



Marina design



AS 3962:2020

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- Boating Industry Association
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- Engineers Australia
- Fire Protection Association Australia
- Marina Industries Association
- Queensland Transport
- Roads & Maritime Services
- Royal Institution of Naval Architects
- Sailing Australia
- Superyacht Australia

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Preface

This Standard was prepared by the Standards Australia Committee, CE-030, Maritime Structures, to supersede AS 3962—2001, *Guidelines for design of marinas*.

The objective of this Standard is to provide designers, manufacturers and operators of marina and vessel berthing facilities with requirements for recreational marinas and small commercial vessels up to 50 m in length. Requirements are also given for on-shore facilities such as dry boat storage, boatlifts, boat ramps and associated parking facilities.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by “C” preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

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NOTES

Australian Standard®

Marina design

Section 1 Scope and general

1.1 Scope

This Standard sets out requirements for the design of marinas suitable for vessels up to 50 m in length.

The Standard covers fixed berth and floating pontoon marina systems, single pontoons and floating wave attenuators. Requirements are also given for on-shore facilities such as dry boat storage, boatlifts, boat ramps and associated parking facilities.

The Standard covers berths, pontoons and marinas located in coastal waters, lakes, rivers and dams.

NOTE Refer to relevant authorities for additional requirements for assessment of the environmental impact of marinas.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS/NZS 1170.0, *Structural design actions, Part 0: General principles*

AS/NZS 1170.1, *Structural design actions, Part 1: Permanent, imposed and other actions*

AS 1428.1, *Design for access and mobility, Part 1: General requirements for access*

AS 1657, *Fixed platforms, walkways, stairways and ladders — Design, construction and installation*

AS 1720.1, *Timber Structures, Part 1: Design Methods*

AS 1851, *Routine service of fire protection systems and equipment (all parts)*

AS 2419.1, *Fire hydrant installations, Part 1: System design, installation and commissioning*

AS 2441, *Installation of fire hose reels*

AS 2444, *Portable fire extinguishers and fire blankets — Selection and location*

AS 3004.1, *Electrical installations — Marinas and boats, Part 1: Marinas*

AS 3600, *Concrete structures*

AS 3745, *Planning for emergencies in facilities*

AS 4100, *Steel structures*

AS 4586, *Slip resistance classification of new pedestrian surface materials*

AS 4997, *Guidelines for the design of maritime structures*

AS/NZS 1664.1, *Aluminium structures, Part 1: Limit state design*

AS/NZS 1664.2, *Aluminium structures, Part 2: Allowable stress design*

AS/NZS 3000, *Electrical installations*

1.3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

1.3.1

attenuator

floating or fixed barrier intended to reduce the height of incident waves as they pass into the marina

1.3.2

Australian height datum

AHD

datum used for land surveys, which corresponds to a national bench-mark level

1.3.3

berth

area of water allocated for the wet storage of boats attached to a fixed or floating marina and allowing for walk on access to boats

Note 1 to entry: Boats at marinas generally occupy single or double berths.

1.3.3.1

berth, accessible

marina berth that meets the requirements set out in [Clauses 3.5](#) to [3.8](#)

1.3.3.2

berth, double

berth for two boats between finger floats or piles (see [Figure 1.1](#))

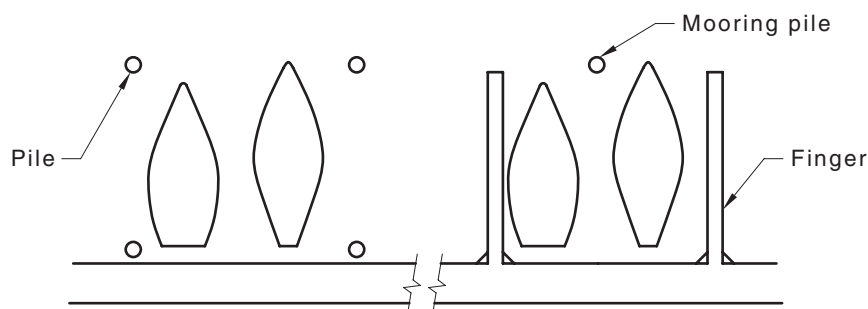


Figure 1.1 — Double berth

1.3.3.3

berths, fixed

berths consisting of piled walkways (jetties) and piled fingers with or without mooring piles (see [Figure 1.2](#))

