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Victorian Boating Facility Design Guidelines

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Victorian Fisheries Authority

VICTORIA State Government

Better Boating Victoria

Victorian Boating Facility Guidelines

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We proudly acknowledge Victoria's First Nations peoples and their ongoing strength in practising the world's oldest living culture. We acknowledge the Traditional Owners' lands and waters on which we live and work, and pay our respects to their Elders past, present and emerging. We recognise the strength of Aboriginal people, Traditional Owners and their communities, and value the ongoing contribution of Aboriginal people to Victorian life, through their daily work, their application of Aboriginal knowledge and practice, and at key events; we recognise how this enriches us all. We have distinct legislative obligations to Victorian Traditional Owner groups related to cultural and natural heritage, that are paramount in our responsibilities in managing Victoria's resources in partnership with Traditional Owners.

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Preface

“All works to upgrade or build new boating facilities will be underpinned by the principle of making it cheaper and easier to boat and fish.

This will apply to creating more space, improving the ease of launching and parking, and improving the boating and fishing experience of all Victorians”.

01: General

1.1 Victorian Conditions

Victoria has approximately 2,500 kilometres of coastline and there are more than 120 bays, inlets and estuaries along its length.The state also has more than 85,000km of rivers and 13,000 natural wetlands. There are over 400 public boat ramps across the state that can provide access to these waterways. This has resulted in a large variety of navigable waterways in which boating requirements may differ substantially, including:

- inland waters with relatively stable water levels
- inland water storages and lakes with large water level fluctuations (e.g. up to 10m)
- the embayment of Port Phillip with an approximate 1m tidal range
- the embayment of Western Port with an approximate 3m tidal range
- tidal and non-tidal rivers
- open ocean boat ramps
- boat ramps in protected harbours

Planning for the design of boating facilities in Victoria should consider the conditions and environment in which the facility is located as well as future conditions, including sea level rise and coastal erosion. A uniform or standard approach to design will simply not work in Victoria given the diversity of the conditions and environment of the land and waterway.

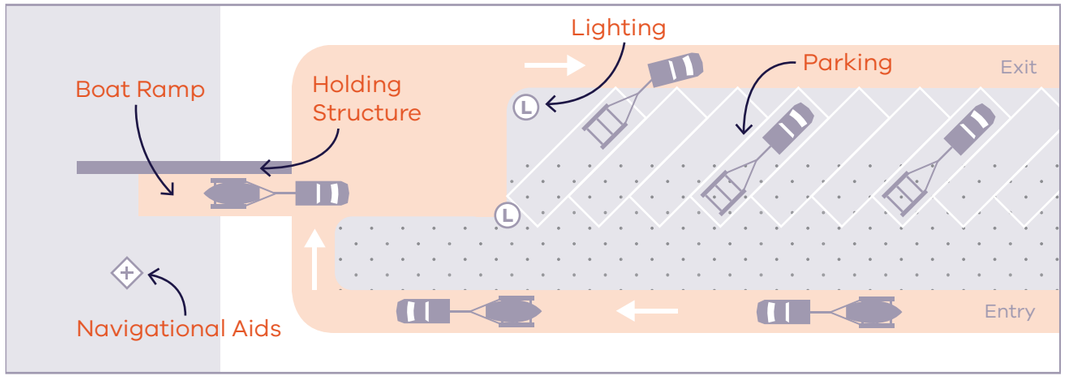
1.2 Objectives and Scope

The objectives of these guidelines are:

- to identify the main functional and design aspects that should be considered when planning the layout and components to be included within a new boat ramp facility, or incorporated into an upgrade of an existing boat ramp facility
- to assist owners and managers of boating infrastructure in procuring design works

Figure 1.1 illustrates the main assets that typically comprise a boating facility. The scope of these guidelines does not apply to navigational aids or the design of boat ramps for launching and retrieving recreational trailer boats where the Gross Combination Vehicle Mass (GCVM) exceeds 4500kg.

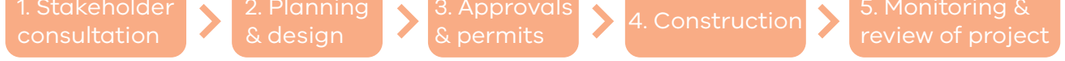
Figure 1.1: The main assets of a boating facility



Application of these guidelines would be subject to site specific environmental conditions and should account for the anticipated level and type of boat ramp usage, as well as the requirements of local authorities. It is recommended that as part of the planning and design process, advice is sought from engineers with specific expertise in the design of small craft facilities.

The process involved in implementing boating projects is broadly outlined in Figure 1.2.

Figure 1.2: Process for delivery of boating projects



Further details on the process for implementing boating projects is provided at **Appendix A.**

1.3 Relevant Standards

1.3.1 Australian Standards

Table 1.1 summarises the relevant Australian Standards that are referenced within these Guidelines. The completeness and date of standards should be checked for currency as part of the design process.

Table 1.1: Relevant Australian Standards

Designation	Title
AS 1170	Structural design actions
AS 1379	Specification and supply of concrete
AS 1428	Design for access and mobility set
AS 1657	Fixed platforms, walkways, stairways and ladders – Design, construction and installation
AS 1742	Manual of uniform control traffic devices
AS 1743	Road signs – specifications
AS 1744	Standard alphabets for road signs
AS 2159	Piling – Design and installation
AS 2416	Design and Application of Water Safety Signs
AS 2758.1	Aggregates and rock for engineering purposes – Concrete aggregates
AS 2890.1	Part 1: Off-street car parking
AS 2890.6	Part 6: Off-street parking for people with disabilities
AS 3600	Concrete structures
AS 3962	Guidelines for design of marinas
AS 4678	Earth retaining structures
AS 4997	Guidelines for design of maritime structures

1.3.2 Other Relevant Standards

Reference should also be made to Australian Standard supplements published by VicRoads:

- VicRoads Australian Standard Supplements: Australian Standard – AS 1742 Manual of Uniform Traffic Control Devices Parts 1-15 (October 2015)
- VicRoads Australian Standard Supplements: Australian Standard – AS 1743 Road Sign – Specifications (August 2017)

References can also be made to VicRoads standard sections:

- VicRoads Standard Sections 100 Series: General
  - 168: Occupational Health and Safety Management
- VicRoads Standard Section 200 Series: Formation
  - 204: Earthworks
  - 205: Rock Fill
  - 210: Geotextiles in Earthworks
- VicRoads Standard Section 300 Series: Flexible Pavements
  - 304: Unbound Flexible Pavement Construction
- VicRoads Standard Section 400 Series: Asphalt and Surface Treatments
- VicRoads Standard Section 500 Series: Concrete Pavements
- VicRoads Standard Section 600 Series: Bridgeworks
- VicRoads Standard Section 700 Series: Incidental Construction
- VicRoads Standard Section 800 Series: Materials

Information on the use of fibre reinforced polymers within concrete can be obtained from AS 5100.8 and VicRoads Section 688. Guidance is also provided in Austroads publications for pavement design aspects and turning path templates for specific design vehicles. Reference should be made to the Safe Design of Structures, Code of Practice (Safe Work Australia, 2012) for safety in design requirements.

1.3.3 Local Government Authority Guidelines

Planning policies specific to local government authorities (LGA) shall be considered in the design of infrastructure. Even where the delivery authority is not an LGA, the local guidelines should be considered. Metropolitan LGAs often have design guidelines, whereas regional and rural LGAs tend to follow the Infrastructure Design Manual. A broad overview of the guidance, relevant to boating facilities, is listed below:

- Carpark design
- Stormwater design
- Traffic design
- Flooding
- Road and geometric design (2D and 3D)
- Survey datums
- Design life
- Standard drawings
- Pavement design
- Landscaping
- Water sensitive urban design
- Utilities
- Public lighting
- Sustainable infrastructure
- Road safety assessments
- Planning requirements

The Victorian Boating Facility Guidelines supplement the design guidance provided by LGAs and are specific to boating facility design aspects not already covered by existing guidelines

1.4 Boat Ramp Standards Drawings and Specifications

A set of drawings and specifications for boating facilities are provided by the Department of Transport and Main Roads, Queensland (DTMR) (https://www.tmr.qld.gov.au/-/media/busind/techstdpubs/Bridges-marine-and-other-structures/Design-criteria-Marine/DesignManualBoatRamp.pdf?la=en). The design philosophy is to use precast concrete planks for the full length of the ramp below Mean High Water Springs (MHWS), and broom finished unchevronned cast in-situ concrete slab above MHWS. This design will be suitable for many Victorian applications, particularly for tidal areas where placement of connecting precast elements underwater may be favoured over relatively costly cofferdam works to construct in dry conditions.

Figure 1.3: Unchevroned Concrete Ramp

The Queensland Design Criteria for Boat Ramps 2015 provides specifications for the components that comprise the standard design. These include requirements for:

- geotextile and geogrid for separation of base materials and containment of the core
- 75 mm crushed rock core or base
- precast concrete ramp planks — roughness criteria to be reviewed by designer for safety
- fully grouted shoulders and shoulder batters (with spoon drain when constructed in cut)
- 75 mm crushed rock shoulder
- cast in-situ anchor beam or connecting slab with anchor beam
- in-situ slab

Several standard drawings are provided by DTMR and these are listed in Table 1.2 for reference.

