



**ACT**  
Government

# BRIDGES AND RELATED STRUCTURES

MUNICIPAL  
INFRASTRUCTURE  
STANDARDS 09

Transport Canberra and  
City Services

SEPTEMBER 2021



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|----------------------------|---|---|
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# ACKNOWLEDGEMENT OF COUNTRY

Transport Canberra and City Services (TCCS) acknowledge that Aboriginal people are the Traditional Owners of Australia. We acknowledge and pay respect to the Ngunnawal peoples as the custodians of the land and waters that we live and thrive on today here in the ACT.

TCCS acknowledges that Canberra’s cultural and natural heritage was maintained by the Ngunnawal people for many generations before colonial settlement on Australian soil. Aboriginal people’s management of the land preserved the natural balance of local plants and animals. This knowledge of the environment in which we live is critical to the protection and restoration of our land today.

It is our responsibility to preserve and encourage Ngunnawal, Aboriginal and Torres Strait Islander cultural integrity. When using this document, consider opportunities to incorporate Ngunnawal, Aboriginal and Torres Strait Islander culture into the bridges and structure designs.



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# 1 BRIDGES AND RELATED STRUCTURES

## 1.1 General

### 1.1.1 Responsibilities

#### 1.1.1.1 Objectives

General: Provide design and documentation for the structures covered by this design standard as follows:

- > Road traffic bridges.
- > Pedestrian bridges including cycling and wheelchair access.
- > Pedestrian, cyclist, equestrian and animal underpasses.
- > Culverts - comprising concrete box culverts, steel or concrete pipe or arch culverts.
- > Structures such as traffic and pedestrian bridge safety barriers, safety rails, protection screens.
- > Earth retaining structures, sign supporting structures and noise barriers associated with bridges.
- > Waterfront structures
- > Boardwalks and jetties.

#### 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.

#### 1.1.1.3 Scope of design

All factors that influence the design shall be considered, including:

- > Ngunnawal and Aboriginal culture.
- > Geometry.
- > Hydrology.
- > Foundation conditions and Earth Pressures.
- > Constraints on span arrangements and clearances.
- > Vehicle Loads, Friction Forces, Earthquake Loads and Secondary Effects.
- > Materials.
- > Construction methods.
- > Environmental constraints.
- > Requirements of affected Authorities.
- > Aesthetics of the structure and surrounds.
- > Signage and Lighting.
- > Debris.

#### 1.1.1.4 Designer's qualifications

Design of structural elements, electrical design, civil design, mechanical design or combination of those shall only be undertaken by engineers who can demonstrate their current registration on the *National Professional Engineers Register*.

Evidence of designer's qualifications and experience: Submit to TCCS as part of Design Acceptance submission.

## **1.1.2 Cross references**

### **1.1.2.1 ACT Legislation**

The following ACT Legislation is relevant to this Standard:

Heavy Vehicle National Law (ACT) Act

Road Transport (General) Act

Road Transport (Safety and Traffic Management) Act

Road Transport (Mass, Dimensions and Loading) Act

Road Transport (Mass, Dimensions and Loading) Regulation

Public Roads Act

Public Unleased Land Act

Territory Plan and General Codes

Work Health and Safety Act

### **1.1.2.2 ACT Government Strategic Documents**

The following strategic documents prepared by various Directorates of the ACT Government are relevant to this Standard:

Bridge safety screens policy

### **1.1.2.3 Design Standards**

This Design Standard references the following component standards:

MIS 01 Street planning and design

MIS 03 Pavement design

MIS 05 Active travel facilities design

MIS 08 Stormwater

MIS 10 Fences, guardrails and barriers

MIS 13 Traffic Control Devices

MIS 14 Public lighting

TRIS 07 Bridges and related structures

### **1.1.2.4 Specifications**

The following Specifications are related to this standard:

MITS 02C Stabilisation

MITS 08 Incidental works

### **1.1.2.5 TCCS Reference Documents**

The following TCCS reference documents are related to this standard:

