to High Centre of Gravity (HCoG) vehicles.
- 7.8 In constrained locations where reverse curves are not practical, two or more “approach treatments” as detailed in Section 4.5.2 may be adopted.

Maximum Entry Path Radius (Section 4.5.3)

- 7.9 Where the circulating carriageway is wider than 5.0m the determination of the entry path radii as detailed in Figures 4.5 and 4.6 will be based on a maximum value of 2.5 m for M2.

Design Vehicle and Vehicle Swept Path (section 4.6.1)

- 7.10 The design vehicle for each roundabout turn movement shall be determined in accordance with Clauses 5.7 to 5.29.
- 7.11 Roundabout shall be designed for the design vehicle within the circulating carriageway for each turn or through movement at each intersection approach.
- 7.12 Check vehicles may utilise the roundabout annulus or additional encroachment area to undertake the intersection movement.

Circulating Carriageway (Section 4.6.2)

- 7.13 A maximum circulating carriageway width for single lane roundabouts of 7.0 m shall be considered within the normal design domain.
- 7.14 Two or three lane roundabouts shall be designed for the lane compliance of the design vehicle for (each turn or through) movement and the concurrent movement of a passenger vehicle(s) alongside the design vehicle.
- 7.15 For two or more lane roundabouts, the maximum individual lane widths of 5.5 m is considered within the normal design domain.

Encroachment areas (Section 4.6.3)

- 7.16 Figure 4.11, Type A encroachment areas will be adopted on State maintained roads.
- 7.17 Encroachment areas may be used on the kerb side to maintain roundabout entry curvature, whilst still enabling access for the largest operational vehicle.
- 7.18 Where kerbside encroachment is adopted pedestrian crossing facilities will be offset a minimum of 2.0 m from encroachment areas.

Superelevation, Gradient and Drainage (Section 4.10)

- 7.19 The Department's normal practice is to provide adverse crossfall through the roundabout circulating carriageway.
- 7.20 Subject to achieving drainage requirements, adverse crossfall of 2% on single lane roundabouts and 2.5% on multi-lane roundabout may be adopted to reduce the risk of truck instability.
- 7.21 Rates of rotation for superelevation should not exceed the maximum as vehicle travels through the roundabout.
- 7.22 Designers need to ensure the design of roundabout does not cause instability issues for heavy vehicles including (HCoG) vehicles.
- 7.23 Roundabouts that meet the following criteria shall be assessed using simulation software (e.g., TruckSim, HVE or UM Truck) to review the risk of truck instability:
- i) an approach speed prior to the roundabout of 80 km/h or greater;
 - ii) on nominated freight routes; and
 - iii) where the largest operational vehicle of a PBS 2A or greater;
- 7.24 For further guidance on vehicle stability assessment, the designer may refer Main Roads WA, "Guidelines for Vehicle Stability Analysis – Main Roads Internal Process" <https://www.mainroads.wa.gov.au/globalassets/technical-commercial/technical-library/road-and-traffic-engineering/guide-to-road-design/guidelines-for-vehicle-stability-analysis-internal-main-roads-process.pdf>

Pedestrian and Cyclist Treatments (Section 5)

- 7.25 Bicycle lane treatments at Roundabouts will be in accordance with the Pavement Marking Manual.
- 7.26 Multilane roundabouts shall include an alternate off road pathway for cyclists to navigate the roundabout within the normal design domain, and in accordance with the Pavement Marking Manual and AGRD Figure 5.4.

Pavement marking and signs (Section 6)

- 7.27 Pavement marking and signage will be in accordance with the Pavement Marking Manual.

Landscaping and Street Furniture (Section 7)

Maintenance (Section 7.4)

- 7.28 Maintenance access provisions for people and or vehicles to access landscaping, street furniture (including lighting) within the roundabout will be agreed with the Department's maintenance personnel.

8 Interchanges (AGRD Part 4C)

Types of Structures (Section 4.1.1)

- 8.1 The Department adopt "spill through" abutments for overbridges consistent in aesthetics with other adjacent projects within the normal design domain.
- 8.2 The designer is to review the project specific urban design framework to coordinate the type of structure with the desired project amenity.