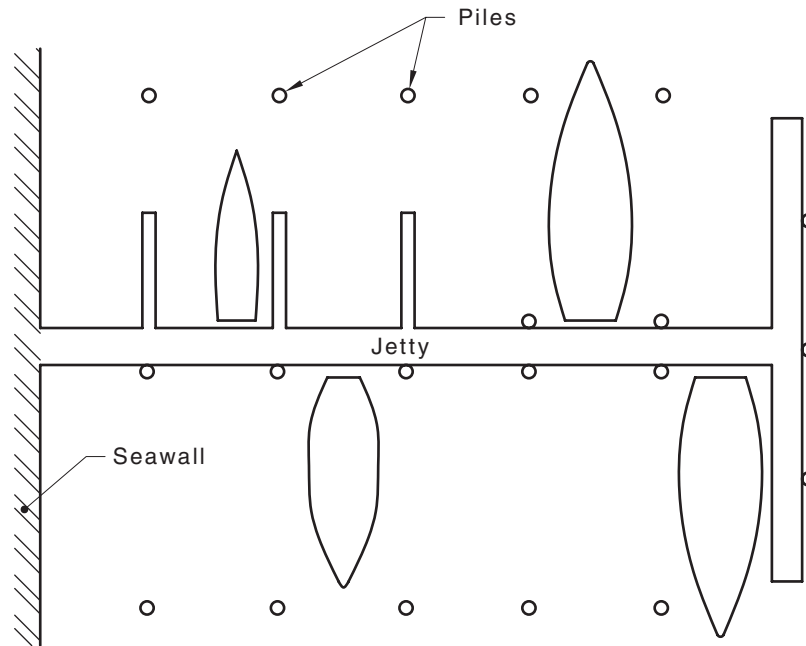


Figure 1.2 — Fixed berths

1.3.3.4 berths, floating

berths consisting of walkways that are buoyant and not supported by any other structure

Note 1 to entry: These floating walkways may be located by means of guide piles, anchor chains or cables, allowing free vertical movement. The boats are moored in either single or double berths, with finger pontoons or along-side berth configuration (see [Figure 1.3](#)).