Reference document 6 Design Acceptance submissions

Reference document 7 Operational acceptance submissions

Reference document 8 WAE quality records

Reference document 9 Final acceptance submissions

### **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)

## **1.1.3 Referenced documents**

### **1.1.3.1 Australian Standards**

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

|                 |   |
|-----------------|---|
| AS 1100         | Technical drawing   |
| AS 1100.101     | Part 101: General principals  |
| AS 1158         | Lighting for roads and public spaces  |
| AS 1348         | Glossary of terms - Roads and traffic engineering   |
| AS 1428         | Design for access and mobility  |
| AS 1428.1       | Part 01: General requirements for access - new building work  |
| AS/NZS 1428.4.1 | Part 4.1 Means to assist the orientation of people with vision impairment – tactile ground surface indicators |
| AS 1657         | Fixed platforms, walkways, stairways and ladders - design, construction and installation                      |
| AS 1726         | Geotechnical site investigations  |
| AS 1798         | Lighting poles and bracket arms - recommended dimensions  |
| AS/NZS 2312     | Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings   |
| AS/NZS 2312.1   | Part 01: Paint coatings   |
| AS/NZS 2312.2   | Part 02: Hot dip galvanizing  |
| AS/NZS 3661     | Slip resistance of pedestrian surfaces  |
| AS/NZS 3661.2   | Part 02: Guide to reduction of slip hazards   |
| AS/NZS 3845     | Road safety barrier systems   |
| AS 3962         | Guidelines for design of marinas  |
| AS 4282         | Control of the obtrusive effects of outdoor lighting  |
| AS 4586         | Slip resistance classification of new pedestrian surface materials  |
| AS 4678         | Earth-retaining structures  |
| AS 4997         | Guidelines for the design of maritime structures  |
| AS 5100         | Bridge design   |
| AS 5100.1       | Part 01: Scope and general principles   |
| AS 5100.2       | Part 02: Design loads   |
| AS 5100.3       | Part 03: Foundations and soil supporting structures   |
| AS 5100.4       | Part 04: Bearings and deck joints   |
| AS 5100.5       | Part 05: Concrete   |
| AS 5100.6       | Part 06: Steel and composite construction   |
| AS 5100.7       | Part 07: Rating of existing bridges   |



ISO 55000            Asset management – Overview, principles and terminology

**1.1.3.2        British Standards**

BS EN 1991            Eurocode 1: Actions on structures

BS EN 1991-2        Part 2: Traffic loads on bridges

**1.1.3.3        Other Publications**

AGRD            Austroads Guide to Road Design

AGRD03        Part 03: Geometric design

AGRD06A       Part 6A: Pedestrian and cyclist paths

AGBT            Austroads Guide to Bridge Technology

AGBT01        Part 01: Introduction and bridge performance

AGBT02        Part 02: Materials

AGBT03        Part 03: Typical superstructures, substructures and components

AGBT04        Part 04: Design procurement and concept design

AGBT05        Part 05: Structural drafting

AGBT06        Part 06: Bridge construction

AGBT07        Part 07: Maintenance and management of existing bridges

AP-C87        Austroads Glossary of Terms

**1.1.3.4        Other documents**

Background to the National Annex to BS EN 1991-2 Traffic loads on bridges, PD 6688-2:2011 (BSI Standards publication).

Bridge Aesthetics - design guidelines to improve appearance of bridges in NSW (RMS).

Bridge technical directions (RMS).

Environment Protection Guidelines for Construction and Land Development in the ACT (EPD)

UK National Annex to Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges, NA to BS EN 1991-2:2003 (BSI Standards publication).



## 1.1.4 Standards

### 1.1.4.1 General

Bridge design: To *AS 5100* and this Standard, unless directed by TCCS to use *TRIS 07 Bridges and related structures*.

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 standard the following abbreviations apply:

AGBT: Austroads Guide to Bridge Technology

CCA: Copper Chrome Arsenate

DA: Development Application

EPD: ACT Environment and Planning Directorate, ACT Government, and its successors.