Table 1.2: Existing standard drawings

Drawing Number	Drawing Name
MRTS300	Boat Ramps
SD4000	Precast Planks for Boat Ramps Type RG4000 and Type RG3500
SD4001	Precast Planks for Boat Ramps Type OS4000 and Type OS3500
SD4020	Boat Ramp Construction – Precast Plank Installation and Anchor Beam – Types 1 and 2
SD4021	Boat Ramp Construction – Earthworks and Crushed Rock Core Details
SD4022	Boat Ramp Construction – Fully Grouted Shoulders and Ungrouted Shoulders
SD4023	Boat Ramp Construction – Slab and Joint Details
TC2100, TC2101_1 to TC2101_8	Traffic Control (TC) standard boat ramp information signs
TC Signs	Non-standard Traffic Control Signs

1.5 Marine and Coastal Policy and the Siting and Design Guidelines for structures on the Victorian Coast

The Marine and Coastal Policy was developed in 2020 by the Department of Environment, Land, Water and Planning (DELWP) to guide the planning and management of matters relating to and affecting the marine and coastal environment. The marine and coastal environment includes all private and public land and waters between the outer limit of Victorian coastal waters and five kilometres inland of the high-water mark of the sea. The policy provides direction to decision makers, including public land managers who directly manage coastal boating facilities and supporting infrastructure.

For all coastal boating facilities, the design shall also be guided by the DELWP Siting and Design Guidelines for Structures on the Victorian Coast. This and further government policy requirements are detailed in **Appendix A.4.**

1.6 Legislative Environment

There are numerous Victorian and Commonwealth legislative Acts (and regulations) that should be considered when planning for the design of boating facilities. These include (but are not limited to) those listed in Table 1.3 and Table 1.4.

Table 1 3: Relevant Victorian Legislation

Act	Year
Marine and Coastal Act	2018
Marine Safety Act	2010
Port Management Act	1995
Crown Land Reserves Act	1978
Planning and Environment Act	1987
Water Act	1989
Environment Protection Act	1970
Environment Protection Act	2017
Aboriginal Heritage Act	2006
Disability Act	2006
Environment Effects Act	1978
Land Conservation (Vehicle Control) Act	1972
National Parks Act	1975
Planning and Environment Amendment (Distinctive Areas and Landscapes)	2018
Traditional Owner Settlement Act	2010

Table 1 4: Relevant Commonwealth Legislation

Act	Year
Environmental Protection and Biodiversity Conservation Act	1999
Native Title Act	1993

The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (Ramsar Convention) should also be considered.

02: Key Functional Criteria

Criteria to be considered in the design of a new or upgraded boating facility are outlined below. These elements should be captured in a design basis specific to the site.

2.1 Stakeholder needs

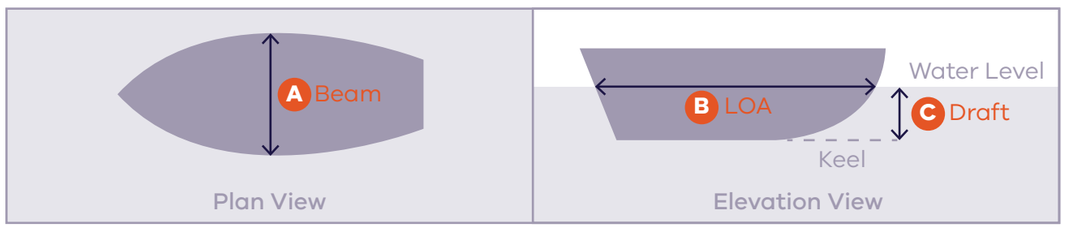
An overarching philosophy for the design of all boating facilities is to understand the specific requirements of the users of that boat ramp. Stakeholder consultation, particularly with recreational boaters, should be at the core of the design basis. For any existing boating facility, stakeholders should be consulted about:

- vessel types
- access requirements and constraints (e.g. is all-tide access required or achievable?)
- operational and functional criteria
- key issues associated at a facility (if existing)
- demand and throughput goals (including congestion)
- the demography of vessels and car-trailer units, and likely parking demand at the site
- environmental, cultural or heritage sensitivities that may influence the design
- safety issues
- known uses when planning for design upgrades, and identification of conflicts with other users

2.2 Vessels

A design vessel refers to the largest vessel size proposed for a particular boat ramp facility. Defining the geometric parameters of the design vessel will inform the design of berthing and navigation infrastructure (Figure 2 1).

Figure 2 1: Geometric design vessel parameters



The design vessel for a particular boating facility is unique and should be specified in consultation with local stakeholders. Table 2 1 provides a list of suggested geometric design vessel parameters. Approximately 98% of all registered trailerable boats are expected to fall within these parameters. Consideration should also be given to the launching of boats much smaller than the design vessel parameters listed in Table 2.1.

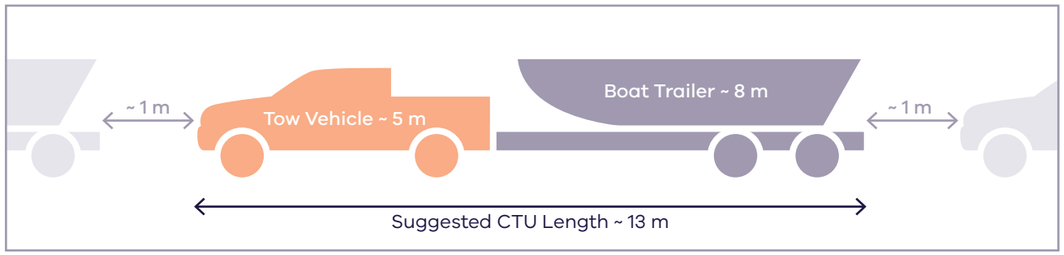
Table 2 1: Suggested geometric design vessel parameters

Parameter	Dimension	Notes
A Beam	2.5m	Based on vehicle width limit for transit on Victorian roads without an oversize permit — the beam changes with length overall.
B Length Overall (LOA)	8m	Lengths up to 12m are possible for a GCVM < 4500kg
C Draft	0.9m	Based on Table 3.1 in AS 3962-2020 – changes with LOA Does not consider keeled trailer yachts

2.3 Car trailers units

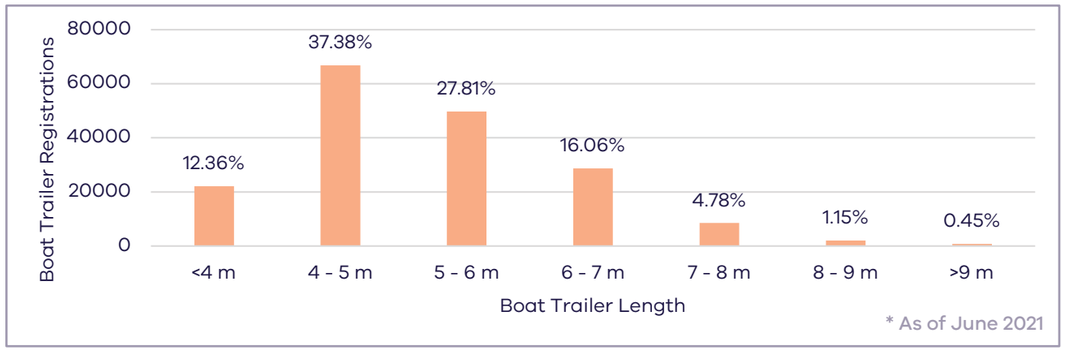
A car-trailer unit (CTU) refers to the combined length of a tow vehicle and boat trailer. Defining the CTU length for a particular boat ramp facility will inform the layout of the facility's parking, queue length, and manoeuvring areas. A CTU length of 13 metres is suggested for standard boat ramp facilities (Figure 2 2). Queue length calculations should allow for an additional 1 metre between each CTU. Approximately 98% of all registered boat trailers are expected to fall within these parameters.

Figure 2.2: Suggested CTU length for standard boat ramp facilities



Alternatively, designers could establish a CTU length that is appropriate for the distribution of CTU combinations at their boat ramp facility (Figure 2 3) if reliable local data can be obtained. Catering to a range of CTU sizes can assist to maximise CTU parking.

Figure 2.3: Distribution of registered boat trailers in Victoria (as of June 2021)



2.4 Throughput

Design throughput refers to the number of launches and retrievals proposed for a particular boat ramp facility. The design throughput for a particular boat ramp facility is unique and should be explicitly defined as an hourly metric (e.g.12 vessels per hour). Defining an hourly design throughput will help inform the scale of a boating facility, such as number of ramps and parking spaces required.

The definition of an hourly design throughput should consider the following assumptions:

- A nominal landside and waterside queue time benchmark of 15 minutes for a peak demand event. It should be noted that this benchmark may not be able to be achieved at certain facilities in the greater metropolitan area and in some regional locations. The benchmark should be treated as a target throughput metric, where the capacity of the facility enables it to occur.
- Regular boat ramp users typically take 7 minutes to launch or retrieve a boat (8.6 vessels per hour). Experienced boat ramp users typically take 4 minutes to launch or retrieve a boat (15 vessels per hour). The retrieval time is also significantly impacted by the retrieval technique adopted by each user (e.g., drive on, winching or use of ropes), and the level of experience and conditions.

Options to improve throughput are discussed in Sections 4.2, 4.3 and 4.4.