Safety Screens (Section 4.9)

- 8.3 Further information on the requirements are detailed with Master Specification part ST-SD-D1.

Ramp Terminal at Minor Road (Section 8.3.4)

- 8.4 The Department adopt either a roundabout or signalised intersection at service interchange ramp terminals with minor roads within the normal design domain.

Exit Ramp (Section 11.2)

- 8.5 Excluding motorways, single lane exit ramps as detailed in Figure 11.1(b) may be adopted for exit ramps with lower traffic volumes within the normal design domain.
- 8.6 Comfortable deceleration for cars (0.26) shall be adopted for exit ramp deceleration distance (Dd).

Entry Ramps (Section 11.3)

- 8.7 The use of simple merge as detailed in Figure 11.6 or ramp details from other State Road Authorities is not considered within normal design domain.

9 Roadside Design, Safety and Barriers (AGRD Part 6)

Methodology

- 9.1 Austroads update to AGRD Part 6 (2020), includes a new approach to consider a project as part of the wider road network to provide best road corridor safety outcomes.
- 9.2 The Department supports the adoption of AGRD Part 6 (2020).
- 9.3 The AGRD Part 6 (2020) methodology will be adopted for projects within the following criteria:
- rural areas 1 km or greater;
 - inner and outer urban areas 500 m or greater; and
 - roadway is in flat or rolling terrain.
- 9.4 Projects that do not meet the above criteria will be assessed using the AGRD Part 6 (2010) previous methodology.
- 9.5 Projects in the urban environment are to comply with DIT Operational Instruction 19.8, "Trees in Medians and Roadsides in the Urban Environment".

Introduction (Section 1)

Roadside Safety Design (Section 1.6)

- 9.6 Irrespective of the guideline or methodology adopted (AGRD Part 6 -2020 or 2010) the designer shall always use their "engineering judgement" to reduce the residual risk to road users "so far as is reasonably practicable" through designing a road network that:
- reduces the probability a driver loses control of a vehicle;
 - reduces the probability a road user (pedestrian, cyclist or driver) miscalculates a movement at a crossing or intersection;
 - remove or reduces (where practical) the hazards in the road environment; and
 - minimises the severity of any crash that may occur to all road users.

Network Risk Assessment (Section 2)

General (Section 2.1)

- 9.7 The use of Network Roadside Risk Intervention Threshold (NRRIT) is a new methodology to the Department, and its adoption threshold levels are still under development.

Network Roadside Risk Intervention Threshold (NRRIT) (Section 2.4)

- 9.8 The NRRIT should be determined in the planning phase for each individual project, based on the targeted iRAP star rating proposed for the corridor.
- 9.9 The NRRIT for new road corridor “greenfield” sites is to be as low as possible within economic constraints, with a nominal NRRIT of 1.0 initially recommended as a target level.
- 9.10 The NRRIT initially recommended as a target level for modifications, changes or upgrades to existing roadways is as detailed in Table RD-GM-D1 9-1.

Table RD-GM-D1 9-1 Nominal NRRIT, upgrades to existing roads

Location	Classification	Nominal NRRIT
Rural road	Arterial / Highway	1.25
	Collector	1.5
Inner or outer Urban road speed limit > 60 km/h	Arterial or Collector	1.5
Inner or outer urban roads speed limit ≤ 60 km/h	Arterial / Highway	1.5
	Collector and local	1.75

- 9.11 The selection of the corridor and projects NRRIT target score rating will be agreed with the Principal prior to commencing detailed design.
- 9.12 The determination of the NRRIT will constitute a **Hold Point**.
- 9.13 The Department has created a risk score calculation spreadsheet which is based on AGRD Part 6 (2020). Refer to https://www.dit.sa.gov.au/standards/road_design_outputs.