RMS: Roads and Maritime Services, NSW Government, and its successors.

TCCS: Transport Canberra and City Services, ACT Government, and its successors.

### 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*, *Austroads Glossary of Terms* and *AP-C87*.

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

**Bridge:** The following items are included in the term 'Bridge':

- > Bridges and culverts which carry roads over depressions and obstructions such as waterways, roadways, or railways. They must have an opening of 1.8m or more when measured along the road centre line, or spring lines of arches, or extreme ends of openings for multiple cells.
- > Special structures under roads, e.g. pedestrian subways, utility tunnels and wildlife and stockaccess, with a cross sectional area greater than 3m<sup>2</sup> regardless of length.
- > Other structures as determined by TCCS.

**Freeboard:** The height of a portion of a structure or other construction, measured to the underside of the superstructure above a given level of water.

**Replaceable components:** Elements within the bridge structure that have a shorter design life than the bridge. This does not include bridge furniture such as light poles, signs and barriers.

**Retaining wall:** A structure that resists lateral pressure from the adjoining ground or maintains in position a mass of earth.

## 1.2 Pre-Design Planning

### 1.2.1 Consultation

#### 1.2.1.1 TCCS and other Authorities

Requirements: Consult with 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.

Bridge number: Register all bridges with TCCS.

Architectural design: Engage with the ACT Government Architect and design review panel prior to completed Preliminary Sketch Plans.

#### 1.2.1.2 Utilities services 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. Protect existing assets to the satisfaction of asset owners.

Proposed new services: Detail any new services proposed or relocated as part of the proposed works.

#### 1.2.1.3 Safety in Design

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

- > Access requirements during construction
- > Maintenance and inspections
- > Public safety
- > Pre-stressed members.
- > Post tensioned members.
- > Demolition.

#### 1.2.1.4 Protection of existing infrastructure

Dilapidation reports: Carry out inspections of all existing structures adjoining the site. Prepare a report on the existing structural condition including a photographic record of any defects.

Groundwater control: Identify potential effects of dewatering during construction.

#### 1.2.1.5 Concept design

Checklists: Complete the following before commencement of detailed design:

- > Action Checklist for preparation of bridge design concept: To *AGBT04, Appendix B*.
- > Matters for resolution before design commences: To *AS 5100.1, Appendix A*.

## 2 DESIGN

### 2.1 Design criteria

#### 2.1.1 Design life

Road and pedestrian bridges: 100 years.

Underpasses and Culverts: 100 years.

Retaining walls associated with bridges: 100 years.

Bridge, Pedestrian and Cycle Barriers: 100 years.

Service bridges: Refer to relevant service authority.

Light Poles, Sign Structures and Noise Barriers: 50 years.

Boardwalks and Jetties: 25 years.

Replaceable components (except for Boardwalks and Jetties): 40 years.

Replaceable components (for Boardwalks and Jetties): 15 years.

Sign blades: 10 years.

#### 2.1.2 Other investigations

##### 2.1.2.1 Waterways and flood design

Design: To AS 5100 and MIS 08 Stormwater.

##### 2.1.2.2 Geotechnical investigation

Requirement: Undertake geotechnical investigations to AS 1726 at the foundations for the bridge or related structure by appropriately qualified professionals.

##### 2.1.2.3 Environmental constraints

General: To AS 5100.1.

Requirement: Conform to *Environment Protection Guidelines for Construction and Land Development in the ACT*.

#### 2.1.3 Geometry

Design: To AS 5100 and AGRD03.

Freeboard: Unless site characteristics require otherwise, 600mm freeboard shall be adopted. Discuss with TCCS to seek approval for other values.

#### 2.1.4 Aesthetics

Design guidance: AGBT04, Appendix C and RMS Bridge Aesthetics.

## 2.1.5 Design considerations

### 2.1.2.4 Maintenance

Design: To *AS 5100* and *AGBT07*.