2.5 Peak demand

The design throughput for a particular boat ramp facility should satisfy peak demand where possible. Peak demand refers to the typical traffic conditions encountered by a particular boating facility during periods of high usage. A peak demand event can be described by queue length or queue size, and should exclude extreme queuing scenarios (e.g. public holidays). A design throughput that does not satisfy peak demand may lead to excessive queuing times.

A traffic study, testing performance under various scenarios, should ideally be undertaken to determine the peak demand for a particular boat ramp facility and to inform investment decisions. Peak demand months differ between coastal (Figure 2.4) and inland (Figure 2.5) boating facilities. Furthermore, the drivers of peak demand (e.g., key fishing or holiday seasons) are often unique to a specific boat ramp facility. Therefore, local users, webcam launch data, types of vessels using the facility and traffic counts should be analysed first to understand the peak demand times before a full traffic study is undertaken. Webcam data aggregation and collection for a particular site should be fully understood before its data is applied in a demand analysis. State-wide data sources (e.g. boat trailer registrations and vessel registrations) are unlikely to provide site-specific data.

Figure 2 4: Example coastal boating facility traffic trend (Altona Boat Ramp)

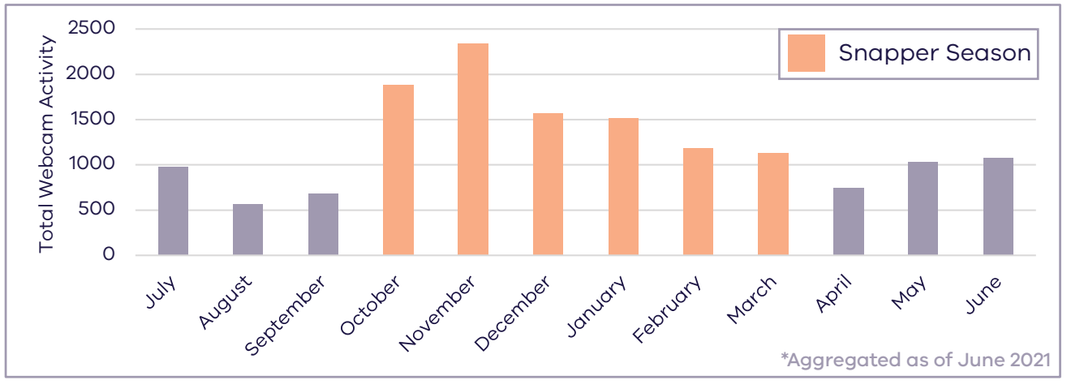
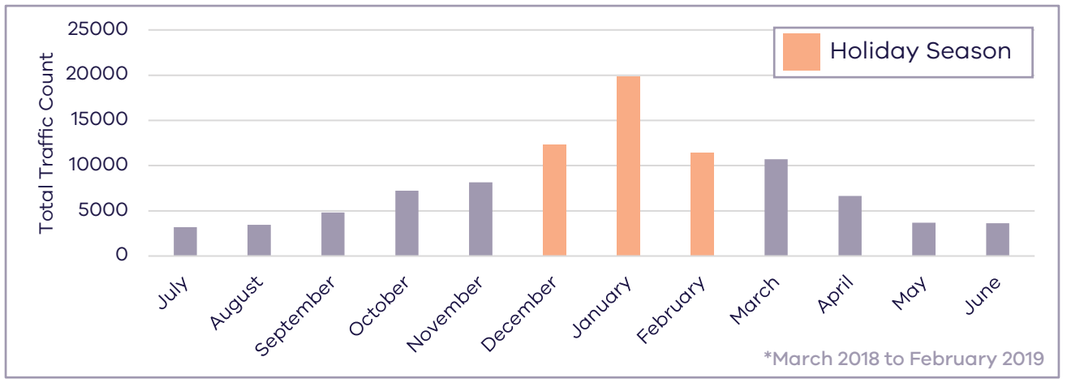


Figure 2 5: Example inland boating facility traffic trend (Lake Eppalock)



Peak demand for a particular boating facility should also consider long-term and short-term redistributions in demand within a network of local boating facilities. Long-term redistributions occur when users permanently shift their preferences towards a new or upgraded site within their local network. Short-term redistributions can occur when excessive queueing at a particular site causes user to migrate to another nearby site. User surveys can be conducted to determine patterns in short-term and long-term redistributions in demand. Signage can also be implemented to control short-term redistributions in demand.

03: Site Investigations

3.1 General

The extent of the site investigations required will depend on a number of factors, such as the flexibility to change a ramp location or site a new ramp, whether a ramp alignment is fixed and car parking area limitations. Advice on the staging of site investigations is provided in Appendix A. The investigations proposed here are typical only and are not intended to be all encompassing. Investigations related to dredging or land reclamation are not covered but may need to be considered in the design process.

3.2 Environmental considerations

Sea Level Rise

The design shall consider allowance for sea level rise over the design life. It is recommended to follow a scenario no more favourable than the mid-scenario from the latest International Panel on Climate Control publication as per AS4997 recommendations.

Waves

The mean wave direction and size should be understood to achieve alignment into the dominant incident wave direction from sea, swell or boat wash. Safety incidents can occur with beam seas. Extreme waves should also be considered in designing infrastructure in accordance with AS 4997. A wave study may be required to validate that short period waves larger than 0.2 m will not occur in the vicinity of the ramp in accordance with AS 3962. A 1-year ARI event and 0.2 m significant wave height may be considered as the benchmark criteria not to be exceeded.

Visibility of approaching waves and clearance from overtopping water must also be considered. At select coastal facilities, wave protection may be required to achieve tranquillity criteria in AS 3962 and/or for safety.

Winds

The prevailing direction of the wind at the boating facility should be considered, particularly on open stretches of coastline, to ensure ability for users to safely launch and retrieve a vessel.

Tides

At coastal locations, the tidal planes (HAT, MHWS and LAT) relative to AHD shall be established for the site. Tidal information can be derived from the Victorian Tide Tables and/or from an analysis of local tide gauge data. In river environments, tidal interpolation may be required. For infrastructure design, surge should also be considered, including in combination with astronomical tide.

Coastal Erosion

Coastal erosion (or shoreline retreat) is the loss of coastal lands due to the net removal of sediments or bedrock from the shoreline and is typically driven by the action of waves and currents. Coastal erosion can be either a rapid-onset hazard (occurs very quickly, over a short period of time), or a slow-onset hazard (occurring over long periods of time). The design shall consider the impacts of coastal erosion.

Currents

Victorian waterways can experience strong currents associated with the tide in coastal locations as well as during river flood conditions. Boat ramps nearest the entrance to Port Phillip and Western Port can experience very fast currents during flood and ebb conditions that can make launching and retrieval of vessels dangerous. The direction and speed of these currents must be considered in the design of the facility layout and in the structural design of holding structures. Currents also need to be considered in inlets leading to the sea and embayments.

Sediment, kelp, and seagrass

Sedimentation, kelp, and seagrass at a boat ramp site can significantly affect its performance as a launching facility if shoaling occurs at the toe of the ramp or over the ramp itself. Sediment, kelp, and seagrass movement in waterway areas surrounding the boat ramp site can also limit or prevent boats from accessing navigable depths after launching. An initial appraisal of the potential for sedimentation should be undertaken as part of the feasibility assessment for boat ramp sites.

This should include the following tasks:

- visual inspection of shoreline morphology
- consultation with local waterway user groups
- review of historical aerial photography
- review or undertake technical studies (e.g. coastal processes studies, coastal hazard assessments, estuary/coastal management plans, flood studies, bank condition assessments)

If sedimentation, kelp and seagrass is a risk at the site, further study may be required to optimise the design and reduce maintenance and safety issues associated with kelp and sedimentation.

Boat ramps in water storages and lakes

The full supply level, prevailing supply level and lowest water storage level shall be determined. Variations in water level can be >10 m. However, the extreme levels may not occur for years or decades. Prior to the ramp length being defined, a historic analysis of supply levels is required and an understanding of the provisions that already exist at other ramps on the water storage.

Boat ramps on rivers

Peak flood levels and flood velocities are important to the design. The average flow direction shall also be established, and the boat ramp ideally aligned in this direction. Any tidal influence on the river must also be established.

3.3 Survey

A preliminary desktop survey can be conducted using Dial Before You Dig to get a basic understanding of any underground services. Further accuracy may be warranted via physical investigations, such as ground penetrating radar and/or potholing. Overhead services (power lines and telecommunications) which may impact construction maintenance of the facility and operation of tall vessels (yachts) should also be considered. The following spatial extent is suggested for the design of boating facilities:

- offshore direction: 10m beyond the LAT -1.0m contour
- landside direction: either 10 m beyond the top of the bank or beyond the HAT +0.5 m contour, whichever is higher
- width: approximately 20 m both sides (subject to the conditions of the site) of the proposed or existing centreline
- A land and bathymetric survey are required with enough detail and extent to locate services, natural and artificial features, and determine contours. Where the end of the boat ramp is covered by sediment, the limits of the ramp and depth of coverage should be determined by probing.

3.4 Geotechnical

The geotechnical investigation requirements will depend on the type of infrastructure works proposed and level of uncertainty associated with site. Similarly, pavement related investigations will differ greatly from data required to support pile driving in the marine environment. Typically, the geotechnical investigation scope is best defined once a concept design is established.