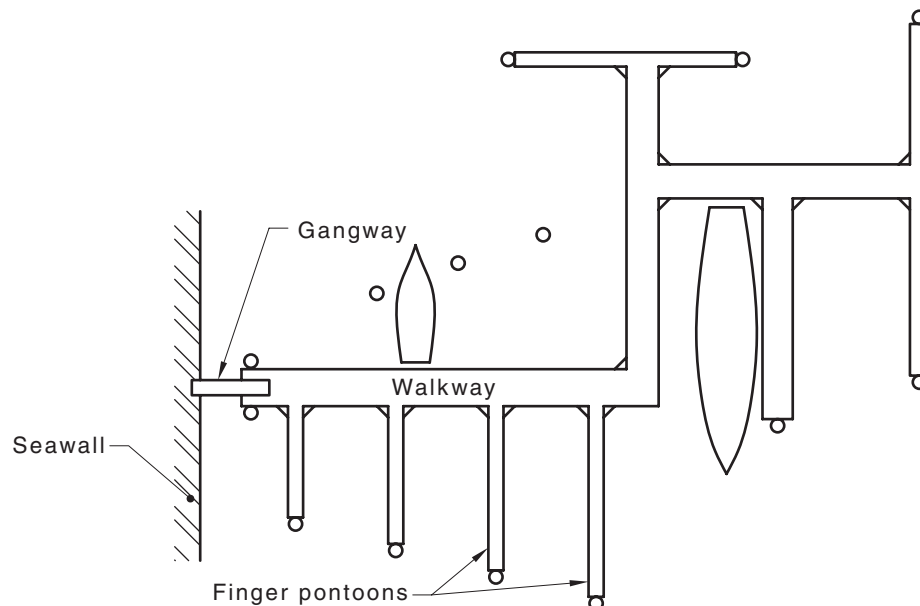


Figure 1.3 — Floating berths

1.3.3.5 berth, single

berth for one boat between finger floats or piles (see [Figure 1.4](#))

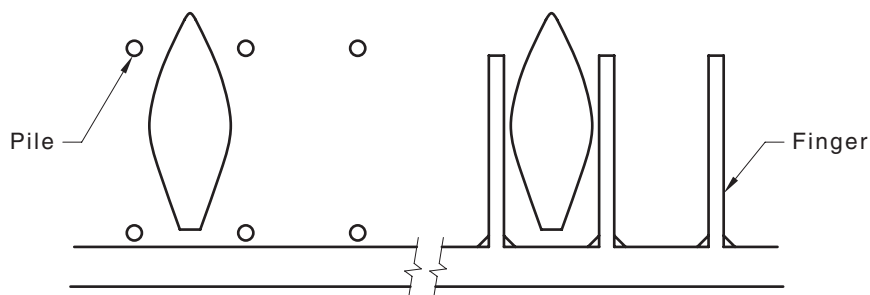


Figure 1.4 — Single berth

1.3.4 breakwater

structure intended to be a solid barrier to incident waves from the sea or adjacent waterbody

Note 1 to entry: This can be in the form of a rock wall, concrete vertical face or sheet piling or other engineered structure presenting a solid barrier from the sea bed.

1.3.5 channel

unobstructed waterway that allows the movement of vessel traffic

Note 1 to entry: See [Figure 1.5](#).

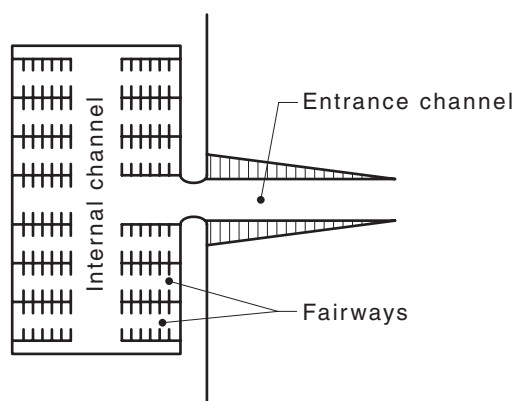


Figure 1.5 — Channels

1.3.5.1 channel depth

depth of water in the channel measured below chart datum

1.3.5.2 channel, entrance

channel that allows vessel movement between the marina and the main waterway (e.g. river or bay)

Note 1 to entry: See [Figure 1.5](#).

1.3.5.3 channel, internal

channel within the marina that allows vessel movement between the entrance channel and the fairways

Note 1 to entry: See [Figure 1.5](#).

1.3.5.4 channel width

width of a channel available for navigation

1.3.6
chart datum
CD

datum used on Australian hydrographic charts and other hydrographic surveys for the specific region

Note 1 to entry: This datum usually corresponds to the level of Lowest Astronomical Tide (LAT).

1.3.7
chine

lower longitudinal external line of any flotation component

1.3.8
draft

vertical distance from still water level to the deepest point of the vessel

1.3.9
dry storage
dry stack

storage of small to medium size vessels, generally in a multi-level rack system

Note 1 to entry: See [Figure 1.6](#).

Note 2 to entry: Also known as “boat stacker”.

Note 3 to entry: Vessels are conveyed to and from the water by a fork lift, crane or other device.

