DESIGN STANDARDS

for

URBAN INFRASTRUCTURE

7 – Bridges & Related Structures

URBAN SERVICES

7 BRIDGES & RELATED STRUCTURES

7.1 Introduction

7.1.1 General

The provisions of this document shall be applied to all new bridges and structures as defined below:

- Road traffic bridges;
- Pedestrian bridges;
- Rail, pedestrian, cyclist, equestrian and animal underpasses:
- Culverts - comprising concrete box culverts, steel or concrete pipe or arch culverts;
- Tunnels;
- Structures such as traffic and pedestrian bridge barriers, stairways, cattle grids etc, which are associated with road construction.
- Landscaping structures such as boardwalks and piers.

Whilst this document prescribes certain minimum requirements, refers to relevant Australian Standards and other references and expresses preferences for the use of certain materials, it is not intended to curtail innovation. Designers are encouraged to propose, where appropriate, the use of new methods, materials or geometric configurations for approval by the ACT Government.

7.2 Bridge Design

7.2.1 Design Considerations

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

- 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.

A bridge number is to be obtained from the ACT Government before the commencement of the Final Design Stage. 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 during the construction stage. Plates shall be manufactured in accordance with Drawing Number DS7_05.

7.2.2 Design Standard

All bridges and culverts shall be designed in accordance with the current edition of the Australian Bridge Design Code (SAAHB77)

All structures are to be designed for loading in accordance with the appropriate part(s) of the relevant Australian Standard. The designer shall determine serviceability criteria that are not specifically listed in the mandatory performance criteria that form part to these documents.

All bridges are to be designed to SM 1600 Design Live Load as described in Austroads Project "Economics of Higher Bridge Design Loadings" – February 1999, Part 2 Design Loads MS1600 Live Load.

7.2.3 Design Information

The designer shall check all stages of design for accuracy, completeness and compliance with the Brief and relevant Standards.

A Design Summary Sheet shall be prepared for all road bridges on completion of the design, and shall be included in the set of design drawings.

The Design Summary Sheet is an important feature of the design as it contains a summary of all major features of the design. It is used for future checking of the structure for heavy load movements, structural alterations or if there are any major maintenance problems. The actual contents will vary depending on the size and complexity of the structure.

The main items to include on the Design Summary Sheet are:

- Details of the span configuration.
- The design cross-sections used in the analysis at critical positions, eg support and mid-span.
- Details of the reinforcement and/or prestress and the section capacities at the critical sections.
- The serviceability design moments and resulting stresses at the critical sections.
- Live Load Distribution Factors for different loadings.
- Design Live Load.
- The available live load capacity at the critical sections, for use in checking heavy load movements.
- Foundation information, ie design bearing pressures for spread footings and design pile loads for piled foundations.
- Design scour allowance.

7.2.4 Maintenance Details

The designer shall prepare maintenance notes for any bridge that contains structural components that may require cyclical maintenance. The notes shall pay particular attention to inspection and maintenance of the following items as appropriate:

- Bearings.

- Joints.
- Subsoil drains.
- Maintenance requirements of any unusual structural elements eg. suspension cables.
- Technical details and recommended procedures for the preventative maintenance of paint systems.
- Barrier repair procedures.

Additional bridge information in the as executed stage and cyclic maintenance requirements are to be submitted as a part of Design and WAE drawings. An "AUTOCAD" drawing containing tables of required information is available from the ACT Government.

A separate bridge site plan is to be shown on the bridge design drawings.

7.3 Bridge Roadway Geometry

7.3.1 General

In the preparation of preliminary designs and in the detailed design phase for road projects, due consideration must be given to the structures which will be required and to the constraints imposed by them.

7.3.2 Alignment

When investigating a roadway alignment the following factors that affect bridge structures have to be considered and implemented where possible.

7.3.2.1 Horizontal Alignment

If curvature is unavoidable, then keep the bridge within the circular portion of the curve.

The centreline of a bridge and its kerbs and handrails should follow the alignment of the road centreline, except in the following instances for beam bridges.