Risk Evaluation Procedure (Appendix B)

- 9.14 Oncoming vehicle risk for a divided road or road with a Wide Centre Line Treatment (WCLT) is calculated by assuming the oncoming vehicle as an isolated hazard with a lateral distance to the isolated hazard of the median or WCLT width plus a 0.5 m allowance for vehicle located within the lane.

10 Paths for Walking and Cycling (AGRD Part 6A)

Path User Considerations (Section 3)

- 10.1 The Department has no supplementary requirements for this section.

Design Considerations (Section 4)

- 10.2 The Department has no supplementary requirements for this section.

Design Criteria (Section 5)

- 10.3 Cyclists can legally ride on footpaths in South Australia.
- 10.4 Paths will only be marked as shared paths where they provide a link to an adjacent shared path network, form part of a shared path route, or as requested by Council or DIT Network Management Services.
- 10.5 The design and signage of an off-road bicycle facility (bike only path, separated path, shared path or footpath) will be cognisant of the connectivity to the adjacent path network and location of the pathway within the urban border or road verge.
- 10.6 Where access is provided for cyclist to utilise a footpath from an on-road bike lane, the footpath will be appropriated designed and sized to cater for the anticipated pedestrian and cyclist mix and traffic volumes.
- 10.7 Marking and signage of paths will be agreed with DIT Network Management Services.

Pedestrian Paths (Section 5.1.2)

- 10.8 Pedestrian paths are to have a minimum width of 1.8 m within the normal design domain.
- 10.9 Pedestrian paths are to comply with PR-PF-D1, Designing for Accessibility.
- 10.10 In constrained locations the Department will consider a reduced width subject to approval of a design exception (departure).

Batters and Fences (Section 5.5.3)

- 10.11 Where the fence provides a smooth surface and does not create a risk of handlebars being caught in the vertical component of the fence, no cyclist deflection rail is required.
- 10.12 Cyclist deflection rails shall be at height of 1.0 m (min) to 1.2 m (max) to reduce the risk of hazard to both adult and junior cyclists.

Crossfall and Drainage (Section 5.6)

- 10.13 Shared sealed paths shall ensure the finished surface is free draining (without ponding) with a minimum crossfall of 2%.

Lighting (Section 5.11)

- 10.14 In general, the Department does not provide lighting for paths away from roads unless site specific condition warrant their inclusion.
- 10.15 The Designer is to assess project specific conditions and potential warrant for lighting of pathway away from road, based on number and type of intended users, site specific features whole of life cost, risk and confirm with the Principle if the path is to incorporate lighting.

Intersections of Paths with Paths and Roads (Section 6 & Section 7)

- 10.16 The Department has no supplementary requirements for these sections.

Paths at Structures (Section 8)

Underpasses (Section 8.3)

- 10.17 Underpasses shall provide clear line of sight (vertically and horizontally) for users through the underpass and on approaches to align with the principles of CPTED.
- 10.18 Underpasses shall have a minimum height of 2.5 m and clear width of 3.6 m within normal design domain.

11 New and Emerging Treatments (AGRD Part 7)

- 11.1 The Department supports the consideration and appropriate of new and emerging treatments included in AGRD Part 7 for treatments on State maintained roads.
- 11.2 The adoption of new or emerging treatment in the short list of options within the project planning phase or as part of detailed design development will be subject to approval of:
 - a) Network Management Services (NMS) – Traffic Control Devices; and
 - b) Technical Services Section – Extended Design Domain / Departures.
- 11.3 The adoption of new or emerging treatments will constitute a **Hold Point**.

12 Hold Points and Witness Points

12.1 The following is a summary of Hold Points referenced in this Part:

Clause	Hold Point	Response Time
2.19	Design basis (road design parameters) adopted in the concept and preliminary design phases.	5 Working Days
2.25	Endorsement of Design Exceptions (EDD / Departures)	10 Working Days
5.5	Acceptance of the intersection type and function layout by DIT NMS	10 Working Days
9.12	Selection of NRRIT prior to commencing detailed design	10 Working Days
11.3	Adoption of new or emerging treatments	10 Working Days