3.5 Siting

For coastal boat ramps, the designer shall refer the Siting and Design Guidelines for Structures on the Victorian Coast. The guidelines cover 15 fundamental elements to be considered including:

- Aboriginal Cultural Heritage
- Coastal Processes
- Geology
- Morphology
- Hydrology
- Vegetation and ecology
- Climatic conditions
- Views
- Public open space
- Local character and sense of place
- Heritage
- Public access
- Increased function and adaptability
- Sustainability
- Materials and finishes

3.6 Contaminated and Acid Sulfate Soils

To enable the construction of new or upgraded boating facilities, soil disturbance and offsite disposal of soil may be required. Soil classification is required for any soil requiring offsite re-use or disposal and involves the sampling and analysis of soil for potential contaminants. Soil waste is categorised between Category A to D, whereby Category A is the most hazardous. Soil containing asbestos only or fill material is classified separately. Categorising soils must be done by a qualified professional in accordance with the EPA guidelines. Guidance for sampling and analysis include:

- EPA Publication 702.2 (2009)
- EPA Publication 1828.2 (2021)

New or upgrade boating facility works may require disturbance or disposal of Acid Sulfate Soils. The 1:100,000 map of potential Coastal Acid Sulfate Soils (published by Agriculture Victoria) maps the Victorian coastline and identifies prospective land that could contain Coastal Acid Sulfate Soils. Investigations at inland sites may be warranted if the proposed works occur around peats, wetlands, or drainage channels where there may be the presence of Inland Acid Sulfate Soils. The scale and type of investigation locations shall be determined based upon:

- Table 2 of the Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils
- EPA Publication 655.1
- VicRoads Technical note TN 22
- National Acid Sulfate Soils Guidance, National acid sulfate soils sampling and identification methods manual, Water Quality Australia, June 2018
- National Acid Sulfate Soils Guidance, National acid sulfate soils identification and laboratory methods manual, Water Quality Australia, June 2018

04: Facility Layout

4.1 Facility layout

4.1.1 Key areas to improve throughput

The facility layout shall be designed to maximise the use of the available land, considering the demand studies outlined in section two and a balance of the following key features of a boating facility:

- internal queue length required to minimise queuing onto roads
- number of CTU spaces required in peak and off-peak times
- number of ramps required to cater for demand
- number of berths/moorings required to cater for demand

The sizing of these key areas is discussed in Sections 4.2, 4.3, 4.4 and 4.5.

4.1.2 General Layout Considerations

A number of factors should be considered to achieve the most efficient launching and retrieval of vessels. Traffic planning considerations include:

- flexibility to choose ramp lanes - certain lanes suit different types of boaters
- a right turn into a reversing bay is preferred so the driver can see the trailer and vessel in the mirror
- driving from the queuing lane and then reversing to the top of the ramp lane
- position holding structures so that a berthed vessel does not impede launching
- quick and easy exit from the ramp lanes. Fish cleaning, de-rigging and washdown areas positioned so that they do not impede exit lanes and parked trailers
- CTUs need to be able to sweep in one movement from the queue lane into reversing position which aligns the trailer with the chosen ramp lane
- minimise the length of reversing lanes. For water storages where ramp lanes can be 100 m long or more, the ability to drive forward and turn at any point on the ramp shall be considered
- waiting bays at the start of a reversing lane
- minimise the walking distance and identify safe pedestrian accessways from the vessel to the car park, particularly where holding berths are limited. Longer walking time increases the time of boats in holding berths

Minimising tripping hazards throughout the facility, especially kerbing and drainage

The facility layout needs to be designed to treat all boaters equally when they are both launching or retrieving their boat. All boaters should be directed to the end of the same queue whether they are waiting to launch or retrieve.

4.2 Internal queue length

The landside internal queue length per lane should be considered to optimise throughput. A review of maximum demand should be undertaken to assess impacts of landside queues and traffic on local roads.

4.3 Number of CTU parking spaces

Ideally, the number of CTU parking spaces would be informed by a study of peak parking demand considering peak days of the year (perhaps removing the busiest outliers, e.g. Australia Day). If a traffic study is not possible, Table 7.1 of AS 3962 provides guidance on the balance between boat ramp lanes and CTU spaces and is summarised in Table 4.1. Boating facilities should provide a minimum of 2 disabled CTU spaces or 1 disabled CTU space per 50 CTU spaces, whichever is largest. Where possible, the number of CTU spaces available at a facility is maximised.

Table 4 1: Number of car/trailer spaces for each ramp lane

Area	Ramp only	With boat holding structures	With separate rigging and derigging areas
Urban	30–40	40–50	50–60
Rural	20–30	30–40	40–50

4.4 Number of boat ramp lanes

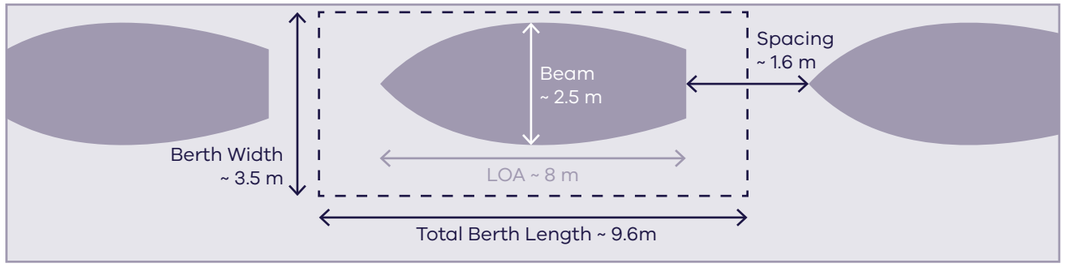
Basic guidance on the number of ramp lanes is provided in AS 3962. A more thorough examination of the number of boat ramp lanes would consider the throughput aims and a number of queueing scenarios. Often, the most effective way to improve throughput at a boating facility and reduce queuing is simply to add further boat ramp lanes. However, this must be balanced with the available CTU parking.

4.5 Number and size of holding berths

The number of holding berths should consider the demand when there are multiple vessels trying to retrieve due to a sudden change in weather conditions. Given a maximum CTU queue length is considered for the design, the marine side queue results from vessel retrievals should also be considered. The design should consider the implications of 80% of vessels attempting to retrieve in a 30-minute window.

The size of holding berths shall be calculated in accordance with AS 3962. The length and width of a holding berth are dependent on the design vessel defined for a particular boating facility (Section 2.2). Figure 4.1 provides suggested dimensions for a holding berth based on the geometric design vessel parameters in Table 2.1.

Figure 4 1: Suggested holding berth dimensions for standard design vessel



The full length of moorings should remain flexible to allow for a large vessel to occupy more than one berth. Ideally, lanes will not be impeded by vessels berthed at holding structures.

4.6 Ramp Geometry

4.6.1 Vertical Geometric Requirements

The following vertical geometry (Figure 4 2) should be explicitly defined when designing a boat ramp:

- slope: ratio between the vertical and horizontal change in the ramp
- landward approach: the landward distance away from the head of the ramp
- crest height: distance between the head of the ramp and design high water
- toe depth: distance between the toe of the ramp and design low water

Figure 4 2: Vertical geometry

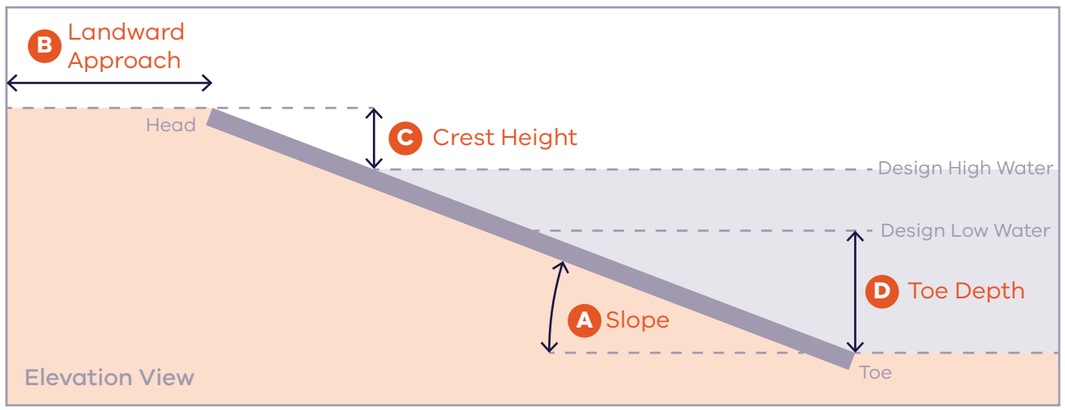


Table 4 2 provides a list of ideal geometry. Further guidance is provided in AS 3962.

Table 4.2: Ideal vertical geometry

Parameter	Recommended Geometry
Slope	1:8
Landward Approach	At least 20m landward from the head of the ramp if a swing manoeuvre straight into the waiting area is achieved. If not, allow 25m.
Crest Height	0.5m above HAT or 1-year average recurrence interval water level.
Toe Depth	1.0m for most ramps 1.25m for fixed-keel trailered sailing yachts. *The navigable channel beyond the toe shall not be any shallower. Allowance for siltation and survey inaccuracy should be considered in addition to these numbers.*

4.6.2 Lane Width

Extra lane width can speed up the reversing process and thus improve ramp traffic flow. Lane demarcation with retro-reflective raised pavement markers (i.e. 'cats eyes') are recommended. Figure 4.3 provides guidance on lane widths. For very long ramp lanes, the default width should be 4.5m or greater to minimise adjustments during reversing. It is not recommended to have more than two boat ramp lanes side by side, without intermediate structures.

