



ACT
Government

MUNICIPAL INFRASTRUCTURE STANDARDS

Part 1 Street Planning and Design

TCCS
Transport Canberra City Services

September 2021

| | |
|----------------------------|-----------------------------|
| Publication Number: | MIS 01 Edition 1 Revision 0 |
|----------------------------|-----------------------------|

| | |
|------------------------|------------|
| Date of Effect: | April 2019 |
|------------------------|------------|

Supersedes: Design Standard for Urban Infrastructure Works Section 2
Edition 1 Revision 0 September 2002

| | | |
|---------------------|------------|-----------------------------------|
| Endorsed By: | Karl Cloos | Director, Infrastructure Planning |
|---------------------|------------|-----------------------------------|

Approved By: Ken Marshall Executive Branch Manager, Roads ACT

Document Information

| | |
|-----------------|------------------------|
| Document | Key Information |
|-----------------|------------------------|

| | |
|-----------------------|--|
| Document Title | Municipal Infrastructure Standards - 01 Street Planning and Design |
|-----------------------|--|

| | |
|-------------------------|--|
| Next review date | |
|-------------------------|--|

Key words

| | |
|-------------------------------|----------------------------|
| AUS-SPEC Base Document | 0041 Geometric road layout |
|-------------------------------|----------------------------|

Revision Register

| Edition/ Revision Number | Clause Number | Description of Revision | Authorised By | Date |
|--------------------------|---------------|-------------------------|---------------|------|
|--------------------------|---------------|-------------------------|---------------|------|

1/0

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

CONTENTS

| | | |
|----------|---|-----------|
| 1 | STREET PLANNING AND DESIGN | 6 |
| 1.1 | General..... | 6 |
| 1.1.1 | Responsibilities..... | 6 |
| 1.1.2 | Cross references..... | 7 |
| 1.1.3 | Referenced documents..... | 9 |
| 1.1.4 | Standards..... | 10 |
| 1.1.5 | Interpretation..... | 11 |
| 1.1.6 | Hierarchical street network..... | 13 |
| 2 | STREET PLANNING | 15 |
| 2.1 | Consultation | 15 |
| 2.2 | Planning concepts | 15 |
| 2.2.1 | Road hierarchy..... | 15 |
| 2.2.2 | Legibility | 15 |
| 2.2.3 | Integrated design principles..... | 16 |
| 2.2.4 | Age friendly design concepts | 16 |
| 2.2.5 | Disability access..... | 16 |
| 2.2.6 | Environmental considerations | 17 |
| 2.2.7 | Climate change adaptation | 17 |
| 2.2.8 | Other considerations..... | 17 |
| 3 | STREET DESIGN..... | 18 |
| 3.1 | Design considerations | 18 |
| 3.1.1 | Traffic volume and composition | 18 |
| 3.1.2 | Road network design criteria..... | 18 |
| 3.1.3 | Design speed..... | 18 |
| 3.1.4 | Operating speed..... | 18 |
| 3.2 | Hazard reduction | 18 |
| 3.3 | Design vehicle | 19 |
| 3.3.1 | Design Vehicle | 19 |
| 3.3.2 | Checking Vehicle | 19 |
| 3.3.3 | Vehicle swept path | 19 |
| 4 | CROSS-SECTION..... | 21 |
| 4.1 | Road reserve characteristics | 21 |
| 4.1.1 | General..... | 21 |
| 4.1.2 | Traffic lanes..... | 21 |
| 4.1.3 | Crossfall | 21 |
| 4.2 | Verges and property access..... | 22 |
| 4.2.1 | Verge design..... | 22 |
| 4.2.2 | Batters..... | 23 |

| | | |
|----------|--|-----------|
| 4.3 | Roadside drainage..... | 23 |
| 4.3.1 | General..... | 23 |
| 4.3.2 | Roadside drainage..... | 24 |
| 4.3.3 | Kerb drainage..... | 24 |
| 4.4 | Other features..... | 25 |
| 4.4.1 | Medians..... | 25 |
| 4.4.2 | On road cycling facilities..... | 25 |
| 4.4.3 | On-Street parking..... | 25 |
| 4.4.4 | Bus stops..... | 26 |
| 4.4.5 | Bus routes..... | 26 |
| 4.5 | Auxiliary lanes..... | 26 |
| 4.5.1 | Speed change (turning) lanes..... | 26 |
| 4.5.2 | Service roads..... | 26 |
| 5 | GEOMETRIC DESIGN..... | 27 |
| 5.1 | Sight distance..... | 27 |
| 5.1.1 | Design parameters..... | 27 |
| 5.2 | Coordination of horizontal and vertical alignment..... | 28 |
| 5.2.1 | General..... | 28 |
| 5.2.2 | Aesthetic consideration..... | 28 |
| 5.3 | Horizontal alignment..... | 28 |
| 5.3.1 | General..... | 28 |
| 5.3.2 | Horizontal curves..... | 29 |
| 5.3.3 | Curves with adverse crossfall..... | 29 |
| 5.3.4 | Pavement widening..... | 29 |
| 5.4 | Vertical alignment..... | 30 |
| 5.4.1 | General..... | 30 |
| 5.4.2 | Longitudinal gradient..... | 30 |
| 5.4.3 | Vertical curves..... | 31 |
| 6 | INTERSECTIONS..... | 32 |
| 6.1 | General..... | 32 |
| 6.1.1 | Design criteria..... | 32 |
| 6.1.2 | Location..... | 32 |
| 6.1.3 | Intersection types..... | 33 |
| 6.1.4 | Sight distance..... | 34 |
| 6.2 | Roundabouts..... | 34 |
| 6.3 | Traffic calming..... | 35 |
| 7 | DOCUMENTATION..... | 36 |

LIST OF TABLES

| | | |
|------------|---------------------------------------|----|
| Table 01-1 | Functional road classifications | 14 |
| Table 01-2 | Design vehicles table | 20 |

SUPERCEDED

1 STREET PLANNING AND DESIGN

1.1 General

Street planning: Movement within the road hierarchy ranges from the higher level arterial or trunk roads to lower level streets and places. Specific planning and design requirements for arterial routes are covered within the Trunk Road Infrastructure Standards. This document is intended to be used for street planning and design within residential, commercial, industrial and mixed use developments with roads of a hierarchy level lower than arterial routes.

The scope of material in this document is limited to street planning and design for general traffic across all transport modes, including cyclists and pedestrians. It is recognised that streets are shared places and may need to prioritise pedestrians and cyclists above vehicles. This standard makes reference to the role of buses and light rail transport modes within the road network but does not cover planning and design details for public transport services.

1.1.1 Responsibilities

1.1.1.1 Objectives

General: Design and document a street system that is appropriate to the land use and provides the following:

- > Improved urban structure, amenity and revitalisation.
- > Appropriate overlay of main and local walking and cycling routes with connections to adjacent networks.
- > Convenient and safe access for pedestrians, vehicles and cyclists.
- > Appropriate access for buses, emergency and service vehicles.
- > A quality road network that minimises whole of life costs.
- > An appropriate space for public utilities.
- > Provision of appropriate access to services for service authorities.
- > An opportunity for street landscaping integrating water sensitive urban design.
- > Consideration for climate change adaptation to improve the resilience and amenity of the built environment.
- > Convenient parking for road users and visitors.
- > Well managed noise and air quality in adjacent residential areas.
- > Conformance to the *Disability Discrimination Act*.
- > An appropriate response to climate, geology and topography, existing built fabric, heritage and cultural context of the area.
- > Phasing of construction to suit access and service provision.
- > Stormwater infrastructure within the road reserve to provide major and minor stormwater flow management.
- > Consideration to Safety in design, operation and demolition.
- > Signage to *MIS 12 Guide Signs* and line marking to *MIS 13 Traffic Control Devices*.
- > Street lighting to *MIS 14 Public Lighting*.
- > Consideration for maintenance functions.