Requirement: Include consideration of the following:

- > Bridges for vehicular traffic utilising precast planks should have an in-situ concrete layer placed onto the planks unless otherwise approved by TCCS.
- > For "voided slab decks" each void shall be provided with a drain hole of 50mm minimum diameter at the lowest point to allow for water to drain effectively.
- > Allowance should be made in the design for a minimum 30mm wearing course over the road deck. A rubberised bituminous waterproofing membrane, between deck slabs and wearing course, should be specified to enhance durability.
- > Provision shall be made in the structure for adequate access arrangements to bearings and abutments for inspection, maintenance, and replacement. Where practical, jacking points (with appropriate access) shall be provided to facilitate bearing maintenance and replacement as necessary. The preferred access to box girder bridges is through the abutments at each end; hatches shall be provided for additional access.
- > Where access is required from an embankment steeper than 1:4, provide landings for inspections within the embankment. Landings shall be minimum 1.0m wide and 2.0m below the soffit.
- > Identify and minimise the extent of confined spaces within the design. For confined space access, provide access points at a maximum spacing of 100m. Each access hatch shall have appropriate anchor points and ladders where required. Maximise opportunities for ventilation and provide lighting within confined spaces.
- > Materials shall be selected with due consideration for durability and resistance to vandalism, including graffiti.
- > Stormwater outlets: Do not discharge onto erodible areas or onto paths.

Operation and maintenance manual: Provide an Operation and Maintenance manual for all new bridges as required by the brief. Include a schedule of replaceable components and identify consumables manufacturers for all non-standard consumables. Specify any keys or other components that will need to be included at the time of handover.

### 2.1.2.5 Construction

Requirement:

- > Materials shall be selected on the basis of maximising durability and minimising maintenance requirements but may be modified, with the approval of TCCS, to satisfy aesthetic criteria.
- > Bridges should preferably be constructed of concrete to minimise maintenance requirements.
- > Where steel components are necessary or required by TCCS, they should be hot-dip galvanized after fabrication. The corrosion protection system shall be to *AS 2312*. Corrosion protection systems, including preparation, are to be shown on the structural drawings. Painting should be avoided where it is aesthetically acceptable.
- > Steel products for bridge works shall be originated from an Australian Certification Authority for Reinforcing Steels (ACRS) registered manufacturer.
- > Timber shall not be used as a structural member in any new (permanent) bridge regardless of loading. In recommending the timber species for non-structural members, the designer should consider durability, maintenance and local availability. CCA treated timber shall not be used in any bridges.
- > Minor pedestrian structures of a temporary nature (design life up to 20 years) may utilise seasoned

hardwood that has been treated with preservative designers. Steel connections shall be hot-dip galvanized. Timber bridges, where practicable, shall have concrete decks.

- > For bridges up to and including 60m and up to 30° skew, elimination of movement joints is preferred where practical.
- > Retaining walls to be designed and certified by an appropriately qualified engineer. Bridge supports shall be independent of retaining walls. Crib block walling is not acceptable for underpasses.

#### **2.1.2.6 Design loads**

General: To *AS 5100.2*.

Requirement: Conform to *AS 5100.2*. Prepare design summary sheet for inclusion in the set of drawings showing design loads used and all major features of the design. Refer also to *Reference document 6 Design Acceptance submissions*.

#### **2.1.2.7 Serviceability**

General: To *AS 5100.2*.

Pedestrian and cycle bridges: To *AS 5100.2* and *BS EN 1991-2*.

#### **2.1.2.8 Ecologically sustainable development**

General: Design to prevent bird roosting within bridges. Surfaces with an incline greater than 60° are preferred for surfaces underneath bridges. Stick-on spikes are the preferred treatment where the roosting point cannot be otherwise engineered out.

Access: Do not use screens or netting that may restrict maintenance access. If stick-on spikes are included in the design, ensure clear maintenance access to bearings.

## 2.2 Road traffic and pedestrian bridges

### 2.2.1 General

Design: To AS 5100.

Design guidance: *AGBT01, AGBT02, AGBT03, AGBT04* and *AGBT06*.