Where the maximum offset from the road centreline to the chord between the ends of the deck is less than 150mm (refer Figure 7.3.2.1), the bridge should be laid out as a straight structure about a centreline parallel to the chord and half the offset distance away from the chord.

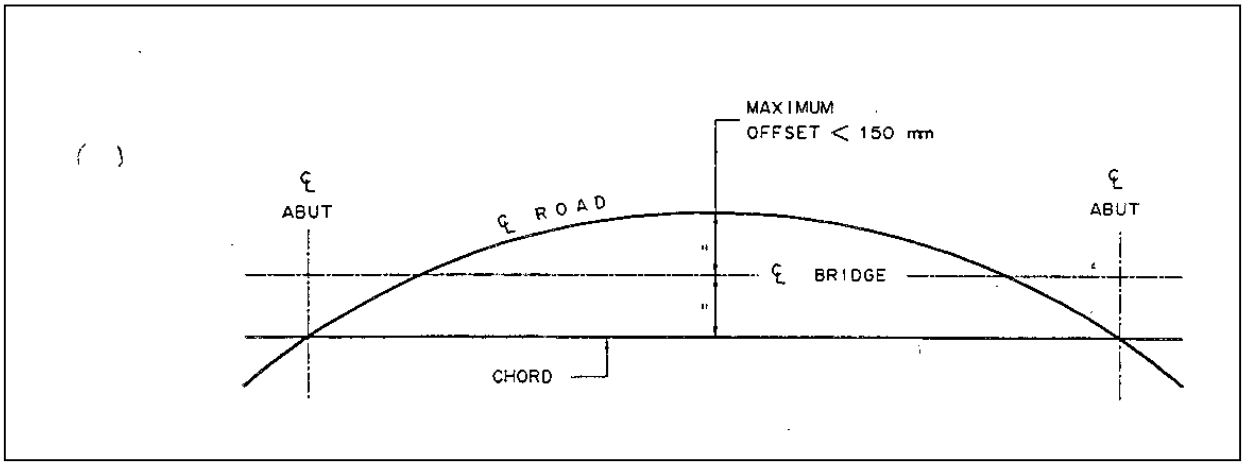

Figure 7.3.2.1

Where the maximum offset from the road centreline to the chord between the ends of the deck is greater than 150mm and less than say 450mm (refer Figure 7.3.2.2), it will usually be possible to set out the substructure and beams on a straight centreline as above and have the deck and kerbs follow the curve with the variation taken up in the deck overhang.

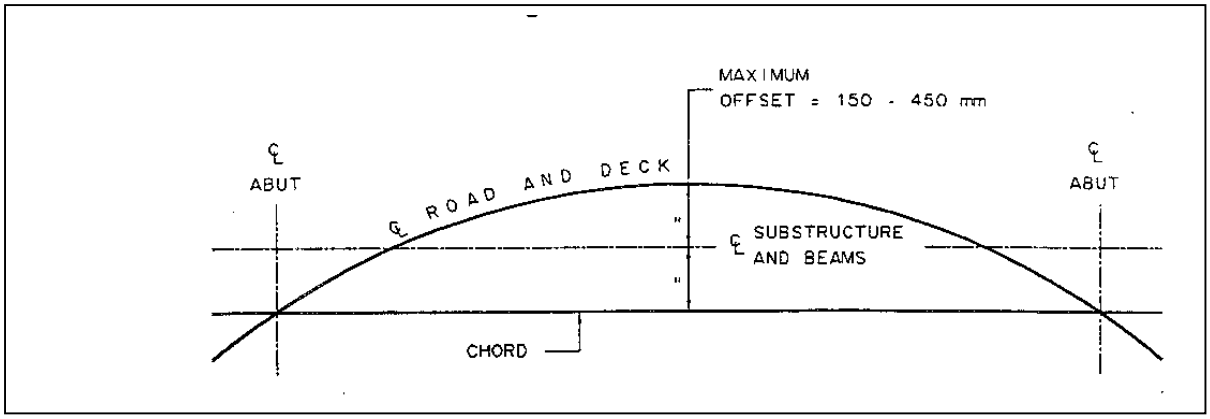

Figure 7.3.3.2

Where the chord offset is greater than 450mm, the substructure should follow the same curved centreline as the deck and road.