Mixed Use zones: In addition to general considerations provide consideration for additional requirements within Mixed Use zones, including the following:

- > Consider accesses that separate commercial and industrial services from residential users.
- > Incorporate acoustic design within the street layout.
- > Evaluate additional access requirements for buses, emergency and service vehicles that are appropriate to the land use.

Industrial zones: In addition to general considerations provide consideration for additional requirements within Industrial zones, including the following:

- > Design for traffic circulation and access that is appropriate to level and type of traffic generation and the land use.
- > Design driveways with consideration for anticipated traffic volumes and dimensions.
- > An appropriate response to adjacent land uses.
- > Grade roads to minimise slope within industrial blocks.

1.1.1.2 Precedence

Where any document except legislation or the *Territory Plan* issued in conjunction with this Design Standard includes technical requirements that conflict with this Design Standard, the requirements of this Design Standard take precedence.

1.1.2 Cross references

1.1.2.1 Commonwealth Legislation

The following Commonwealth Legislation is relevant to this Standard:

Aboriginal and Torres Strait Islander Heritage Protection Act

Australian Capital Territory Planning and Land Management Act

Disability Discrimination Act

Environment Protection and Biodiversity Conservation Act

1.1.2.2 ACT Legislation

The following ACT Legislation is relevant to this Standard:

Emergencies Act

Environment Protection Act

Heritage Act

Legislation Act

National Capital Plan

Nature Conservation Act

Planning and Development Act

Planning and Development Regulation

Public Roads Act

Public Unleased Land Act

Road Transport (General) Act

Road Transport (Safety and Traffic Management) Act

Road Transport (Mass, Dimensions and Loading) Act
Road Transport (Safety and Traffic Management) Regulation
Territory Plan and related Codes
Tree Protection Act
Utility Networks (Public Safety) Regulation
Water Resources Act
Work Health and Safety Act

1.1.2.3 ACT Government Strategic Documents

ACT Climate Change Adaptation Strategy
ACT Movement and Place Framework
ACT Pest Animals Management Strategy 2012 – 2022
The ACT Planning Strategy – Planning for a sustainable city
ACT Road Hierarchy
ACT Weed Strategy 2009-2019
Active 2020: A Strategic Plan for Sport and Active Recreation in the ACT & Region 2011-2020
Canberra Plan: Towards Our Second Century
The City Plan
Nature Conservation Strategy 2013 – 2023
Strategic Bushfire Management Plan for the ACT
Threatened Species Action Plans
Transport for Canberra: transport for a sustainable city 2012-2031
Towards Zero Growth – Healthy Weight Action Plan

1.1.2.4 Design Standards

This Design Standard references the following component standards:

| | |
|--------|---------------------------------|
| MIS 02 | Earthworks and site grading |
| MIS 03 | Pavement design |
| MIS 04 | Subsurface drainage |
| MIS 05 | Active travel facilities design |
| MIS 06 | Verges |
| MIS 07 | Driveways |
| MIS 08 | Stormwater |
| MIS 09 | Bridges and related structures |
| MIS 10 | Fences, guardrails and barriers |
| MIS 11 | Off street parking |
| MIS 12 | Guide signs |
| MIS 13 | Traffic Control Devices |

- MIS 14 Public lighting
- MIS 15 Urban Edges Management Zone
- MIS 24 Soft Landscape Design

1.1.2.5 Specifications

The following specifications are related to this standard:

- MITS 02A Clearing and grubbing
- MITS 02B Bulk earthworks
- MITS 07 Segmental Paving

1.1.2.6 TCCS Reference Documents

The following TCCS reference documents are related to this standard:

- Reference document 4 Protection of public landscape assets
- Reference document 6 Design Acceptance submissions
- Reference document 7 Operational acceptance submissions
- Reference document 8 WAE quality records
- Reference document 9 Final acceptance submissions
- Reference document 10 Landscape consolidation

1.1.2.7 Design Guides

The following design guides are related to this standard:

- Environment Protection Guidelines for Construction and Land Development in the ACT, EPA
- Canberra Streetscape Design Guidelines
- Crime Prevention through Environmental Design General Code, ACTPLA
- Development Control Code for Best Practice Waste Management in the ACT, ACT No Waste
- Underground Services in a Shared Trench Agreement, Telstra, NBN, TransACT, Zinfra, Evo Energy

1.1.2.8 Further reading

- Australian Transport Assessment and Planning Guidelines
- Complete streets: Guidelines for urban street design, IPWEAQ.
- Liveable neighbourhoods: A Western Australian Government sustainable cities initiative, Western Australian Planning Commission.

1.1.3 Referenced documents

The following documents are incorporated into this Design Standard by reference:

1.1.3.1 Standards

- AS 1348 Glossary of terms - Roads and traffic engineering
- AS 1428 Design for access and mobility
- AS/NZS 2890 Parking facilities
- AS/NZS 2890.1 Part 1: Off-street car parking
- AS2890.2 Part 2: Off-street commercial vehicle facilities

| | |
|---------------|---|
| AS 2890.5 | Part 5: On-street car parking |
| AS/NZS 2890.6 | Part 6: Off-street parking for people with disabilities |
| AS/NZS 3845 | Road safety barrier systems |

1.1.3.2 Other publications

Austrroads

| | |
|---------|---|
| AGRD | Austrroads Guide to Road Design |
| AGRD01 | Part 01: Introduction to road design |
| AGRD02 | Part 02: Design Considerations |
| AGRD03 | Part 03: Geometric design |
| AGRD04 | Part 04: Intersections and crossings |
| AGRD04A | Part 4A: Unsignalised and signalised intersections |
| AGRD04B | Part 4B: Roundabouts |
| AGRD06 | Part 06: Roadside design, safety and barriers |
| AGRD06A | Part 6A: Pedestrian and cyclist paths |
| AGRD06B | Part 6B: Roadside environment |
| AGRD07 | Part 07: Geotechnical investigation and design |
| AGRD08 | Part 08: Process and documentation |
| AGTM | Austrroads Guide to Traffic Management |
| AGTM03 | Part 03: Traffic studies and analysis |
| AGTM05 | Part 05: Road management |
| AGTM06 | Part 06: Intersections, interchanges and crossings |
| AGTM07 | Part 07: Traffic management in activity centres |
| AGTM08 | Part 08: Local area traffic management |
| AGTM11 | Part 11: Parking |
| AGTM12 | Part 12: Traffic impacts of development |
| AP-G34 | Design vehicles and turning path templates |
| AP-G88 | Cycling aspects of Austrroads guides Guide to traffic engineering practice - Bicycles |

1.1.4 Standards

1.1.4.1 General

Road design: To *AGRD01 Introduction to road design* and *AGRD02 Design Considerations*.

Geometric design: To *AGRD03 Geometric Design*.

Intersection design: To *AGRD04 Intersections and crossings*, *AGRD04A Unsignalised and signalised intersections*, *AGRD04B Roundabouts*.

Geotechnical investigation and design: To *AGRD07 Geotechnical investigation and design*.

Proprietary products: To *TCCS Products previously considered for use list*

1.1.5 Interpretation

1.1.5.1 Abbreviations

General: For the purposes of this Design Standard the following abbreviations apply:

| | |
|----------|--|
| AADT: | Average Annual Daily Traffic. |
| ACT ESA: | Australian Capital Territory Emergency Services Authority. |
| ASD: | Approach Sight Distance. |
| AU: | Auxiliary. |
| BA: | Basic. |
| CH: | Channelised. |
| DDA: | Disability Discrimination Act |
| EDC: | Estate Development Code |
| EPA: | Environment Protection Authority, ACT Government and its successors. |
| EPD: | Environment and Planning Directorate, ACT Government and its successors. |
| HOV: | High occupancy vehicle. |
| LATM: | Local Area Traffic Management. |
| MGSD: | Minimum gap sight distance. |
| NDD: | Normal Design Domain. |
| SBMP: | Strategic Bushfire Management Plan. |
| SISD: | Safe Intersection Sight Distance. |
| TCCS: | Transport Canberra and City Services, ACT Government and its successors. |
| WSUD: | Water sensitive urban design. |

1.1.5.2 Definitions

General: For the purpose of this Design Standard, the definitions of terms used to define the components of the road reserve are in conformance with *AS 1348, Glossary of Austroads Terms* and *AGRD03 Geometric design*.