Bridge number: A bridge number is to be obtained from TCCS before the commencement of the Final DesignStage. All correspondence regarding the bridge is to include the bridge reference number. Two plates with the bridge reference number are to be installed on the bridge. Plates shall be manufactured in accordance with *ACTSD-0905*.

#### 2.2.1.1 Design life maintenance

Requirement: Design for low maintenance.

Procedures for planned maintenance: To *AGBT07*.

#### 2.2.1.2 Drainage

General: Conform to *MIS 08 Stormwater*.

Longitudinal drainage:

- > Longitudinal slope shall be 0.5% minimum except over water where a level structure is acceptable.

### 2.2.2 Materials

General: Document low maintenance materials for construction, finishes and fitments. Consider exposure conditions and appropriate durability requirements. Ensure that there are no sharp edges on finished fixtures that could pose a hazard to pedestrians.

Protection of materials: Document protection methods for materials to satisfy durability requirements.

#### 2.2.2.1 Public utilities

General: If public utilities are required, if not accommodated within the structure conceal from public view unless approved by TCCS.

### 2.2.3 Provisions for pedestrians and cyclists on road bridges

Walkways and cycleways: To *AS 5100.1, AGRD06A* and *MIS 05 Active travel facilities design*.

Disabled access: To *AS 1428.1* and *AS/NZS 1428.4.1*.

On-road cycling: Where required by the road hierarchy or existing routes, provide on-road cycle lanes on bridges or an appropriate, alternative.

## 2.3 Pedestrian, cyclist and animal underpasses

### 2.3.1 General

Standard: To *AS 5100*, *MIS 05 Active travel facilities design* and *MIS 14 Public Lighting*.

Design: Conform to *Crime Prevention through Environment Design General Code*. Where there is an overlay between animal (e.g. equestrian, livestock) and other recreational user groups, provide facilities that address each user group. Design for physical separation wherever practical.

Vertical clearances:

- > Cyclists and pedestrians: To *AGRD06A*.
- > Equestrians: 3.5m.

Earthworks:

- > Grassed batter slopes shall not exceed 1 in 4 slope.
- > For slopes greater than 1 in 4 the surface shall be paved or earth retaining structure used.
- > Provide concrete mowing strip between grassed areas, paved areas and retaining walls.

Drainage: Conform to *MIS 08 Stormwater*.

## 2.4 Structures, other than bridges, associated with roads

### 2.4.1 General

#### 2.4.1.1 Buried corrugated metal structures

General: The use of buried metal culverts is not permitted unless specifically approved by TCCS.

#### 2.4.1.2 Earth retaining structures

Standard: To *AS 5100* and *AS 4678*.

Typical Designs: Refer to ASD-0901, ASD-0902, ASD-0903 and ASD-0904. Confirm suitability of designs and details for particular location, soil conditions and all other circumstances.

Safety railings: To *MIS 10 Fences, guardrails and barriers*.

#### 2.4.1.3 Culverts

Standard: To *AS 5100.2*, *AS 5100.3* and *MIS 08 Stormwater*.

#### 2.4.1.4 Noise barriers

Standard: To *AS 5100.1* and *AS 5100.2*.

General: Consider the potential for sun glare, overshadowing issues and *RMS Bridge Aesthetics*.

Maintenance: Select low maintenance materials and identify manufacturers for all non-standard consumables.

## 2.5 Structures used for public safety

### 2.5.1 Barriers and rails

Standard: To *AS 5100.1*, *AS 5100.2* and *AS/NZS 3845*.



Design vehicles: Undertake a risk assessment to determine the appropriate vehicle and test level for barrier design. Include consideration for the following as a minimum:

- > Speed environment.
- > Heavy vehicle routes: Refer to General B-Double Exemption Notice, Road Transport (Mass, Dimensions and Loading) Regulation 2010.
- > Path alignments.

Omitting safety barriers: Conform to *AS 5100.1, clause 10.5.2*. Specify flood depth indicators and signposting.

Final design drawings: Show details of all safety barriers and rails, including barrier performance level and support details.