Figure 4.3: Recommended lane widths

4.6.3 Ramp Crest Level

For accessibility, the ramp crest should be defined as per Table 2.1, but the designer shall also ensure the crest height does not lead to flooding issues for surrounding assets. Flood levels should be considered. To accommodate a typical change in grade between the boat ramp and a flat approach or manoeuvring area, a vertical curve should be provided over 4 to 6 m.

4.6.4 Ramp Length

The recommended length of ramp below the ramp crest that is exposed at the Mean High-Water Level is 10 metres to enable a tow vehicle and trailer to occupy the ramp whilst launching. Ramps at water storages may extend over a considerable length to accommodate large water level fluctuations. Design features that may assist in these situations include:

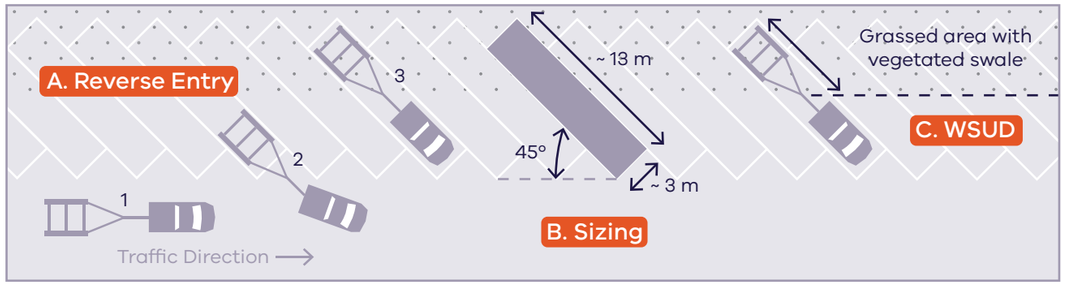
- provision of turning points along the ramp to reduce the trailer reversing distance
- provision of a compacted area alongside the ramp to facilitate parking at lower water levels
- diversion and spreading of stormwater runoff on the ramp (e.g. a grooved surface) and installation of scour protection to prevent scour adjacent to the ramp at low water levels
- siting of the ramp to allow modification (e.g. lengthening) in response to future water level conditions (e.g. drought)
- provision of a stop log at the ramp toe to warn drivers about the end of the ramp

Ramps mostly in "cut" should be avoided as they will experience siltation which will affect traction.

4.7 Parking sizes and arrangements

CTU parking spaces should ideally be angled at 45 degrees. CTU parking spaces (including disabled CTU parking spaces) should be a minimum of 3m wide and 13m long to accommodate typical CTU combinations (Figure 4 4). Larger CTU parking spaces should be considered to accommodate oversized vehicle arrangements and shorter CTU parking spaces may also be considered to optimise capacity.

Figure 4.4: Typical CTU parking angled at 45 degrees with reverse entry



The portion of the CTU parking space that is occupied by trailers may be sealed in high use or poor drainage areas or grassed to minimise impervious areas and facilitate infiltration of surface runoff (Figure 4.4). If the area is grassed, durability against turning movements should be investigated. The width of CTU spaces and grassed area (measured perpendicular to the alignment of the parking space) will vary according to the adopted parking angle. CTU reverse in parking is recommended when space is limited for safety on departure. However where practical, drive through parking should be utilised.

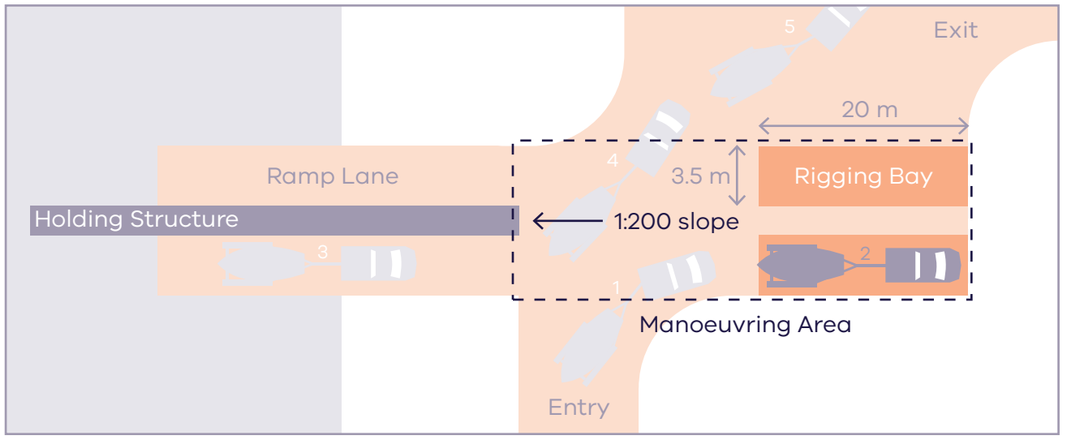
Disabled CTU spaces and disabled car-only spaces should be located closest to the boat ramp and amenities. A hard surface path should be incorporated from all disabled access car spaces to the boat ramp as well as to amenities. The size and arrangement of car-only parking spaces should be provided in accordance with AS 2890.1. Disabled access car-only spaces should be provided in accordance with AS 2890.6 and AS 1428.

4.8 Rigging, manoeuvring area and de-rigging

To reduce the time that vehicles occupy the manoeuvring area and boat ramp, a designated reversing bay should be provided along the accessway to the manoeuvring area (Figure 4 5). The reversing bay should comprise a 3.5-metre-wide and 20-metre-long parking bay with tapered entry and exit points that allow traffic to pass alongside. One bay per boat ramp lane is recommended. To reduce congestion a de-rigging and tie-down area should be provided along the exit accessway from the manoeuvring area. The number of bays and size of this area should be similar to the rigging area. A clear manoeuvring area should also be provided behind the crest of the boat ramp to allow for turning and reversing of vehicles. The manoeuvring area should:

- be as wide as the boat ramp
- be orientated to permit straight line reversing to the boat ramp launching position
- be free of obstructions (e.g. overhead lines, lane dividing barriers, kerbs etc.)
- minimise all other public activities in the immediate area for safety
- the slope of the manoeuvring area shall be at least 1:200 slope towards the ramp

Figure 4.5: Reversing bay and manoeuvring area for two-lane boat ramp



4.9 Access from public roads

Entrance driveways into boat ramp facilities from public roads should be positioned to minimise adverse effects on existing traffic flows associated with the entry/exit of vehicles from the facility. The width of the entrance driveways should be in accordance with AS 2890.1. As a minimum, accessways provided within the boat ramp facility should:

- be 5 metres wide for one-way access along entry and exit accessways to the boat ramp or parking areas
- be 8 metres wide to provide one-way access between opposing angled (45 or 60 degree) car and trailer parking spaces
- be 9 to 10 metres wide to provide one-way access between opposing 90-degree car and trailer spaces
- accommodate car and trailer turning paths in accordance with the template provided within AS 3962-2020 (Figure 7.1)
- include ground markings (e.g. arrows) to direct traffic into different areas of the facility and to indicate the direction of traffic flow
- provide sufficient length for boat/trailer queuing along the approach accessway from the entrance to the rigging and manoeuvring areas
- be clear of overhead lines at the reversing bays and manoeuvring areas

05: Infrastructure Design

5.1 Design life

The design life of the various elements of a boating facility shall be as follows:

- Jetties and ramp - 50 years in accordance with AS4997 – Design of Maritime Structures
- Pontoons - 25 years in accordance with AS3962 – Design of Marinas
- Pavements, lighting, furniture, drainage and civil structures – in accordance with Council guidelines

5.2 Ramp

5.2.1 Design philosophy and details

For tidal boat ramps, the current design philosophy is to use precast concrete planks for the full length of the ramp below MHWS, and broom finished unchevronned cast insitu concrete slab above MHWS.

The longitudinal section will:

- be grooved below MHWS for drainage and traction. A broom finished cast insitu ramp slab is permitted above MHWS. The precast elements shall also be a rough finish
- consider shoulder armouring in the ungrouted section of the shoulders on the upstream side in watercourses subject to flooding
- have fully grouted shoulders on both sides to at least AHD. Ideally, fully grouted shoulders should extend further than AHD
- the landward approach slab should have a minimum slope of 1:200 and maximum 1:16 slope. The slope of a landward approach slab shall never be negative
- ramps may require piles for deflection control or to support suspended ramps. A piled design may also be preferred to avoid temporary cofferdam construction at some locations

5.2.2 Ramp loads and load cases

It is recommended that ramps be designed to class 10 in accordance with AS4997 and VicRoads requirements. Ramps in exposed locations may be subject to wave and uplift forces that may govern the structural design. The structural design of ramps located in estuaries or rivers is likely to be governed by ramp loading and foundation conditions.

5.3 Holding Structure design

Holding structures are required to allow for boaters to safety moor their vessel during launch or retrieval. They also provide safe access in and out of the vessel.

The pontoon or jetty should be located alongside each ramp lane where possible, or central to a double lane. At smaller ramps in rivers and water storages, a holding structure may simply be a pile installed on the downstream side of the ramp to which a vessel may be secured.

5.3.1 Length

The length of the holding structures shall consider the design vessel as described in Section 2 and the provisions in AS3962.