The words 'street' and 'road' have been defined as follows:

Road: A designated path forming a route between two places for vehicular traffic and services. Roads include verge space, carriageways and associated public areas and may also provide vehicular access to properties.

Street: A place that enables shared activities such as walking, gathering, socialising, cycling, access to properties and motor vehicle usage. Streets include verge space, carriageways and associated public areas. Landscaping, services, drainage and lighting are all integral to the design of the street.

Other definitions that pertain to this Design Standard are outlined below,

Batter: Surfaces in steep landforms which connect the flatter portion of the verge or other elements of cross-sections to the final surface.

Block: A parcel of land, as defined in the Territory Plan.

Checking Vehicle: *To AP-G34 Design vehicles and turning path templates.*

Design Vehicle: To AP-G34 Design vehicles and turning path templates.

Driveway: Vehicle access across the verge to the block from the edge of the carriageway to the property line.

Floodway: Areas where a significant discharge of water occurs during floods often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood level.

Level of Service (LOS): An index of the operational performance of traffic on a given traffic lane, carriageway or road when accommodating various traffic volumes under different combinations of operating conditions. It is usually defined in terms of the convenience of travel and safety performance.

Municipal road: All roads which become part of the public road system and are supplementary to arterial and sub-arterial roads. Municipal roads include major collector roads, minor collector roads, access streets and rear access lanes. Municipal roads primary function is to provide access to leases/blocks.

Nominal kerb line: Also known as the nominal face of kerb, it is the location on the kerb, kerb and gutter or open channel invert from which the road carriageway width is measured. Refer to *ACTSD 0101-02 Kerb and gutter standard details* for actual location for each kerb type.

On-road cycle lane: The portion of a road carriageway for the exclusive use of cyclists.

On-street parking: A portion of the road carriageway available for vehicle parking full or part time.

Open space: Land accessible to the public in a natural setting or developed to support leisure and sporting activities.

Path: A public access way for the movement of pedestrians and manually propelled vehicles that is not located within a road.

Plan transition: 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.

Property Line: The street frontage of a block and defines the boundary between public and private property.

Road reserve: The strip of public land between abutting property boundaries, specifically gazetted for the provision of public right of way. It includes the road carriageway, as well as community paths, verges and landscape.

Side friction factor (f): A measure of the frictional force between the pavement and the vehicle tyre.

Community path: A path for the joint use of pedestrians and cyclists.

Shared trench: A trench with multiple services, as defined in the Underground Services in a Shared Trench Agreement, (Telstra, NBN, TransACT, Zinfra, Evo Energy).

Shoulder: The portion of formed carriageway that is adjacent to the traffic lanes and flush with the surface of the pavement.

Shoulder width: The measurement taken from the outer edge of the traffic lane to the edge of usable carriageway and excludes any berm, verge, rounding or extra width provided to accommodate guideposts and guard fencing.

Speed (85th percentile): The speed at or below which 85% of the vehicles travel:

- > **Design speed:** A speed fixed for the design and correlation of those geometric features of a carriageway that influence vehicle operation.
- > **Desired speed/Operating speed:** The speed over a section of a road adopted by a driver as influenced by the road geometry and other environmental factors.

Threshold treatment: A section of a lane with changed pavement marking or surfacing, to indicate a change in speed environment.

Traffic lane width: Traffic lanes are measured to the face of the kerb or to the lane line for multi-lane roads or roads with shoulders.

Verge: The section of the street formation that joins the carriageway with the property line. It may accommodate public utilities, stormwater flows, street lighting poles, traffic signs, paths, road safety barriers and plantings.

Water sensitive urban design (WSUD): A design framework that aims to minimise the impact of the urban built form on the natural water cycle.

Width of clear sight path: the width of the portion of carriageway which does not have its line of sight through the device blocked by streetscape materials, usually vegetation.

1.1.6 Hierarchical street network

1.1.6.1 Street functions

Objective: Design streets to support the activity and vitality of land uses in appropriate locations. Recognise that streets provide dual and at times competing functions of movement and place making. Design for clear legibility to convey the street function to all road users.

Planning context: Identify the strategic function of streets as described in the *ACT Movement and Place Framework*.

1.1.6.2 Functional road classifications

General: Functional road classifications are based on traffic volumes, land uses or place making are not explicitly considered. The hierarchical road network aims to maximise road safety, priority for pedestrians and cyclists, residential amenity and legibility.

Arterial Road: Arterial Roads are strategically significant roads that cater for high vehicle volumes travelling over large distances. They do not interact with the places that the road passes through.

Sub-arterial Road: Sub-arterial Roads are main roads between strategic centres that provide safe, reliable and efficient movement.

Major Collector: Major Collector roads are part of urban neighbourhoods. These roads collect and distribute traffic between the primary (arterial and sub-arterial) road network and the user destinations.

Minor Collector: Minor Collector roads distribute traffic from Access Streets to Major Collector or Arterial roads. A reasonable level of residential amenity and safety is maintained by restricting vehicle speeds by means of street alignment, intersection design or by speed control measures.

Access Streets: Access streets are used where the residential environment is dominant, traffic is subservient, speed and volumes are low and pedestrian and cycle movements are facilitated. Access Streets are categorised as Access Street A or B according to traffic volumes and context. Access Street A generally collects traffic from Rear Lanes and connects to other Access or Collector Roads; they do not normally accommodate traffic from other streets.

Rear Lane: Rear lanes are narrow and short streets which have the primary function of providing vehicular access to the rear of blocks.

Classification of the existing network: To the *ACT Road Hierarchy*.

Table 01-1 Functional road classifications

| Street type | Traffic volume (vph) | | | |
|------------------------------------|----------------------|------------------------------|-----------------------------|------------------|
| | Transport Corridors | Residential zones (incl CZ5) | Commercial Zones (excl CZ5) | Industrial Zones |
| Arterial & Sub-arterial | >6,000 | N/A | N/A | N/A |
| Major Collector | N/A | 3,001-6,000 | 3,001-6,000 | 3,001-6,000 |
| Minor Collector | N/A | 1,001-3,000 | 1,001-3,000 | 1,001-3,000 |
| Access Street B | N/A | 301-1,000 | 0-1,000 | 0-1,000 |
| Access Street A | N/A | 0-300 | N/A | N/A |
| Rear Lane | N/A | 0-160 | 0-100 | N/A |

2 STREET PLANNING

2.1 Consultation

2.1.1.1 TCCS and other authorities

Responsibility: Consult with the TCCS and other relevant authorities during the preparation of design. In addition to the requirements of this Design Standard, identify the specific design requirements of these authorities.

2.1.1.2 Public consultation

Non-statutory consultation: Undertake public consultation on designs if such action is required by the project brief.

Statutory consultation: Conform to the requirements of the *Planning and Development Act*.

2.1.1.3 Utilities service plans

Existing site conditions: Obtain plans from all relevant utilities and other organisations whose services, trees, important ecological habitats or other assets exist within the area of the proposed development. Plot this information on the relevant drawings including the plan and cross-sectional views. As a minimum, designs should refer to 'Dial-before-you-dig' information that is readily available in most areas.

Responsibility: Confirm service plans accuracy with onsite inspection and also potholing if deemed necessary.