Avoid locating the bridge on spiral transition lengths if possible. Where varying curvature is adopted, sudden changes in radii and curvature across the bridge should be avoided. However, if the radii are changed the tangent points should be located at pier positions. Radii across the bridge should be as large as possible.

Avoid tapers and flared ends on structures. Where a taper must be provided, it should be commenced at a pier position, and be limited to complete spans. Where flares must be provided, they should commence outside the limits of the bridge.

Skew of bridge should not exceed 45°.

Where a replacement bridge is to be constructed adjacent to an existing structure, not less than 2.5m should be provided between them to allow for working room.

7.3.2.2 Vertical Alignment

Avoid locating bridges on sag curves as vehicle dynamic effects are increased and appearance is adversely affected. Long bridges on flat vertical curves may be acceptable where no alternative exist. Consider the impact effects of the vertical alignment proposed.

Avoid locating bridges on straight grades with sag curves at each end of the bridge. It is desirable for the bridge to be of uniform height above the road being crossed.

For bridges over roads and railways, a minimum grade of 0.3% is desirable to provide for deck drainage. Bridges over streams can be level, irrespective of the length.

The grade line at stream crossings must be checked to ensure that the required waterway area and clearance above flood levels is provided.

Avoid variation in grade of one kerb of a bridge relative to the other if possible. Where this in unavoidable the grades should be arranged to be uniform over the full length of the bridge.

Avoid large differences in level between adjacent median kerbs, for divided roads with independently graded carriageways having close but separate structures.

Check the tolerable depth of surface regulation on existing bridge decks to avoid overstressing the structure.

7.3.2.3 Combination of Horizontal and Vertical Alignments

Consider the visual effects of combined horizontal and vertical alignments and changes in superelevation on the appearance of bridge barriers. Co-ordinate horizontal and vertical alignments and sightlines with the road design. Refer to Austroads Guide to Traffic Engineering Practice.

7.3.2.4 Structural Depths

The following approximate rules may be used for the total structural depth of girder and deck when investigating grade lines for grade separation structures and stream crossings for the purposes of preliminary design

Type of Structure	Depth (m)
Beam and Slab	L / 18 + 0.3
Box Girder	L / 24 + 0.3

Table 7.3.1

Where L = Span Length (m) of the longest span in the structure

The ratios stated to not include allowances for crossfalls and bridge deck surfacing.

7.3.2.5 Structural Economy

In fixing the geometry of the road, the following points should be kept in mind.

- Alignments should be selected to make bridge crossings as nearly square as is practicable.
- Bridge curvature should be avoided where practicable. Where curvature must be introduced, tangent points should be located off the structure where possible.
- Bridge splays should be avoided where practicable. Where a splay must be provided, it is preferable that it should commence at or adjacent to a pier and that the extent of splay be limited to the approach span. The radius of splay should be as large as possible.

Although due attention must be given to these matters, the safety standard of the road should not be compromised because of structural considerations.

7.3.2.6 Positioning of Structure in Relation to Ramps

Exit Ramps

Where it is necessary for the point of separation of freeway traffic lanes to occur in the vicinity of a bridge over the freeway, the point of separation preferably should be located on the approach side of the bridge in an area not affected by the shadow of the bridge.

Entry Ramps

Where a structure over the freeway is located on the approach side of the nose of an entrance ramp the ramp and freeway geometry and the configuration of the structure shall be arranged to ensure that mutual visibility is achieved between vehicles on the ramp and on the traffic lanes over a distance of not less than 60m from the ramp nose.

7.3.2.7 Use of Retaining Structures

Where practicable, alignments should be selected to avoid the use of retaining structures.