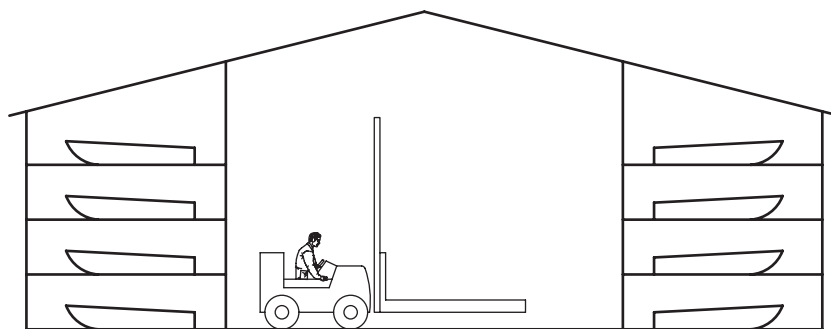


Figure 1.6 — Dry storage

1.3.10
fair chart
collector sheet

compilation of all available hydrographic data

1.3.11
fairway

unobstructed waterway between rows of berths which allows vessel movement between internal channels and individual berths

Note 1 to entry: See [Figure 1.5](#).

1.3.12
fetch

distance over open water across which wind can generate waves

1.3.13
finger

fixed or floating structure connected to the walkways, which provides pedestrian access to and from a berthed vessel (see [Figure 1.7](#))

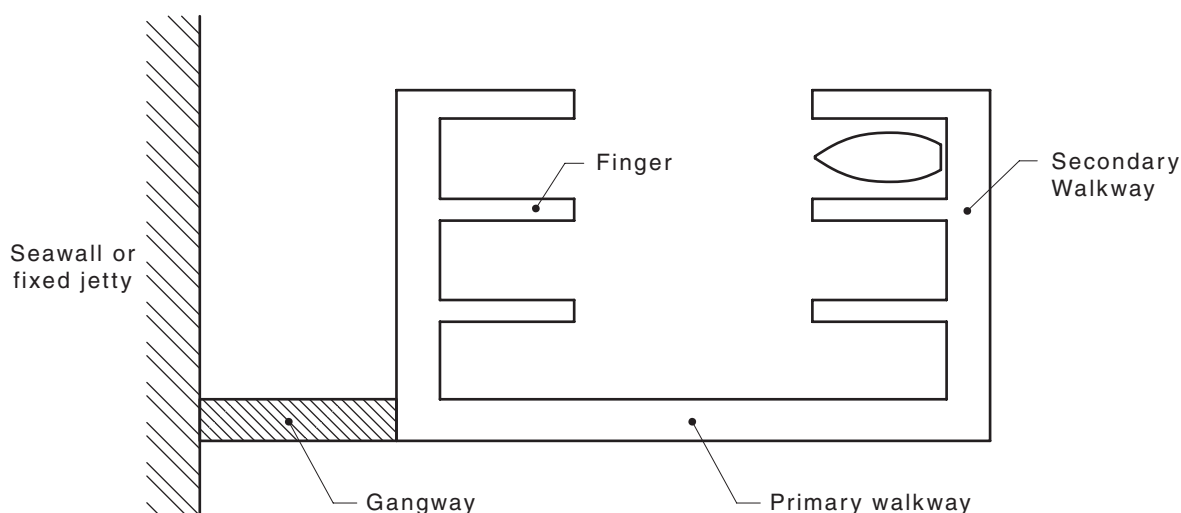


Figure 1.7 — Walkways and fingers

1.3.14

floating structures, stabilized

structures for which adequate stability can be demonstrated by virtue of connected fingers or pile capture devices capable of transmitting stabilizing forces or which are of L-shape or T-shape or similar stable configuration. Any connections should be capable of transmitting the stabilizing forces