2.1.1.4 Safety in Design

Requirement: Implement safety in design processes in accordance with the *Work Health and Safety Act*.

2.2 Planning concepts

2.2.1 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.

Preparation for design: Design development inputs to include the following;

- > Desired network function,
- > Compatibility with main and local walking and cycling route hierarchies.
- > The requirements of a Concept Plan to conform to the *Estate Development Code*.

2.2.2 Legibility

General: Design for clear legibility in conformance with the following:

- > Differentiation: Reinforce legibility by providing sufficient differentiation between the street functions as required by the *Estate Development Code*.
- > Landmark features: Emphasise distinct landmark features such as watercourses, mature vegetation or ridge lines within the structural layout so as to enhance the legibility.

2.2.3 Integrated design principles

Requirement: Integrate all design principles in the development of the street network to provide a balance between maximising amenity, safety and convenience considerations and those related to the drivers' perception of appropriate driving practices.

Preparation for design: Design development inputs to conform to *AGRD08*.

Consider: Output from previous phases such as:

- > Movement networks (*ACT Movement and Place Framework*)
- > Settlement strategies (eg *ACT Planning Strategy*).
- > Transport strategies (eg *Transport for Canberra*).
- > Urban Design and Land Use Masterplans.
- > Deed of Agreement (if applicable).
- > Development Application.
- > Estate development planning.
- > Concept or master planning.
- > Precinct Codes.
- > Traffic modelling.
- > Previously prepared designs including Capital Works.
- > Any interface with adjacent areas and associated designs.
- > Introduced features: Provide the necessary legibility, by the inherent design and functional distinction of the street network in addition to introduced physical features such as pavement and lighting details.

2.2.4 Age friendly design concepts

Requirement: Adopt strategies to ensure streets remain accessible for people at every stage of their lives. Include consideration for the following:

- > Provide accessible paths of travel to and from open space areas.
- > Reduce road crossing distances for pedestrians with the use of medians or tighter radius kerbs at intersections where possible.
- > Provide access to public transport.
- > Provide public seating set back from main thoroughfares in safe and well maintained areas. Seats should include back rests and arm rests.
- > Provide large, clear signage for way finding.
- > Plan for adult recreation facilities such as fitness circuits.
- > Avoid unnecessary changes in level.

Accessible paths: To *MIS 05 Active travel facilities design*.

2.2.5 Disability access

Requirement: Provide equal rights, opportunity and access for people with disabilities in accordance with the *Disability Discrimination Act*.

Standard: To *AS 1428*.

2.2.6 Environmental considerations

General: Identify and prevent potential for environmental harm.

Requirement: Evaluate the environmental considerations including the following:

- > National or locally listed endangered species or habitats: To *ACT Threatened Species Action Plans*.
- > Erosion and sediment control: To *MITS 02B Bulk earthworks* and EPA requirements.
- > Water quality: To *MIS 08 Stormwater* and EPA requirements.
- > WSUD: To *Water Sensitive Urban Design Code*.
- > Tree protection: to *MITS 02A Clearing and grubbing* and TCCS requirements.
- > Bushland and conservation area management: To *ACT Nature Conservation Strategy*.
- > Design and plan streets for energy and water conservation.
- > Promote the efficient use of land and of energy, and minimise greenhouse gas emissions.
- > Enhance and protect built and natural heritage in accordance with Heritage ACT requirements.

2.2.7 Climate change adaptation

General: The *ACT Climate Change Adaptation Strategy* establishes the importance of increasing the built environment resilience and amenity in the context of a changing climate.

Mitigation: Design to reduce the impact of development on climate change by including consideration for the following:

- > Landscaped areas are designed to provide amenity and biodiversity, protect buildings and spaces from the elements and incorporate sustainable urban drainage systems.
- > Plan buildings, gardens and public spaces to exploit the best solar orientation.
- > Provide appropriate recycling and green waste facilities in accordance with ACT No Waste requirements.
- > Creating a permeable network of direct routes to increase the sustainability of the development.
- > Species selection that is appropriate to the Canberra climate and will require minimal watering or maintenance activities.
- > Species selection and layout to maximise canopy and shading thereby reducing the heat island effect.
- > Incorporate more frequent and extreme events into stormwater drainage design, refer to *MIS 08 Stormwater*.
- > Design for bushfire management in accordance with the *Strategic Bushfire Management Plan* for the ACT and *MIS 15 Urban Edges Management Zone*.

2.2.8 Other considerations

Requirement: Evaluate the other environmental design considerations; refer to *AGR06B* and the following:

- > Topography: minimise cut and fill to *MIS 02 Earthworks and Site Grading*.
- > Existing and future allocation for public utility services: consult with relevant service providers and refer to *MIS 06 Verges* for typical service alignments.
- > Bushfire management: refer to the *SBMP* and *MIS 15 Urban Edges Management Zone*.
- > Visual intrusion: consider the full impact of streets including cut and fill batters and road furniture.
- > Vehicle head light intrusion: consider vertical alignment adjacent to intersections.
- > Noise: consider vertical alignment adjacent to intersections and/or sensitive areas (e.g. schools, hospitals) to minimize braking noise.
- > Vibration and pollution.

3 STREET DESIGN

3.1 Design considerations

3.1.1 Traffic volume and composition

Requirements: Determine the AADT using traffic generation rates specified in the *Estate Development Code* or to *AGTM03 Traffic studies and analysis* where information is not provided within the *Estate Development Code*.

3.1.2 Road network design criteria

Routing: Provide routing as follows:

- > Avoid routes in lower level streets that are more convenient than the higher level street network or perceived to be a short cut in conformance with *AGTM08 Local area traffic management*.
- > Provide access to arterial roads at appropriate intervals in order to limit traffic volumes within lower level streets and provide adequate capacity to accommodate through movements within the arterial road network.

Traffic volumes and speeds: Conform to *Estate Development Code*.

Road layout: Conform to *Estate Development Code*.

Pedestrian or bicycle network: conform to *MIS 05 Active travel facilities design*.

3.1.3 Design speed

3.1.3.1 General

Guidelines: Use design speed as the basic parameter of geometric road design. Recognise that the Design Speed is dependent on the functional road classification, strategic function, topography, adjacent land use and the desired speed of drivers.

3.1.3.2 Design speed values for municipal streets

Requirement: Conform to the design speeds specified in the *Estate Development Code*.

3.1.4 Operating speed

Model: Determine the operating speed using the operating speed model to *AGRD03, clause 3.5* to predict the operating speed of cars along the length of the street where the operating speed varies with the horizontal curvature and is also dependent on the driver behaviour, street and the vehicle characteristics.

3.2 Hazard reduction

High speeds: Avoid vertical or horizontal curves of low design speed located in otherwise high-speed sections to minimise hazards for road users. Recognise that operating speeds may be in excess of posted speed limits.

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

Road safety barriers: Assess the need for and design road safety barriers to *AS/NZS 3845* and *MIS 10 Fences, guardrails and barriers*.

Cycle rest rails and steel barriers: Prior to the design of bicycle rest rails at roundabouts and intersections, a risk assessment shall be performed in accordance with the Autroads Safe Systems Approach to form the basis of a design recommendation to TCCS. For further discussion on the application of bicycle rest rails, refer to *MIS10 Fences, Guardrails and Barriers* and *MIS 05 Active travel facilities design*.

Safety in Design: Adopt appropriate risk management processes including Road Safety Audits as required by the Principal or TCCS.

3.3 Design vehicle

3.3.1 Design Vehicle

Design vehicle: To **Table 01-2 Design vehicles table**.

B-Double 25m vehicles: For defined routes only, refer to the Road Transport (Mass, Dimensions and Loading) General B-Double Exemption Notice.

Semi articulated 19m vehicles: For defined access routes to commercial or industrial zones.