7.3.3 Sight Distance

7.3.3.1 Along Structures

It is essential that the bridge railing does not reduce the necessary horizontal and vertical sight distance from an adjacent unsignalised road intersection. Refer to AustRoads Road Design Guidelines for sight distance requirements.

Additional sight distance along the bridge from an adjacent unsignalised road intersection may be provided by:

- Provision of footways, additional bridge width or wider than normal footways along the bridge; or
- Tapering or flaring the ends of the bridge, bridge end posts or railings – (this is considered undesirable); or
- Regrading of vertical alignment across the bridge if possible.

7.3.3.2 Roads Under Bridges

The vertical visibility limitation due to a structure over a sag curve should be checked graphically on the longitudinal section. The criterion to be adopted in this case is the line of sight from a truck or bus driver's eye level taken to be 2.5m above the pavement, measured to an object 0.6m above the pavement, 0.6m being the height of a tail-light or discernible part of another vehicle.

Both horizontal and vertical sight distances under structures must be checked.

7.4 Materials

Materials used in the works shall be the most appropriate to the task. Selection of materials shall be made in conjunction with the ACT Government at preliminary sketch plan stage of the design work. Materials shall be selected on a basis of maximising durability and minimising maintenance requirements but may be modified, with the approval of the ACT Government, to satisfy aesthetic criteria.

Bridges should preferably be constructed of concrete to minimise maintenance requirements unless otherwise specified with Brief. Where steel components are necessary, they should be hot-dip galvanized after fabrication, and painting avoided if this is aesthetically acceptable.

Timber is generally only an acceptable construction material for use in pedestrian recreation areas such as boardwalks, jetties and similar structures. In recommending the timber species, the designer should consider durability and maintenance as well as availability in the ACT of the species and size of members specified.

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.

Where steel structures are preferred because of economic, aesthetic, or practical considerations, and component size precludes galvanizing, the corrosion protection system shall be to AS 2312 "Guide to the Protection of Iron and Steel Against Exterior Atmospheric Corrosion". Corrosion protection systems, including preparation, are to be shown on the structural drawings.

All structures shall be designed and constructed in accordance with the relevant sections of the current edition of the codes and standards as published by Standards Australia and the Building Code of Australia. Designers shall maintain knowledge of all amendments and upgrades to standards and work shall conform to the standard current at the time of commission. Where there is conflict between this guide and relevant standards, the designer shall consult with the ACT Government to confirm requirements.

Retaining walls should normally be constructed of reinforced concrete. If stone or brick finish is required, facing is preferred to reduce future maintenance problems. However, walls less than 2.1m high may be constructed of stone or brick in accordance with Standard Drawings DS7_01 to DS7_04 (or similar appropriate design).

Stone pitching of embankment slopes should be grouted to avoid the possible dislodgment of stone. The extent of stone pitching should be minimised.

7.4.1 Properties to be specified on design drawings

7.4.1.1 Concrete

- Characteristic Strength
- Design Shrinkage strain
- Modulus of Elasticity
- Design Creep Factor
- Admixtures: Manufacturer(s)' details and product number(s).

7.4.1.2 Steel

- Grade(s)
- Corrosion Protection System(s):
- Manufacturer, full system code and guarantee period shall be shown on WAE drawings and details stamped on the structure.

7.4.1.3 Prestressing Tendons

- Stressing Force
- Design Extension
- Design Anchorage System
- Strand Structure
- Ultimate Tensile Strength of Tendons or Bar
- Yield Strength
- Modulus of Elasticity
- Calculated Immediate Loss of prestress
- Estimated Long-term Loss of prestress

7.4.1.4 Timber

- Species (if relevant)
- Stress Grade
- Joint Grade

- Durability class
- Density
- Structural Grade

7.4.1.5 Masonry

- Long Term Growth
- Mortar Mix
- Bond Strength

7.4.1.6 Soil and Foundations

- Safe Bearing Capacity
- Material Description
- Density
- Friction angle (if appropriate)
- Cohesion (if appropriate)
- Design Saturation Condition (if appropriate)

7.5 Aesthetics

7.5.1 General

All bridges in urban areas and visually important sites in rural areas shall be given appropriate aesthetic design considerations.