5.3.2 Pontoons

The design of pontoons and jetties shall follow AS 3962 and AS 4997 respectively. Where pontoons are accessed by non-powered craft and/or personal watercrafts, consideration should be given to providing a lower freeboard for sections of the pontoon. Gangways providing access to pontoons shall comply with AS 1428.1 and AS 3962.

Figure 5.1: Pontoon and gangway

5.3.3 Jetties

Design of jetties shall follow AS 4997. Jetties are usually more resilient structures than pontoons. Jetties are unlikely to be feasible in waterbodies where the water level fluctuations are large. However in many cases jetties can be provided with low landings to accommodate tidal fluctuation. Fenders shall be close enough and extend vertically such that vessels cannot get caught between fenders or under the structure.

5.3.4 Universal Design

Planning for equitable access is based on the concept and principles of universal design. In a practical sense in relation to boating facilities, this means that planning should be undertaken to ensure that the design of the facility supports and enables use by everyone. This includes children and older adults, people of different sizes and abilities, people with and without access challenges, people who are left-handed or right-handed and people using a range of mobility aids.

Universal Design principles is a primary consideration in the design of boating facilities. The following example guidance is provided:

- Ramps: All public boating facilities must comply with AS 1428.1-2021 and Disability Standards for Accessible Public Transport (2002). This code states that the ramp grade shall be 1:14 for at least 80% of the high and low tide levels
- Width: the width of access structures should be a minimum of 1.2 m wide allowing for wheelchair access. A wider deck may be preferred for functional reasons
- For ideal accessibility, pontoons are preferred where they can be practically installed as they provided the optimum freeboard at all water levels. Where the wave climate outlined in Section 3.2 cannot be achieved, pontoons are unlikely to be feasible. When designing jetties, freeboard should be kept to a minimum, e.g. under 1m. Multiple landings may be appropriate. Davits may be considered on holding structure to facilitate wheelchair access. Ladders should not be used for access purposes, only for recovery from the water

More information on Universal Design and elements relevant to planning for an equitable boating facility is available at the website below:

https://sport.vic.gov.au/publications-and-resources/design-everyone-guide/planning-universal-design

Figure 5.2: all ability access pontoon

5.4 Pavement Design

The designer should consider a balance of durability and environmental sensitivity in the design. Whilst the pavement should not fail over the design life, consideration should be given to implementation of unsealed or landscape areas if loading cycles are low and water can be managed (refer Figure 5.1 to Figure 5.4 for examples). Specifically, for parking of empty trailers where loading is light, a grassed area may be appropriate as shown in Figure 5.5. Any additional maintenance requirements over traditional pavements should be discussed with the facility manager.

Figure 5.3: Grassed areas

Figure 5.4: Gravel pavement

Figure 5.5: Asphalt porous pavement

Figure 5.6: Permeable pavers

Figure 5.7: Boating facility with [grassed areas]

5.4.1 Concrete Pavement

Concrete connecting and approach slabs shall be designed in accordance with the following:

- DTMR drawings listed in Table 1.1
- AS 3600 – Concrete Structures

See sections 1.5, 5.2 and 5.6 for further detail.

5.4.2 Sealed Pavement

Sealed pavements shall be designed in accordance with the following:

- Infrastructure Design Manual or equivalent LGA guidelines
- VicRoads Standard Sections - 300 Series - Flexible Pavements
- VicRoads Standard Sections - 400 Series - Asphalt and Surface Treatments

5.4.3 Unsealed pavement

If approved for use by the asset manager, unsealed pavements may be designed to Austroads Guide to Pavement Technology Part 6: Unsealed Pavements.

5.5 Drainage

5.5.1 Overland drainage

All new infrastructure designs shall include an assessment of stormwater runoff and demonstrate drainage to an approved discharge point. Stormwater drainage shall follow the best practice measures and principles of WSUD – in line with the following documents:

- Council's stormwater management plans
- Infrastructure Design Manual – Clause 20

Overland drainage measures should consider the provision of bioretention trenches, dish drains, and vegetated swales to detain and infiltrate stormwater runoff into landscaped areas (Refer figures 5.8 and 5.9).

Figure 5.8: Dish drains

Figure 5.9: Vegetated swale

5.5.2 Subsoil drainage

Where subsurface drainage is required — it shall be completed in accordance with the requirements of the Infrastructure Design Manual, or standard council drawings.

Subsurface pavement drainage is not required where the design can demonstrate the following criteria:

- Existing subgrade is free draining
- Direct drain paths to the ocean/ water body can be demonstrated

5.6 Materials

Structures in freshwater environments may follow guidance found in common steel and concrete codes. For saltwater or brackish water environments, refer AS 4997 Section 6 for design material durability requirements. The structural design of reinforced concrete elements should incorporate the following:

- exposure classification of C2 as outlined in AS 3600
- concrete mix design satisfying the recommendations provided within AS 4997-2005
- concrete class of SC50 in accordance with AS 1379 (to satisfy the recommendations provided in AS 4997-2005 for mix design, suppliers need to provide a special class, 50 MPa concrete mix)
- the durability class of aggregates should be Class C in compliance with AS 2758.1
- cover to reinforcement should be 65mm or greater
- galvanised reinforcement should be specified in combination with stainless steel or galvanised tie wire
- black steel reinforcement should be specified in combination with mild steel tie wire
- design stresses for serviceability actions should remain less than or equal to 150 MPa to control crack widths
- any cast-in fixtures, or doweled connections used should be stainless steel (Duplex Grade 2205) and electrically isolated from internal reinforcement
- expansion joints should be located in slabs at maximum 10 metre centres in both longitudinal and transverse directions.
- if fit for purpose, recycled materials should be consider in the design for sustainability

5.7 River Boat Ramps

The following considerations are specific to boat ramps located in rivers:

- installation of piles on the downstream side of the ramp to hold boats after launching
- construction of rock mound structures on the upstream side of the ramp to reduce exposure to currents
- provision of guide poles in the ramp approach area in high flow regions
- creation of a sheltered basin behind the bank of the river
- a typical 0 degrees to 15 degrees (up to 30 degrees maximum) downstream rotation (from shore-normal) to suit the river flow line

5.8 Water Storages

The following considerations are specific to boat ramps located in water storages:

- consider the provisions in Section 4.6.4 as a guide
- water storage boat ramps can experience fluctuations of 10+ meters. As a result, ramps can extend for long lengths. Even though it is often difficult to achieve, 1:8 is still the preferred ramp slope, at least for the most common water storage level. Variation to this grade should fall within the Australian Standard (1:7 – 1:9)
- a network approach to the design of water storage ramps is required, where a 1:8 grade is best achieved over the different storage levels
- general beach access for retrieval is practical. On ramp pontoons, restrained by piles, may also be considered where the ramp gradient is no steeper than 1:8
- curbs are not recommended, and wide drivable shoulders are required to allow the user to drive down the ramp in a forward motion and undertake a full turn at any point
- turnaround areas on long inland lakes storages boat ramps should consider the distance between turnarounds and the longest distance a boater should have to back a trailer into the water. Consider any ramp batters as smooth trafficable surfaces (e.g. not rock but concrete)

5.9 Navigation requirements

5.9.1 Design of navigation areas

The navigable areas surrounding a boat ramp shall comply with AS3962 (2020) – Guidelines for the design of marinas. Channels should be marked in accordance with the Boating Safety Signage, Zoning and Buoyage Guidelines produced by Maritime Safety Victoria.

Where dredging occurs, there is a requirement under the Marine and Coastal Act consent to issue a Notice to Mariners that describes changes to depths. The Australia Hydrographic Office also uses this information to update its charts. It should be noted that in some cases, the authority delivering the boat ramp project will not manage the waterway. This is undertaken by waterway managers, local port managers and port management bodies. These bodies are regulated by Maritime Safety Victoria.

5.9.2 Navigation safety assessments

In some cases, it may not be possible to provide a compliant design or there may be risks that required further evaluation. In these instances, the following process is recommended:

1. Initial desktop safety assessment in accordance with AS3962
2. Navigation risk assessment in accordance with the International Association of Marine Aids to Navigation and Lighthouse Authorities Simplified Method

The assessment should primarily focus the navigable extents and navigation infrastructure. The stakeholders involved in such as safety assessment shall include representation from users of the waters (e.g. coast guard or local boating/fishing clubs). Vehicle queue orientation should be such that vehicle lights do not shine directly into the channel. Maritime Safety Victoria is the lead agency in any navigational risk assessment.

5.10 Safety Considerations

Safety in design is a legislated requirement in Victoria. Several areas of a boating facility require special attention in design. These include but are not limited to:

- fall from height handrail between sloping ramps and accessways to berths
- pathways that intersect the waiting bay and ramp in the path of reversing vehicles
- cyclist paths through the facility
- navigable depths and widths
- slip hazards, particularly in the underwater section of the ramp
- kerbing fitted to both sides of the ramp
- guideposts fitted at the seaward corners of the boat ramp to assist retrieval
- islands for pedestrians amongst parking and launching facilities

A boating facility safety assessment template is included in Appendix B: Boating Facility Safety Assessment (Template). This shall be consulted as part of the safety in design process. Site specific risks shall also be attained through consultation and review of any incident data (e.g. published by Maritime Safety Victoria).

06: Ancillary Ramp Amenities

Whilst the boat ramp and manoeuvring area, accessways, rigging, parking areas and boat holding structures are considered the main components of a boating facility, it is recommended that the following ancillary features also be considered in order to improve the amenity of the facility.