ACTION Steer Tag bus (with bike rack): For defined bus routes, refer to ACTION.

3.3.2 Checking Vehicle

General: Select a Checking Vehicle appropriate to the land use, typically one size larger than Design Vehicle in accordance with *AP-G34 Design vehicles and turning path templates*.

Commercial and Mixed Use zones: ACT ESA Bronto 44m Fire Truck.

3.3.3 Vehicle swept path

General: Design intersection turning movements with consideration for verge widths, intersection geometry, vertical alignment, kerb ramps and medians, on-road cycling lanes and on-street parking.

Line marking for intersections: To *ACTSD 3505 Pavement markings - T-intersections*.

Objectives:

- > Provide a safe environment for all road users, with consideration for sight distance, road rules and efficient pedestrian crossings.
- > Minimize kerb radii to encourage a safe speed environment appropriate to the road classification.

Clearance: Provide 500mm clearance from the swept path of the vehicle body at all kerb ramps.

Vehicle path: Turns to be in accordance with *Australian Road Rules, ACT*.

Parking: Intersection turning movements shall not encroach on marked car parks or marked on road cycle lanes except where permitted to do so under the *Australian Road Rules, ACT*. Where informal on street parking is permitted, it is acceptable to assume that vehicles are not parked in these locations while demonstrating turning movements.

Submission: Demonstrate compliance with the following.

Table 01-2 Design vehicles table

| Scenario | Design Vehicle ¹ and Considerations | |
|-------------------------------------|--|--|
| Collector and Collector | 12.5m HRV | Vehicle to remain in lane, do not cross road centrelines on left turns |
| Major Collector and Access B | 12.5m HRV | Vehicle to remain in lane, do not cross road centrelines on left turns |
| Minor Collector and Access | 12.5m HRV | In the absence of barrier lines, the vehicle for the free left turn may cross both centrelines, provided that there is a minimum 2.5m clearance to oncoming traffic in both streets. The vehicle for the priority controlled left turn shall remain within its lane (to prop prior to turning) but may cross the centreline of road that vehicle is turning into. |
| Access to Access (and lower) | 12.5m HRV | In the absence of barrier lines, the turning vehicle may use any part of the pavement. |

Notes: ¹ Steer-tag Bus with bike rack or 19m/25m Vehicle on defined routes

The following 'auto-turn', or equivalent vehicle modelling program, output details must be submitted as part of demonstrating compliance to *Table 01-2*.

- > show all kerb crossing points, inclusive of required minimum clearance outside swept paths;
- > show the location of all regulatory signage and pavement marking;
- > show all pavement widths commensurate to nominated street type;
- > show sight lines for all vehicles utilising the intersection;
- the safe stopping distance should be the critical sight distance for through approaching vehicles. Evidence must be shown of how this has been maximised commensurate to the speed environment. Refer to *Section 6.3* for LATM considerations;

4 CROSS-SECTION

4.1 Road reserve characteristics

4.1.1 General

Cross section: Provide for all street functions appropriate to the land use, including the following:

- > Safe and efficient movement of all vehicle users, pedestrians and cyclists.
- > Economic to construct and maintain.
- > Provision for parked vehicles. Give particular attention to access for disabled persons in conformance with the *Disability Discrimination Act*.
- > Access to public transport.
- > Buffer from traffic acoustic nuisance for residents.
- > Provision of public utilities and drainage.
- > Landscaping of streets.

Operational aspects: Design for the following:

- > Allow vehicles to proceed safely at the intended operating speed.
- > Minimise traffic delays for road users.
- > Take into consideration the restrictions caused by parked vehicles.
- > Consider appropriate vehicles such as delivery trucks, emergency vehicles, waste collection and buses.

4.1.2 Traffic lanes

4.1.2.1 General

Lane width: Determine the number and width of the traffic lanes required depending upon the traffic volume, presence of cyclists, bus routes, available road reserve width and the side friction constrained by abutting access.

Carriageway width: Conform to the *Estate Development Code*.

On-road cycling: Avoid traffic lane widths 3.3 to 3.7m where on-road cycle lanes are not marked.

4.1.2.2 Plan transitions

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

4.1.3 Crossfall

General: It is desirable to crown roads on the centreline. Provide crossfall for road drainage and to provide superelevation on horizontal curves.

Crossfall: Provide pavement crossfalls to *AGRD03*. A typical crossfall for a paved surface is 3%.

Crossfall changes: To avoid abrupt changes in crossfall, which can cause discomfort in travel and create a visible kink in the kerb line, conform to the following:

- > 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 stormwater inlet structures 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.

4.2 Verges and property access

4.2.1 Verge design

4.2.1.1 General

Verge criteria: Conform to *MIS 06 Verges* with consideration of the following:

- > Utility services.
- > Community path location.
- > Access to adjoining properties.
- > Likely pedestrian and cyclist usage.
- > Preservation of trees.
- > Stormwater overland flow.

Street hierarchy: Direct property access is permitted on streets classified as Minor Collector roads or lower within the ACT road hierarchy. Direct property access to Major Collector streets is permitted where the access and egress is in a forward direction only.

4.2.1.2 Paths

Path design: Conform to *MIS 05 Active travel facilities design*. Provide for the safety of pedestrians and cyclists by providing sufficient width and control of landscaping to provide sight distances. Refer to *MIS 05 Active travel facilities design*.

Longitudinal grade of paths: Parallel to the longitudinal grade of the road, where not required to comply with DDA limits, refer to **Disability Access**.

4.2.1.3 Driveways

Property Access: Provides unobstructed access to individual blocks from the road carriageway. Vehicles shall be able to enter or reverse in a single movement, taking into consideration the possibility of a vehicle being parked on the carriageway opposite the driveway.

Driveway profile: Conform to *MIS 07 Driveways*.

4.2.1.4 Trees

Trees and Street furniture: Provide the following with consideration of land use, drainage and verge surfacing:

- > Street trees to *MIS 25 Plant species for urban landscape projects*.
- > Street furniture to *MIS 20 Street and park furniture*

4.2.2 Batters

4.2.2.1 General

Requirement: Accommodate differences in level across the road between road reserve boundaries by the following measures used individually or combined:

- > Battering at the road reserve boundary and providing the verge at a standard crossfall.
- > Battering over a portion of the verge, excluding a corridor width allowed for services and road safety against the kerb, generally 2m wide and constructed at a standard crossfall.

4.2.2.2 Batter slopes

Planning: Design the batter slopes considering the following factors:

- > Recommendations of geotechnical investigations.
- > Batter stability (establishment of vegetation) and road safety.
- > Available width of road reserve.
- > Sight distances.
- > Maintenance costs and accessibility requirements. The maximum batter slope for a mowing is typically 4H:1V.
- > Future vehicle access. The maximum batter slopes for batters extending into future residential blocks is typically 6H:1V.

Standard: To *AGRD03, Table 4.11*.

Benches: Provide benches for high batters > 10m vertical height or batters on unstable ground. Provide benches as indicated in *AGRD03, Figure 4.14*.

- > Minimum width of bench: 3m.
- > Maximum crossfall: 10%.
- > Preferred bench width for road safety, maintenance and drainage: 5m.

4.3 Roadside drainage

4.3.1 General

Objective: Provide drains to remove water from the road and its surroundings and to maintain road safety and pavement strength. Provide table drains, catch drains, median drains, swales or kerbs and gutter. Provide flood protection for property and the public and include opportunities to integrate water sensitive urban design into the street environment.

Stormwater design: To *MIS 08 Stormwater*.

Swales: To *MIS 08 Stormwater*.

Subsoil drains: To *MIS 02 Earthworks and site grading*.

4.3.2 Roadside drainage

4.3.2.1 Table drain

General: Provide a dish drain, or similar structure along the invert of table drains, seal the outer edges of the pavement, the shoulder verges and the drain lining where scour is likely to occur to *AGRD03, Figure 4.16*. Provide the following slopes:

- > Side slopes: < 4H:1V.
- > Desirable slope: 6H:1V.