In situations where aesthetics are a major consideration in the design, materials adopted may be varied from those specified in other sections of this document on the basis of aesthetic assessment. Any such deviation shall be subject to the approval of the ACT Government.

A recommended reference is "Bridge Aesthetics around the World: – Transportation Research Board, National Research Council, Washington DC 1991".

7.5.2 Pedestrian Bridges

Pedestrian bridges in a particular locality should have a consistency of style to the extent that the consistency can be feasibly produced. However, considerable diversity is appropriate on a metropolitan scale to take into account the varying locations and structural requirements.

7.5.3 Appearance and finishes

Visible surfaces on concrete superstructures shall have a good quality smooth finish. Abutments and piers shall be smooth textured. Where vandalism is likely, a protective sealant shall be applied to facilitate the removal of graffiti.

For bridges in prominent locations, where the appearance from the side and below is important, the use of internal headstocks is preferred.

Services on bridges or other structures in prominent locations, if not accommodated within the structure, shall not be visible unless approved by the ACT Government.

7.6 Drainage

Longitudinal drainage of structures shall be provided for run-off from a 1 in 10-year frequency storm. For structures carrying freeway traffic, there shall be no flooding of traffic

lanes. Provision shall be made for longitudinal drainage on long bridges. The longitudinal slope of a bridge carriageway shall be a minimum of 1% except over water where a horizontal structure is acceptable.

The decks of bridges over streams shall be drained by the provision of scuppers at the kerb face. The crossfalls on the bridge are to match those on the abutting pavements. Consideration shall be given to the effect of drainage outlets. Scuppers on overpasses should be arranged so as not to discharge onto traffic or pedestrian areas below. Where possible, outlets shall be connected to the drainage system.

7.7 Construction and maintenance provisions

Bridges utilising precast planks should have an in-situ concrete layer cast onto the planks to ensure satisfactory performance.

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 for inspection, maintenance, and replacement. Where practical, jacking points shall be provided to facilitate bearing maintenance and replacement as necessary.

Box girder bridges are to be provided with access hatches to voids in the superstructure. Access manholes should be provided outside traffic lanes.

7.8 Approaches

Careful consideration shall be given to the design of approach structures and the compaction of backfill behind the abutments to avoid future maintenance problems associated with the long-term settlements of the approaches.

Requirements for quality of materials and compaction of backfill to abutments and wing walls are to be included in the specification, paying particular attention to placement and compaction procedure as well as to testing requirements.

For small bridges, the wearing course at the road pavement end of the approach slab and at the abutment joint should be provided (as a minimum provision) with a sawcut 12mm wide (minimum) filled with an approved sealant. For longer spans (over 15m) the use of an approved expansion joint may be necessary.

An assessment shall be made of possible erosion at the bridge structure and at other associated elements. The minimisation of erosion as well as the provision of suitable erosion protection measures for all areas likely to be eroded shall be considered and incorporated in the design.

If stone pitching is specified as erosion protection, special attention shall be paid to the provision of adequate drainage, expansion joints and to the quality and compaction of backfill and subgrade.

A footing shall be constructed at the toe of the stone pitching to prevent it from sliding. Concrete dish gutters of sufficient stormwater capacity shall be provided along all unrestrained edges of stone pitching.

The subgrade surface is to be sprayed with an approved environmentally safe "weed-killer" prior to stone pitching to prevent excess flow over the stone pitching.

7.9 Pedestrian, Cyclist and Equestrian Underpasses

7.9.1 General

Pedestrian and equestrian underpasses shall be designed to promote a sense of security in the user. A well-lit and open structure, which does not provide opportunities for concealment of persons in the vicinity, is required.

The approach slopes to underpasses require special attention.

7.9.2 Vertical Clearances for Underpasses

Minimum clearances for underpasses shall be:

- In general, 2.5 metres (refer also to Austroads Bicycle Design Code).
- For equestrian trails, 3.5 metres.