6.1 Landscaping

Landscaping around the facility can provide shade and visual amenity for users. There are also WSUD benefits. Species should be selected to not impede or overhang usable access road widths. Landscaped areas may also double as oversized parking areas for large CTU's if they can be designed appropriately for drainage and movement loads.

6.2 Toilet facilities

Toilet facilities should be considered at all significant facilities. Disabled toilets should be available.

6.3 Fish cleaning facilities

Fish cleaning facilities are purpose built to enable users to easily clean fish. They are optional and depend on user needs at a specific ramp. If provided, they should be located in an area that does not lead to traffic congestion. The following features should be considered:

- the size is appropriate to the boating facility demand and the species of fish. The maximum size is typically 2.4m per table and more than one table may be considered
- roof and lighting
- connection to seawater with timed water flow along with durable flexible hoses. Local pollution levels shall be understood in consultation with DELWP
- easy to clean surface
- self-cleaning/draining with wastewater connected to sewer. A trade waste agreement with the local water authority is required if connected to the sewer. Many water authorities will not allow salt water to be drained into the sewer system, so a potable water supply for these systems may be required. If disposal is direct into the environment, EPA approval will be required
- rubbish bins for fish frames and offal

6.4 Washdown bays

Washdown bays refer to dedicated areas in a boating facility used for washdown. The provision of washdown bays shall follow the best practice measures and principles of WSUD:

- Washdown water may contain sediment and automotive fluids that cannot be discharged directly into the stormwater system or surrounding environment. Sediment traps, infiltration trenches, and other WSUD control measures should be considered to filter runoff
- Detergents and other chemicals shall not be used during the washdown process unless appropriate wastewater detention and treatment systems have been implemented
- Where possible, alternative water supplies should be used for washdown purposes (e.g. stormwater harvesting)
- Washdown bays shall limit the spread of marine pests into the surrounding environment
- The washdown hose should have an appropriate water pressure to clean surfaces

In general, washdown bays are supported if there is sufficient capacity for CTU parking. In constrained parking environments however, CTU parking should be prioritised over washdown bays, whereby boaters are encouraged to use external washdown facilities.

6.5 Webcams

All new and upgraded boating facilities shall consider the installation of webcams that are compatible with Boating Vic. Boating Vic is an online service managed by Maritime Safety Victoria that publicly hosts webcam images from boat ramps and ramp car parks. The webcam images are refreshed every five minutes, which enable users to remotely check usage levels at a particular boating facility (Figure 6 1). These webcams also count the number of launches occurring per hour at a particular boat ramp facility. All requirements, specifications and details for the webcams are provided by Maritime Safety Victoria.

Figure 6 1: Example webcam images of ramp (left) and carpark (right)

6.6 Lighting and Reflective Markers

Public lighting in the carpark shall follow the requirements referenced in Section 1.3. Over the ramp itself, consideration should be given to the industrial lighting levels due to the nature of rigging and de-rigging if glare to moving traffic can be avoided. The need for lighting on the boat ramp can reference the facility usage levels in low light conditions (dusk, non-daylight hours and dawn), which can be determined from webcam data if available (e.g. the usage early morning and late at night). Reflective markers are required on the ramp and holding structures to identify features such as structure extent, bollards and extents of the ramp. Raised cat's eye type markers need to be used on the reversing lane lines to give direction if the pavement is wet. Jetties and amenities should be lit where practical for pedestrian safety. Lighting for navigation purposes is a separate consideration and Maritime Safety Victoria should be consulted.

6.7 Signage

Signage should be selected, designed, and placed in accordance with the documents summarised in Table 6.1. For inland waterways, consideration should be also given to the design of easily relocatable signs.

Table 6.1: Signage guideline documents

Category	Document Title	Publisher	Availability
Boating	Boating Safety Information Signage guidelines	Maritime Safety Victoria	Online
Boating	Waterway Management Guide - Signage and navigational aid visibility	Maritime Safety Victoria	Upon request
Boating	A guide to beach safety signs, flags and symbols	Royal National Lifeboat Institution	Online
Boating	AS 2416-2002 Design and Application of Water Safety Signs	Standards Australia	Online
Road	AS 1742-2014 Manual of uniform control traffic devices	Standards Australia	Online
Road	AS 1743-2001 Road signs - specifications	Standards Australia	Online
Road	VicRoads Australian Standard Supplements: Australian Standard – AS 1742 Manual of Uniform Traffic Control Devices Parts 1-15	VicRoads	Online
Road	VicRoads Australian Standard Supplements: Australian Standard – AS 1743 Road Sign - Specifications	VicRoads	Online

Examples of some common signage that may be found in boating facilities are shown in Figure 6 2. Print-ready digital files of boating and road signage can be requested from Maritime Safety Victoria and VicRoads respectively.

Figure 6.2: Example signage

Figure 6.3: Example all abilities signage

Glossary

Accessway	A road providing a vehicular thoroughfare to a ramp or parking area.
AHD	Australian Height Datum.
Average Recurrence Interval (ARI)	The average number of years before an event of a given magnitude is predicted to occur. For example, a 5-year ARI event occurs every 5 years.
Combined Biotope Classification Scheme (CBiCS)	CBiCS provides a means of describing, mapping and monitoring biological communities, abiotic structural habitat components and ecosystem types. It is a central component of marine spatial planning, environmental assessments, monitoring and research.
Chevron	The pattern formed by the impression of the drainage/traction grooves.
Crest Level	Elevation of the transition between the boat ramp and manoeuvring area.
Davit	Device with mechanical arms and winch used to lower items into water.
De-rigging	The act of readying and tying down a boat for transportation on a road.
Design Low Water Level	The minimum operable water surface elevation over the intended life of a boat ramp defined to maximise usage of the boat ramp under the range of environmental conditions likely to be encountered at the site. In waterway areas influenced by tides, the Design Low Water Level should be defined by the Lowest Astronomical Tide (LAT) as determined from local tide surveys. In non-tidal areas, the Design Low Water Level should be determined from analysis of water level records to determine the lowest water level that is reasonably likely during the proposed period of usage. The influence of artificial structures (e.g. dams) or water abstraction activities within waterways may also need to be considered.
Design High Water Level	The maximum operable water surface elevation over the intended life of a boat ramp defined to maximise usage of the boat ramp under the range of environmental conditions likely to be encountered at a site. This is used to set the crest level of a boat ramp so that it is not submerged during elevated water level and wave runup conditions. This water level should be defined in consultation with local authorities and include allowances for astronomical tides, storm surge, wave setup, freshwater flooding, and predicted sea level rise, based on projections that are widely accepted by competent scientific opinion or as stipulated in local regulations, over the design life of the facility.
Draft	The vertical distance between a boats water line and the lowest part of the boat including hull fittings and motor.
Freeboard	The lowest vertical distance between the water surface and the deck of a floating structure including pontoons and vessels.
Gangway	A structure which provides access between a walkway or shore and a floating structure or vessel.
Geotextile	A synthetic fabric that is placed under rock fills to prevent the underlying material from washing out.
Gross Combination Vehicle Mass (GCVM)	The combined mass of the trailer with load (vessel) and tow vehicle.
Highest Astronomical Tide (HAT)	The highest tide level predicted to occur under average meteorological conditions and any combination of astronomical conditions.
Jetty	A horizontal decked walkway on piered or piled footings providing pedestrian access from the shore to the waterway and is generally aligned perpendicular to shore.
Length Overall (LOA)	Is the maximum length of a vessel's hull measured parallel to the waterline.
Longitudinal Grade	Slope of the boat ramp, manoeuvring area or accessway parallel to direction of travel. The direction of travel in the manoeuvring area is towards the boat ramp.
Lowest Astronomical Tide (LAT)	The lowest tide level predicted to occur under average meteorological conditions and any combination of astronomical conditions.

Manoeuvring Area	The area at the top of the ramp that allows the driver of car-trailer units to align their combination before reversing down the ramp.
Mean High Water Level and Mean High Water Springs	In waterway areas influenced by tides, the Mean High Water Level (MHWL) should be defined by the Mean High Water Springs (MHWS) tidal condition. In non-tidal areas, the Mean High Water Level may be determined from an analysis of water level records or local knowledge. It should include an allowance for predicted sea level rise over the design life of the facility that is based on projections that are widely accepted by competent scientific opinion, or as stipulated in local regulations.
Mean Water Level	The average sea surface elevation over a long time period, preferably 18.6 years or more, or the average level that would exist in the absence of tides. In non-tidal areas this average water surface elevation would be determined from analysis of water level records or local knowledge.
Pontoon	A floating platform used for access to the water or a vessel.
Precast Plank	A concrete reinforced section that is prepared and hardened in a designed shape before placement in a desired position.
Rigging	Preparation of a boat for launching with removal of tie down straps.
Scour	Removal of material around a structure by the force of moving water.
Toe Depth	Depth of the vertically lowest point of the surface of a boat ramp.
Under Keel Clearance	Vertical distance between lowest part of a vessel hull and the seabed.
Usable Berth Length	The length of the berthing area at jetties and pontoons that provides at least 300 mm Under Keel Clearance for the Design Vessel in a complying wave climate of 0.2 m and for soft bed conditions. For suitable water depth in non-complying wave climates and hard bed conditions see Clause 3.2 of AS 3962-2020.
Vertical Curve	Provides a transition between two sloped roadways, allowing a vehicle to negotiate the elevation change at a gradual rate rather than a sharp cut.
Washdown	The act of cleaning a boat, motor and/or trailer with freshwater following retrieval at a boat ramp.
Webcam	Is an Internet Protocol camera that feeds or streams an image or video in real time to, or through a computer network. There is a network of webcams installed at selected boat ramp facilities in Victoria.