Safety barriers and fences in the public realm not associated with bridges: To *MIS 10 Fences, guardrails and barriers*.

Transition to bridges: Ensure that there are no protrusions from barriers on the approach to bridges.

## **2.5.2 Lighting and lighting support structures**

Standard: To *AS 5100.2, AS 1158, AS 1798, AS 4282* and *MIS 14 Public Lighting*.

Final design drawing: Show details of lighting poles and support details.

## **2.5.3 Bridge safety screens**

Standard: To *AS 5100.1* and *AS 5100.2*.

Materials: Avoid materials that will concentrate sun glare or become a distraction to drivers where roadways pass underneath the bridge on an east-west orientation.

Risk assessment: Determine the need for bridge safety screens to prevent objects being thrown from bridges by undertaking a site specific risk assessment in accordance with the *Bridge safety screen policy*. Unless a risk assessment determines otherwise, provide a minimum 1.8 m high screen on all pedestrian bridges where crossing a roadway.

## 2.6 Waterfront structures

### 2.6.1 Wharfs, jetties and boardwalks

General: To AS 4997.

Disabled access: To AS 1428.

Slip resistance: To AS 3661.2 and AS/NZS 4586.

Ramp width: To AGRD06A

### 2.6.2 Boat ramps

Standard: To AS 4997.

Scour protection: Design the footings to bear on rock or make allowance in the design for loss of material in conformance with the geotechnical report and wind/hydrodynamic/sediment report.

### 2.6.3 Floating structures and fenders

Standard: AS 4997.

Construction materials selection: Consider marine growth.

Requirement: Where custom designed structures are proposed the designer shall thoroughly research and verify the claims of the manufacturer by reference to past performance and referees as well as any other necessary testing.

### 2.6.4 Lifebuoys

Risk assessment: Determine the need for lifebuoys by undertaking a site specific risk assessment.

Requirement: Provide safety equipment such as lifebuoys on or adjacent to structure together with appropriate signage.

### 2.6.5 Access and safety structures

Standard: AS 4997, AS 1657, AS 3661 and AS 1158.

Requirement: Risk assess and provide appropriate fencing and or hand railing particularly in restricted passages or narrow sections or where the drop to water or the depth of water exceeds 1.0m.

- > Provide even, non-slip surfaces generally but especially on slopes and adjacent to unfenced edges.
- > Provide appropriate lighting.
- > Avoid structure design that would entrap a person under the structure.
- > Provide safety ladders where the depth of water at the edge exceeds 1.0m.
- > Provide kerbs or wheel stops, in the absence of handrails, to offer protection to wheelchair users.

### 2.6.6 Materials

Standards: To AS 4997 clause 6 and AS 3962 clause 5.2.

Requirement: Materials shall be selected on the basis of sustainability, economy, aesthetics and durability. Where timber is used, it shall, wherever possible, be recycled or plantation timber. The use of threatened timber species or CCA treated timber is not permitted.

### 2.6.7 Durability

Standard: To AS 4997.

Requirement: Enhance durability by:

- > Attention to design details (e.g. use of cup head bolts instead of recessed hexagon heads).
- > Appropriate selection of materials (e.g. use of Durability Class 1 timbers).
- > Attention to joint design (e.g. avoidance of opportunities for water to pond and the treatment of inaccessible areas of joints with preservatives and sealants).
- > Oversizing of members which may later need planing down to remove splintered and checked timber.
- > Use of double locknuts to maintain connection between members subject to shrinkage.
- > Surfaces liable to be handled shall be free of splinters and preservative oils.

## **2.6.8 Maintenance**

Standard: to *AS 4997 Clause 6*.

Maintenance: Document low maintenance materials for construction, finishes and fitments. Consider exposure conditions, appropriate durability requirements inspection and maintenance access.

Protection of materials: Document protection methods for materials to satisfy durability requirements

Requirement: Document a regime of regular inspections.

## **2.7 Temporary works**

### **2.7.1 Design**

Standard: To *AS 5100*.

## **3 DOCUMENTATION**

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



Transport Canberra and  
City Services

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