7.9.3 Grassed slopes

In the majority of underpasses a simple grass/tree area surrounds the site of an underpass. This treatment should be extended up to the underpass structure itself.

The grass surface should not exceed a slope of 1 in 4**.** The shapes and minimum sizes of these areas and the locations of trees need to be related to the manoeuvrability characteristics of standard tractor mounted machinery. Between the underpass structure and any retaining walls, grass treatment a concrete mowing edge should be provided to assist in maintaining a clean edge.

Designers should pay particular attention to manholes. These must be set flush with finished levels.

There should be no shrub planting around underpasses. Should particular circumstances arise where a grassed embankment is not possible or desirable, the ACT Government should be informed before any alternative treatment is adopted.

7.9.4 Hard Paving

Any slopes steeper than 1:4 should be paved, however where landform permits it is preferable (except in medians) that 1:4 grassed areas abut the underpass.

Paving material should be chosen to complement the surface finish of the inside of the underpass - concrete, stone pitching, etc. Crib-block walling is not acceptable for underpasses.

7.9.5 Existing Trees

It has been found that retention of existing trees in the vicinity of underpasses can result in unnecessarily high construction and landscape maintenance costs. In addition the disturbance is such that the trees die in many cases. Proposals to retain existing trees should be fully justified.

7.9.6 Drainage

Particular care should be paid to satisfactory disposal of drainage from landscaped areas and from underpass floors. Drainage systems should be vandal proof. Sump gratings should be set flush with grass or paving and be designed and sited to permit safe pedestrian and cyclist

use. Where raised open mouth sumps are installed in grassed areas, mowing strips should be provided and a triangular concrete apron provided to extend approximately 1 metre from the mouth of the sump.

7.10 Bridge Barriers

Barrier types should be chosen taking into account the following:

- Aesthetic requirements.
- Consistency with adjacent structures.
- Requirement for acoustic protection of adjacent land uses.
- Accident potential and consequent maintenance requirement (cast in balusters are not acceptable).
- Need to maintain sight lines.
- Protection of cyclists or other special interest users as required by the design brief.

Road safety barriers are frequently associated with bridges and bridge barriers in particular. The design of the road safety barrier / bridge barrier interface is a significant safety issue and shall be carefully considered by the designer taking into account the particular circumstances.

The design of safety barriers, their layout, extent and their interface with rigid barriers shall be in accordance with AS / NS 3845 – Road Safety Barrier System and the Australian Bridge Design Code (SAA HB77).

On structures using the New Jersey style parapet any kerb on the approaches must transition to a flush kerb so that the dynamic performance of the parapet is not impaired. The line of the asphaltic concrete on the approach should be carried across the structure so that approximately 0.9m of concrete flush with the asphaltic concrete delineates the parapet on the lower side of the carriageway and 0.6m on the upper side.

For all non-rural bridges, a continuous protective balustrade shall be provided at the bridge structure itself as well as in all areas adjacent to it, eg. around approach embankments or bank protection or any other embankment, along the side of any ramp or stairway leading to the bridge etc., if:

- The change in level is greater than 1m (or 5 risers in the case of a stairway) from the lower ground surface, except where the slope of the adjoining embankment is less than 1 in 2.
- No wall or any other protective barrier is provided.

7.11 Pedestrian and Cycle Barriers on Bridges

Barriers at paths accessible to pedestrians shall be fitted with protective infills to ensure the safety of children who may use the path. The balusters of these shall be such as to prevent children achieving access through them or getting their heads stuck. The minimum acceptable level of protection shall utilise vertical bars with maximum clear spacing of 110mm. Such bars shall be substantial enough to prevent damage by vandals. The use of horizontal elements, which may encourage climbing, shall not be permitted.

Barriers at paths accessible to cyclists shall be constructed in accordance with the requirements of “latest updates of AUSTROADS Bicycle Design Code” with the inclusion of horizontal protective rail and with the standard height of 1400mm.

The railings depicted on the Standard Drawing DS7-06 are considered to comply with these requirements. Other railing designs are permissible provided compliance is demonstrated.