Appendix A: Design deliverables and certification

This appendix provides a guide to the typical design stages and deliverables expected at each stage.

A.1 Typical Staged Design Process

The typical requirements for each design phase described below should be considered guidance only and are intended to supplement guidance stipulated in delivery authority guidelines (e.g. The Infrastructure Design Manual). Cost estimate and other advice required at different project stages are not captured below.

Pre-Concept Planning (5% complete)

- Aim: Establish the scale and constraints
- Consider the importance of the boat ramp within the network of the surrounding facilities
- Identification of stakeholders for consultation
- An in-depth review of demand using all available information and site-specific traffic studies where possible
- Identification of any requirements associated with commercial use, emergency services, including Police, Water Police, Marine Rescue, State Emergency Service and Ambulance
- Consideration of the use of the boat ramp for purposes other than boat launching and risks associated with these activities (swimming, pedestrians, cyclists, paddle sports etc.)
- High level identification of environmental constraints and opportunities
- Traffic studies to optimise the space available for CTU parking and efficient traffic circulation
- High level understanding of physical attributes and constraints
- Determining the planning approval pathway, including permits and licences. Reference to the DELWP Siting Guidelines is required

Concept Design (30% complete)

- Aim: recommend a concept option
- Stakeholder consultation
- Site visits
- All studies as required in accordance with the DELWP siting guidelines
- Geotechnical studies
- Cadastral plan together with planning and environmental overlays
- Feature survey, topographic survey and hydrographic survey as required
- Plan view drawings and sections as required to demonstrate intent

Preliminary Design (70% complete)

- Aim: All plans and section drawings fully dimensioned and sized
- All civil and drainage, dredging, structural, signs and lines and utilities drawings as required
- Design drawings, specification, final Safety in Design report and design report
- Fully dimension plan and longitudinal section showing tidal or water storage levels. Local tide level to AHD conversion must be shown on the drawings for coastal locations

Detailed Design (90% complete)

- Aim: Fully detailed set of documentation for construction
- All civil and drainage, dredging, structural, signs and lines and utilities drawings as required
- Design drawings, specification, final Safety in Design report and design report
- Design drawings will include all necessary detail e.g. precast plank schedule, pile set-out plan, reinforcement detailing etc
- Detailed investigations, e.g. high resolution coastal process assessment

Final Design (100% complete)

- Aim: Fully detailed set of documentation for construction with all stakeholder comments closed
- Full package for tender purposes captured a final version of the above and with all client comments closed out
- Certified design package

A.2 Certification

The designer shall certify the construction drawings and shall also certify (by declaration notes on the drawings or by a separate Engineer's Certificate) that the design of the works:

a. is suitable for the intended usage

b. is structurally adequate for the intended location and anticipated usage

c. is structurally adequate to allow for the scour resulting from flood and tidal conditions (if applicable)

d. does not impose loads on existing structures that would exceed their design capability

e. would not adversely affect the stability of the bed and the banks of the waterway in which the Works are to be constructed

f. is designed in accordance with all appropriate Australian standards including the Victorian Boating Facility Design Guidelines

g. does not adversely affect the use of adjacent structures

h. has a non-slip surface

A.3 Design Report

The design report shall contain the following sections:

a. document control page

b. project details and scope

c. design details:

- site investigations (geotechnical, flood height and current, wave climate)
- design tidal planes (if applicable)
- assumptions
- design methodology
- compliance with these Design Criteria and reasons for deviations
- compliance with signage requirements

d. workplace health and safety hazards associated with the design (in the construction and operation phases)

e. special design and or construction requirements for approval conditions.

f. design basis

g. calculations

A.4 Typical Approvals in Coastal Environments

The approval requirements for coastal projects can differ to those of inland projects. The below approvals specific to coastal projects are provided as a guide only:

a. Local Ports requirements (e.g. Works Permit)

b. Marine and Coastal Act Consent and all necessary background studies. For example, a background study may include an ecologist undertaking a dive investigation to determine local benthic habitats against the Victorian State CBiCS classification scheme

c. Cultural Heritage Management Plan

Appendix B: Boating Facility Safety Assessment (Template)

Purpose: Assess an existing boat ramp against standards (many of which are not mandatory to follow), good practice, and best practice.

Tools: Consider waders, measuring tape, underwater camera, and prod.

Applicable local, national and international standards for boat ramps:

- AS 3962-2020: Guidelines for design of marinas
- AS 4997-2005: Guidelines for design of maritime structures
- California Department of Boating and Waterways, 1991
- Department of Transport and Main Roads Queensland, 2015
- NSW Boat Ramp Facility Guidelines, 2015
- Ohio Department of Natural Resources, 2003
- Oregon State Marine Board, 2011
- South Australian Boating Facility Advisory Committee, 1997
- U.S. Army Corp of Engineers, 2012

Waterside Safety Assessment

Topic	Considerations	Record site observations	Ref. (photo or survey)
Tranquillity	Sheltered from [significant] waves larger than 0.2 m (short period). Long period waves should also be considered separately. (AS 3962 cl.7.2.2) Alignment of ramp to dominant waves, considering swell, sea and boat wash. (AS 3962 cl.7.2.2) (OSMB 3.03) (ODNR p.25)	Note: record any obvious issues. A coastal study will be required	
	Boat ramps may have features to dissipate wave energy and reduce reflection. (best practice)	Note: observe shore steepness, roughness and any dissipating features	
Navigational safety	Separation of launching operations from channel. (AS 3962 cl.7.2.2(e))	Note: bathymetry is required to confirm	
	Consider AtoN's and sector lighting. (IALA)		
	Waterside queuing to be avoided. Low speed manoeuvring should be possible without blocking the channel. (AS 3962 cl.7.2.2(e), cl.7.2.3.5) (CDBW 101C.) (USACE 11-1.1.3) (OSMB 5.02(B5))	Note: bathymetry is required to confirm	
	Adequate water depth on approach to ramp (typically no less than -2.0m LAT for recreational facilities). The width of the channel should be 20m. (AS 3962 cl. 3.1)	Note: bathymetry is required to confirm	
Pedestrian safety	Space to be provided on ramp for standing and being isolated from CTUs. E.g. kerb that separates vehicles and pedestrians. (good practice)		
Handrailing	Effective control of fall from height hazard onto hard surface (e.g. on mooring jetty). Falls to water or land greater than 1.5m to be recorded. (AS 4997 cl.3.4) (CDBW 301A-3a)		
Ramp Gradient	Should be between 1:7 and 1:9 with 1:8 being preferred. If grades are outside of this range it should be clearly sign-posted. Ramp gradients should be uniform. (AS 3962 cl.7.2.3.3) (USACE 11-1.2.1)	Note: Survey required to confirm	
Ramp texture	Ramp texture — ribbed and rough preferred. Ribs should be at a 45° angle or diamond waffle pattern to promote self-cleaning. Shallow grooves are unacceptable. (AS 3962 cl.7.2.3.4) (SABFAC 3.1)		
Ramp cleanliness	Should be free of organic matter, silt and/or kelp. (good practice)		
Fishing exclusion zone	Signage should be erected to discourage fishing in proximity to the ramp. (good practice)	Note: takes pictures on any signage	
Safe trailer manoeuvring	Ramp toe should be at least 1m below design low water level for normal trailered vessels. This should be extended to 1.2m for fixed keel yachts. Consider signs that indicate water depth. (AS 3962 cl.7.2.3.2(e))	Note: bathymetry is required to confirm	

Topic	Considerations	Record site observations	Ref. (photo or survey)
Safe trailer manoeuvring	End and edge drop-off should be prevented by stop logs and kerbs. (USACE 11-1.2.2)		
Security/ operations	Webcam with live ramp activity can optimise ramp operations and reduce ramp rage. (best practice)		
Lighting	Lighting should be provided to acceptable lux levels. (AS 3962 cl.6.5) (USACE 11-1.4.5) (SABFAC 2.3)	Note: a lighting model may be required	
Signage	Safety signage should be provided. (AS 3962 cl.7.2.1, cl.7.2.3.2(e), cl.7.2.3.3) (DTMR Sec.9) (SLSA 2007 (GO1312 cl.5)	Note: take pictures of any signage	
Vessel holding structure	Each ramp should be supported by a mooring pontoon or jetty capable of holding an appropriate number of vessels according to usage and at any tide state. (AS 3962 cl. 7.2.3.5)	Note: observe number of boat ramp users while at site and any waterside queuing	

Landside Safety Assessment

Topic	Considerations	Record site observations	Ref. (photo or survey)
Pedestrian safety	Separation of pedestrians and vehicles as far as practicable with any interaction not involving reversing vehicles. (SLSA 2007 GO1312 cl.2.5)		
	Safe access to CTU parking area from ramp with designated walking areas and no trip hazards. (good practice)		
Vehicle safety	Avoid sharp grade changes (vertical curves). Queuing should not block other traffic systems. (AS 3962 cl.7.3.3.2)	Note: Appropriate software may be used Note: Survey required confirm	
Overhead wires	Air draft of vessels should be considered in the context of any overhead restrictions. (AS 3962 cl.7.3.3.2)