4.3.2.2 Catch drains

General: Provide catch drains to prevent overloading of the table drain and scour of the batter face at least 2m from the edge of cuttings to minimise possible undercutting of the top of the batter.

4.3.2.3 Median drains

General: Provide median drains with desirable maximum side slopes 10H:1V to reduce the chance of vehicle overturning. Provide a median of minimum 10m width. Place the invert of the median drain below subgrade level to facilitate drainage of pavement layers. If this cannot be achieved pavement subsurface drains shall be provided.

For medians with water sensitive design measures, and narrower medians (less than 10m), designs shall meet the safety requirements of *AGRD03*. Incorporate WSUD principles in *MIS 08 Stormwater*.

4.3.3 Kerb drainage

4.3.3.1 General

Kerb and gutter: Provide kerb and gutter to perform the following:

- > Collect and convey surface drainage to a discharge point.
- > Delineate the edges of the carriageway.
- > Separate carriageways from areas dedicated to community path users.
- > Support the edge of the base course of the pavement.
- > Reduce the width of cut by substituting an underground drainage system in place of table drains.

4.3.3.2 Kerb type and placement

Requirement: Conform to *Estate Development Code* and as follows:

- > Provide upright kerb adjacent to parking lanes and parking areas, and bus bays to reduce the risk to pedestrians.
- > Provide upright kerb or permeable kerb adjacent to parkland, floodways and other open space areas. Refer also to *MIS 10 Fences, guardrails and barriers*.
- > Provide upright barrier kerb on straight sections of road to restrict vehicle access only. Upright barrier kerb should not be used along curves on bus routes or where on-street parking is permitted. Provide bollards for the same purpose in these situations.
- > If required to meet estate planning or housing reasons, provide layback kerb on access streets to allow for off-road parking and for continuous access to property.

4.4 Other features

4.4.1 Medians

General: Medians are not generally required for major collector and lower hierarchical roads. If it is required to include medians for traffic or estate planning reasons, the following tables shall be used.

Median width: Minimum median width to *AGRD03, Table 4.15*.

Median slopes: Provide median slopes to *AGRD03, Table 4.16*.

4.4.2 On road cycling facilities

General: Consider provisions for cyclists in the road design and provide adequate space for cyclists to share the road safely and comfortably by providing on-road cycle facilities in the form of the following:

- > On road cycle lanes: Provide separation from other motor traffic with exclusive cycle lane on the left side of the road by pavement markings and signs.
- > Shared lanes for joint use by cyclists and other vehicles without lane marking.

Standard: To *MIS 05 Active travel facilities design*.

4.4.3 On-Street parking

4.4.3.1 General

Objective: Provide the required number of parking spaces within the road reserve for visitors and service vehicles, with consideration for the following:

- > Convenient and safe to access.
- > Well defined with traffic control devices.
- > All-weather surface.
- > No restriction to the safe passage of vehicular, disabled and pedestrian traffic.
- > Standards: To AS 2890.5, AGRD03, clause 4.10 and AGTM11 Parking.

4.4.3.2 Planning

Number of spaces: Comply with the *Parking and Vehicular Access General Code*.

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

Commercial zones: Include provision for loading zones.

Parking controls: Parking permits for new private residential developments will not be permitted. Make provision for waste collection, as required by the land use on the adjacent block.

Property access: Access through indented parking bays will not be permitted.

4.4.3.3 Design

Material: Construct indented parking areas of concrete, interlocking pavers, bitumen or other suitable base material designed to *MIS 03 Pavement Design*.

Parallel Indented Parking: Kerbs shall be provided at either 45° or 90° to delineate parking bays.

Angled parking: Will only be permitted with prior approval from TCCS.

4.4.4 Bus stops

New bus stops: In conformance with the requirements of the *Disability Discrimination Act*, other road authorities and *transport agency disability standards* which outline the requirements of the access paths, manoeuvring areas, ramps, waiting areas, surfaces and tactile ground surface indicators.

Urban bus stops: To *ACTSD 0530-0532 Bus stop standard details*

Standard:

- > Location: Refer to the *Estate Development Code* and *ACTION* requirements.
- > Layout and path connections: To *MIS 05 Active travel facilities design*.
- > Pavement design: To *MIS 03 Pavement design*.
- > Line marking: To *MIS 13 Traffic Control Devices*.

4.4.5 Bus routes

Criteria: Conform to the following:

- > The *Estate Development Code Elements 2.1, 2.2 and 13.1*
- > Design the road hierarchy to cater for buses on routes identified.

Dimensions: Conform to *Estate Development Code Tables 2A, 2B and 3*.

4.5 Auxiliary lanes

General: Provide auxiliary lanes or service roads adjacent to the through traffic lanes to enhance traffic flow and maintain the required level of service where an Arterial road meets with the major or minor collector road.

4.5.1 Speed change (turning) lanes

General: Provide speed change (acceleration or deceleration) lanes at intersections or interchanges to allow an entering vehicle to access the traffic stream at a speed approaching or equal to 85th percentile speed of the through traffic.

Auxiliary lane width: Provide auxiliary lane width not less than the normal width for that section of the road.

Crossfall: Provide same crossfall of the auxiliary lane as the adjacent lane.

4.5.2 Service roads

General: Provide service roads to access an adjacent property or control access to the Major Collector or Arterial road from the adjacent property. Service roads are designed to be operated as one way or to provide the ability to turn around.

Minimum service road lane width: To *AGRD03, Table 4.26*.

Minimum service road carriageway width for roads with low traffic volumes and low parking demand: To *AGRD03, Table 4.27*.

Operating speed: 40km/h.

Outer separator width: To *AGRD03, Table 4.28*.

Verge: Consistent with the requirements for the Major Collector or Arterial Road, as appropriate, refer to *MIS 06 Verges* and the *Estate Development Code*.

5 GEOMETRIC DESIGN

5.1 Sight distance

5.1.1 Design parameters

5.1.1.1 General

Requirement: Provide stopping and sight distances at all points on the road conforming to *AGR D03, Section 5*.

General: To *AGR D03, Table 5.1* and the following:

- > Object cut-off height: 0.2m.
- > Driver eye height: Adopt the following:
 - For cars: 1.1m.
 - For commercial vehicles: 2.4m.
- > Driver reaction time: Adopt reaction time of 2.0 seconds for all municipal roads. If 1.5 seconds reaction time is required, arrange approval from TCCS. *AGR D03, Table 5.2* provides further details on reaction times.

5.1.1.2 Stopping sight distance

Requirement: Conform to the following:

- > General: To *AGR D03, clause 5.3*, measured from an eye height of 1.15m to an object height of 0.20m.
- > On sealed roads: Car stopping sight distance to *AGR D03, Table 5.5*.
- > On horizontal curves: To *AGR D03, Figure 5.4*.
- > On horizontal curves with roadside barriers: Provide minimum shoulder widths and manoeuvre times for sight distances over roadside safety barriers on horizontal curves to *AGR D03, Table 5.7*.

5.1.1.3 Horizontal curve perception sight distance

Requirement: Provide sufficient sight distance by adopting larger crests for a horizontal curve. Do not provide a horizontal curve starting over a crest. Check sufficient visibility is provided for the curve by providing:

- > Clear driver eye height: 1.1m.
- > A zero object height such that the driver can see the road surface in order to perceive the curvature.
- > Driver visibility of a minimum of:
 - 5 degrees of arc.
 - 80m of arc.
 - The whole curve.

5.2 Coordination of horizontal and vertical alignment

5.2.1 General

Objective: The 3 dimensional alignment of the road aims to increase efficiency, safety, encourage uniform speed, improve aesthetics, and provide harmony with the landform and drainage.