7.12 Retaining Walls

Retaining walls to support roads, bridges, carparks and similar structures are important civil engineering structures. They shall be designed by a qualified and experienced Chartered Engineer, taking into account appropriate design conditions such as loadings, geotechnical conditions and likely use of the area.

Design assumptions including soil parameters slope and quality of backfill, drainage provisions etc shall be clearly specified on the drawings.

The ACT Government has prepared illustrative drawings showing typical retaining walls. Designers wishing to use the details shall check and certify the suitability of the designs and details for the particular location, soil conditions and all other circumstances. Retaining wall drawings included are listed in Section 7.14.

7.13 Boardwalks & Jetties

7.13.1 General Requirements

Boardwalks and jetties are special structures whose main purpose, in general, is recreational. They are located along Canberra's waterways and as such are subject to a mild marine environment with its attendant consequences on maintenance and safety considerations.

The presence of the water body is at once a hazard and an opportunity for access to the water. Access should therefore be convenient but safe.

The "Design Life" of Boardwalks and Jetties shall unless otherwise specified be twenty-five years.

For boardwalks and jetties the following considerations are additional to the requirement of this Chapter and those of Australian Standards AS1657-1992 "Fixed platforms stairways and ladders – design construction and installation" and AS1428.1 "Design for Access and Mobility". Reference may also be made to the NSW Public Works Department's "Design Guidelines for Wharves and Jetties."

7.13.2 Safety

Safety will be enhanced by:

- Appropriate fencing and or handrailing particularly in restricted passages or narrow sections or where the drop to water or the depth of water exceeds 1.00m.
- Use of even, non-slip surfaces generally but especially on slopes and adjacent to unfenced edges.
- Appropriate lighting.
- Avoidance of details that would entrap a person under the structure.
- Use of appropriate warning signs that will be easily seen in the context.
- Provision of safety equipment, such as life rings. Appropriate signage shall be provided and the equipment located near the edge.
- Where required, the provision of an emergency telephone
- Safety Ladders shall be provided where the depth of water at the edge exceeds 1.0m. The spacing of ladders, generally 100m, shall be determined in consultation with the Authority with reference to the intensity of use.
- Handrails are generally required all around jetties and wharves to safely contain users, guide them to access points and to provide rest and support opportunities.
- Kerbs or wheel stops should be provided, in the absence of handrails, to offer protection to wheelchair users.

7.13.3 Durability

Durability of marine structures requires adequate attention to design and maintenance and will be enhanced by:

- Attention to design details (eg. use of cuphead bolts instead of recessed hexagon heads).
- Appropriate selection of materials (eg. use of Durability Class 1 timbers).
- Attention to joint design (eg. 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 planning 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.

7.13.4 Maintenance

Regular maintenance of marine structures is especially vital to minimise whole of life costs and risk and to maximise asset life:

- A regime of regular expert inspections at six monthly intervals is recommended for all timber structures. Concrete or steel structures should be inspected at twelve-month intervals.
- Defects should be followed up and repaired in a timely manner.

- Provision shall be made in the design for inspection and maintenance access.

7.13.5 Further Design Considerations

Boardwalks and jetties are recreational structures that as generally more lightly loaded than bridges.

Aesthetic considerations and the context of the structure will generally dictate the use of soft materials such as timber and the use of "light" structures. Where aesthetics is less critical and the use of more robust structures and durable materials is appropriate (eg. a jetty serving a carpark) the use of inexpensive low maintenance materials (such as concrete) may be preferred.

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

The use of prefabricated or system designed structures is acceptable. Floating jetties are often a cost effective and practical solution. 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.

7.14 Standard Drawings

Title	**Drawing No.**
Gravity retaining walls – stone and clay brick	DS7-01
Reinforced concrete block walls up to 2100	DS7-02
Stone pitched retaining walls	DS7-03
Retaining walls general notes	DS7-04
Bridge identification plate	DS7-05
Pedestrian bridge barrier railings	DS7-06