Requirement: Conform to the following:

- > Minimum radius horizontal curves shall not be used with crest vertical curves.
- > Contain the crest vertical curves within horizontal curves to enhance the appearance of the crest by reducing the three dimensional rate of change of direction and to improve safety.
- > Provide the same design speed of the road in both horizontal and vertical planes.
- > Minimum radius horizontal curves shall not be introduced at or near the top of a vertical curve.
- > Consider three dimensional combined horizontal and vertical stopping sight distance and minimum sight distance.
- > Provide a horizontal curve to indicate the change in direction before introduction of vertical curve in both directions of travel.
- > Be aware that 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.

5.2.2 Aesthetic consideration

Requirement: Conform to the following:

- > Provide horizontal curves slightly longer than the vertical curve, such that the curves fit with the terrain and are coincident.
- > Provide long horizontal curves to short curves such that:
 - The overtaking opportunities are not reduced.
 - Small deflection angles avoid the appearance of a kink.
 - Best appearance is provided for deviations around obstructions.
 - The far tangent point is beyond the driver's point of concentrated vision for curves located at the end of long straights.

Additional guidance: Refer to *AGRD03, clause 6.3*.

Drainage: Enable efficient pavement drainage and reduce the risk of aquaplaning. Where possible avoid sections of grades < 1%. Refer to *AGRD03, Clause 6.4* for additional guidance.

5.3 Horizontal alignment

5.3.1 General

Requirement: Provide horizontal alignment for safe and continuous vehicle operation at a uniform travel speed. Include the following:

- > For municipal roads, where physical restrictions curve radii cannot be overcome, introduce curvature of a lower standard than the design speed of the project to *AGRD03, Table 7.1*.
- > Determine the horizontal alignment from the design speeds for a particular street within the road hierarchy (see **Design Speed**).

Horizontal clearances: Provide minimum horizontal clearances to service infrastructure, street furniture and trees. Conform to *MIS 06 Verges*.

5.3.2 Horizontal curves

5.3.2.1 General

Types of horizontal curves: Straights between reverse curves are desirable but not necessary on municipal roads. Transition curves and compound curves are not required on municipal roads.

5.3.2.2 Horizontal curves and tangent lengths

Speed/radius relation: Conform to the following:

- > For a given design speed, utilise the minimum radius of curvature that ensures that drivers can safely negotiate the curve.
- > Avoid curves that progressively tighten (e.g. parabolic curves) and sudden reverse curves that drivers cannot anticipate as they have the potential to produce an uncomfortable sense of disorientation and alarm.

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

Maximum straight lengths: Conform to the *Estate Development Code*.

Tangents: Determine appropriate lengths for tangents between speed restrictions, which may be curves, narrow sections or other obstructions.

Sight distance: Determine the sight distance on curves to *AGRD03, clause 5.4*.

5.3.2.3 Side friction and minimum curve size

Recommended side friction factors: To *AGRD03, Table 7.5*.

Minimum radii for horizontal curves based on superelevation and side friction: To *AGRD03, Table 7.6*.

Maximum allowable deflection angles without horizontal curves: To *AGRD03, Table 7.7*.

5.3.3 Curves with adverse crossfall

General: Avoid adverse crossfall greater than 3% except for curves with an operating speed ≤ 70 km/h in constrained areas and for intersection turns and roundabouts.

Minimum radii with adverse crossfall: To *AGRD03, Table 7.12*.

Adverse superelevation: Provide adverse superelevation at the following:

- > Property access controls.
- > Channel drainage controls.
- > Grading restrictions.
- > Intersections to maintain visibility of the road surface.

5.3.4 Pavement widening

Widening: Provide pavement widening on curves to *AGRD03, Table 7.13* to maintain lateral clearance between vehicles taking into account the following factors:

- > Radius of the curve.
- > Width of lane on a straight road.
- > Vehicle length, width and swept path.
- > Vehicle clearance.

5.4 Vertical alignment

5.4.1 General

5.4.1.1 Vertical controls

Requirement: Consider the effect of the following features on the vertical geometric design:

- > Existing topography: minimise cut and fill.
- > Geotechnical conditions.
- > Existing intersections.
- > Property entrances.
- > Pedestrian access.
- > Service utility assets.
- > Median openings.

Documentation: Show vertical alignment on a longitudinal section with an appropriate vertical scale, typically 5H:1V or 10H:1V.

Minimum clearance above flood levels: Above 100 year ARI events plus 0.3m to 0.5m freeboard

5.4.1.2 Vertical clearances

General: Provide minimum vertical clearances over roadways and community paths to *AGRD03, Table 8.1*.

5.4.1.3 Underground services

Clearance requirements: Consult the relevant authority or *MIS 06 Verges* to determine the minimum clearance requirements for:

- > Gas mains.
- > Water mains.
- > Stormwater drains.
- > Sewer mains.
- > Telecommunication cables.
- > Underground electrical cables.
- > Road authority assets e.g. traffic signals and street lighting.

5.4.2 Longitudinal gradient

General: Provide grades as flat as possible, consistent with longitudinal drainage requirements such that all vehicles operate at the same speed.

Intersections: Conform to *AGRD04A, clause 2.2.2*.

5.4.2.1 Maximum grades

Maximum longitudinal grade: To *AGRD03, Table 8.3* and *Table 2A and 2B of the Estate Development Code*. *The Estate Development Code* or *Precinct Code* takes precedence if there are conflicts.

Maximum grade in cul-de-sacs and turning heads:

- > Conform to *Estate Development Code* for road longitudinal grade.

Conform to *ACT No Waste Development Code* for turning head geometry

5.4.2.2 Minimum grades

Requirement: Conform to the following minimum grades.

Road with kerb and gutter:

- > Minimum desirable grade: 1%.
- > Flatter grades (between 0.5% and 1.0%) may be permitted subject to providing satisfactory evidence that drainage provision and the proposed construction practices are such that ponding will not occur.
- > Grades flatter than 0.5% may be permitted only in exceptional circumstances (i.e. widening of existing pavement). The designer shall outline procedures that will ensure that the finished gutter profile and pavement surface are free draining and that the width of flow is within the requirements.

Roads without kerb and gutter in cut:

- > Draining to unlined drains and floodways: minimum 0.5%. Maintain flow velocity <2m/s.
- > Draining to lined drains: 0.3%.

Roads without kerb and gutter and not in cut:

- > In fill and outside the superelevation transitions, unkerbed roads may have 0% grade providing that table drains have positive gradient or the surface runoff freely sheds away from the road formation.

5.4.3 Vertical curves

5.4.3.1 General

Criteria: Design vertical curves in conformance with the following:

- > Provide vertical curves on all changes of grade exceeding 1%.
- > Desirable minimum design speed: Accordance with *Table 4 of the Estate Development Code*.
- > The length of the crest vertical curve for Stopping Sight Distance: To *AGRD03, Table 8.7*.
- > Limit the length of crest curve with 0.3% to 0.5% grade: 30 to 50m.

Side road intersections: Locate intersections of roads at a safe distance from a crest, determined by visibility from the side road. If it is proposed to locate intersections of a side road where a crest occurs, ensure that sight distance conforms with *AGRD04A, Section 3*.

5.4.3.2 Sag Curves

Sag curves: Provide the lengths of sag vertical curves to *AGRD03, clause 8.6.4* and the following:

- > Drainage limitations.
- > For kerbed roads: Limit the maximum length of sag curves with less than 0.3% grade to 30m.

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

- > For desirable riding comfort: 0.05g.
- > For minimum riding comfort: 0.10g.

6 INTERSECTIONS

6.1 General

6.1.1 Design criteria

Requirement: Consider the following factors in the location and design of intersections:

- > Alignment and grade of approach road.
- > Bus stops and bus priority.
- > Provision of drainage.
- > On road cycling, pedestrian paths, priority and layout of crossing points (refer to *MIS 05 Active travel facilities design*).
- > Interference with public utilities.
- > Property access.
- > Topography.
- > Natural and built environment.

Urban intersections: To *AGRD04, Table 4.1*.

Road user considerations: To *AGRD04, Table 3.12*.

Design criteria: Design intersections to *AGTM06*.

Pedestrian and cycle path intersections: To *MIS 05 Active travel facilities design*.

Bus stops: To *MIS 05 Active travel facilities design*.

6.1.2 Location

Requirement: Locate intersections to *AGRD04, Table 4.2* and the following:

- > Estate Development Code.
- > Streets intersection: Preferably at right-angles and not less than 70°.
- > Landform: Allowing clear sight distance on each of the approach legs of the intersection.
- > Vertical grade lines at the intersection: Conform to the following:
 - Provide a desirable grade in accordance with *AGRD04A, clause 2.2.2*.
 - Allow for any direct surface drainage.

Traffic volumes: Design for all movements to occur safely without undue delay. Use projected traffic volumes in designing all intersections or junctions on major and minor Collector roads.

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

Drainage: Design the road reserve cross-section profile to satisfy the drainage function of the carriageway and/or road reserve.

Turning movements: All turning manoeuvres are to be checked for compliances with the swept path of the design vehicle either using standards template or using computer software such as AutoTURN.

6.1.3 Intersection types

6.1.3.1 General

Traffic management: Select the type of intersections for traffic management in conformance with *AGTM06, Table 2.4*.

The basic forms of an intersection may include the following:

- > Signalised, unsignalised or a roundabout.
- > Channelised (i.e. has traffic islands and/or medians) to develop specific types of intersections, or unchannelised.
- > Flared, to provide additional through and/or turning lanes, or unflared.
- > An intersection to which different driver expectations and hence different design and traffic management guidelines may apply.

6.1.3.2 Unsignalised four way intersections

General: Unsignalised four way intersections should be avoided in street planning.

Pre-Approval: Obtain TCCS approval for unsignalised four way intersections prior to design submission based on an engineering assessment of traffic volumes, road safety objectives and suitable configuration meeting *AGTM06 Intersections, interchanges and crossings*.

Application: Unsignalised four way intersections will only be considered within Access Roads in Residential zones and within shared zones in Mixed Use zones in order to improve pedestrian and cyclist permeability. Consider additional intersection treatments to convey user priorities and enhance road safety such as:

- > Threshold treatments;
 - Use of this treatment should consider the surrounding road environments and possible multiple function as a traffic calming device. Refer to *Section 6.3* for traffic calming aspects.
 - The hierarchy of preferred materials for threshold treatments are as follows. All materials must have colour contrast from the surrounding road pavement and the proposed line marking:
 - Asphalt
 - Concrete
 - Pavers – Refer to *MITS 07 Segmental Paving* for paver layout detail for traffic direction
- > Splitter islands;
- > Mountable “micro” roundabouts; or
- > Visual intersection offsets.

Exclusion: Unsignalised four way intersections are not appropriate in high pedestrian or vehicle traffic areas such as commercial zones or on collector roads.

6.1.3.3 Types of turn treatments

General: Provide the appropriate type of right-turn and left-turn treatments from the following:

- > Basic turn treatment:
 - Urban Basic Right-turn Treatment (Type BAR): To *AGRD04A, Figure 7.6*.

- > Auxiliary lane turn treatment: Provide short lengths of auxiliary lane to improve safety on high speed roads where an arterial road meets with sub-arterial, collector or local roads. Provide the following turn treatments as appropriate:
 - Urban auxiliary left-turn treatment:
 - Urban Auxiliary Left-turn (AUL) major road: To *AGRD04A, Figure 8.6.*
 - Setting out details of the left turn geometry to *AGRD04A, Table 8.2.*
- > Minimum kerb radii for low speed environment to *AGRD04A, Table 8.3.*
- > Urban auxiliary right-turn treatments: Not as safe as a channelised treatment at unsignalised intersections. This treatment shall not be used unless approval is given by TCCS.
- > Channelised turn treatment (Type CH):
 - Municipal road Channelised intersection turn treatment:
 - Channelised right-turn (CHR): To *AGRD04A, Figure 7.8.*
 - Short turn lane (CHR(S)): To *AGRD04A, Figure 7.7.*
 - High entry angle left-turn island (CHL): To *AGRD04A, Figure 6.,5 6.6 and 6.8.*
 - CHL with acceleration lane: To *AGRD04A, Figure 6.7 and 6.9.*

6.1.4 Sight distance

Sight distance: Provide adequate horizontal and vertical sight distance at intersections. Examine each intersection location for conformance with the criteria for Approach Sight Distance (ASD), Minimum gap sight distance (MGSD) and Safe Intersection Sight Distance (SISD). Ensure ASD and SISD are achieved for all intersections, and MGSD where appropriate. Reposition an intersection if required to obtain conformance with the following sight distance criteria:

- > ASD: To *AGRD04A, Table 3.1* and grade corrections to *Table 3.4* for sealed roads.
- > MGSD: To *AGRD04A, Table 3.6* for various speeds.
- > SISD: To *AGRD04A, Table 3.2* and grade corrections to *Table 3.4.*

6.2 Roundabouts

Design criteria: To *AGRD04B* and *AGTM06.*

General: Provide 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 (e.g. buses, trucks, waste collection vehicles, cars).
- > Central islands: Of diameter sufficient to give drivers guidance on the manoeuvres expected.
- > Deflection of 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 through the intersection will be less than the design speed within the vehicle lane.

6.3 Traffic calming

Design criteria: Calming devices (e.g. thresholds, slow points, speed humps, chicanes and splitter islands) to *AGTM08*. Select the type of local area traffic management devices from *AGTM08*, *Table 7.1*.

Local area traffic management (LATM) devices: Design for 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.
 - Other visual queues such as building set-back and height
- > Location of devices/changes:
 - Other than at intersections, maintain consistency with streetscape requirements.
 - For compatibility with existing street lighting, drainage pits, driveways, and services.
 - Slowing devices optimally at spacings of 100m to 150m.
- > Design vehicles:
 - Ensure emergency vehicles are able to reach all residences and properties.
 - Major and minor collector roads with a 'feeding' function between arterial roads and access streets may be designed to *AP-G34*.
 - Bus routes: Allow buses to pass without mounting kerbs and with minimal discomfort to passengers.
 - Provide for building construction traffic in newly developing areas where street systems are being developed in line with LATM principles.
- > Control of vehicle speeds:
 - Reduce speed using devices which shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platform pedestrian/school/bicycle crossings).
 - Create a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 300m), using appropriate devices, streetscapes, or street alignment to create short sight lines.
- > Visibility requirements (sight distance):
 - Provide critical sight distances so 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 drivers, pedestrians and cyclists.
 - Ensure night time visibility of street features. Locate speed control devices 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.
- > Safety: Provide roadside design that conforms with *AGRDO6* including:
 - Safety barriers.
 - Treatment options.
 - Steep down grades.

6.3.1.1 Critical dimensions.

Dimensions: Conform to the following:

- > Pavement narrowing:
 - Single lane between kerbs: 3.50m.
 - Single lane between obstructions: 3.75m.
 - Two lane between kerbs: Minimum 7.0m.
 - Single bus lane: minimum 4.0m.
- > Plateau or platform areas: 75mm to 150mm height maximum, with 1 in 15 ramp slope relative to road grade.
- > Width of clear sight path through slowing devices: 1.0m 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).
- > Mountable areas required for the passage of large vehicles: To appropriate turning templates.

7 DOCUMENTATION

Requirements: Comply with *Reference document 6 Design Acceptance submissions*.



ACT
Government

TCCS
Transport Canberra City Services
September 2021