1.3.15

floating structures, non-stabilized

floating structures without the stabilizing elements detailed in [Clause 1.3.14](#) (e.g. a rectangular plan pontoon)

1.3.16

freeboard

distance from the still water level to the deck level

1.3.17

gangway

ramp that provides pedestrian access between a fixed jetty or shore and a fixed structure or floating structure

1.3.18

hardstand

paved area, usually not covered, used for the storage of vessels and for maintenance activities such as painting, antifouling and repair work

1.3.19

highest astronomical tide

HAT

highest tide level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions

1.3.20

incident waves

waves arriving at the marina site boundary whether from a wind wave spectrum, vessel wash, swell, seiche or other source and either passing into the marina directly or being affected by a marina breakwater or attenuator

1.3.21**lowest astronomical tide****LAT**

lowest tide level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions

Note 1 to entry: There is a possibility of negative tides.

1.3.22**marina**

area of water and land that includes a group of pontoons, jetties, piers, or similar structures designed or adapted to provide berthing for vessels used primarily for recreation or commercial activity with or without a breakwater or attenuator at its boundary and may include ancillary services and facilities such as hardstands, slipways and other facilities for the repair and maintenance of vessels and the provision of fuel, provisions and accessories and other activities and services incidental to or directly related to the provision of marina services

1.3.23**may**

indicates the existence of an option

1.3.24**mooring**

detached or freestanding structure or device to which a vessel is secured or attached

1.3.25**pontoon**

floating platform (see [Figure 3.5](#))

1.3.26**relevant authority**

agency authorized by legislation or regulation to issue determinations, orders, or other instructions in respect of any subject covered by this Standard

1.3.27**sea, beam**

sea condition with waves approaching from within 22.5 degrees to abeam

1.3.28**sea, head**

sea condition with waves approaching up to 22.5 degrees from the centre-line

1.3.29**sea, oblique**

sea conditions that are not head sea (see [Clause 1.3.28](#)) or beam sea (see [Clause 1.3.27](#))

1.3.30**seawall**

structure separating sea and land

1.3.31**seiching**

long-period oscillatory wave motion in an enclosed or semi-enclosed body of water which is dependent on the geometry of the basin, reflective characteristics of the foreshore, wave period, and resonance

1.3.32**sewage pumpout facility**

mobile or static pumpout facility provided for the removal of sewage from a vessel

1.3.33**shall**

indicates that a statement is mandatory

1.3.34**should**

indicates a recommendation

1.3.35**slope**

vertical change in height over a given horizontal distance

1.3.36**straddle carrier**

mobile hoist designed to lift or lower vessels in and out of the water and to carry them to or from maintenance or storage areas

1.3.37**walkway****1.3.37.1****primary walkway**

structure that provides for pedestrian access between secondary walkways and the shore (see [Figure 1.7](#))

1.3.37.2**secondary walkway**

structure that provides pedestrian access between berths and primary walkways. Typically lies parallel to a fairway (see [Figure 1.7](#))

1.3.38**significant wave height** **H_s**

average height (crest to trough) of the highest one third of all waves measured over a period of time of a “Rayleigh distributed” spectrum of wave heights (see [Clause 4.8.2.2](#))

1.3.39**vessel beam**

greatest width of vessel including all permanent attachments

1.3.40**vessel length**

length measured between extremes, including bowsprits and stern davits or marlin boards

Section 2 Investigations

2.1 Surveys

2.1.1 General

2.1.1.1 Survey grid

A uniform survey grid should be adopted for the total project area. All terrestrial and hydrographic surveys should use this survey grid.

Consideration should be given to incorporating the survey grid for the project area into the regional coordinated survey grid, e.g. Mapping Grid Australia (MGA).

Where a local survey grid is adopted, this should be clearly noted on the drawings. The correlation to an established regional coordinated grid should be nominated on the drawings.

2.1.1.2 Survey datum

All survey data shall be reduced to one of the following recognized datum:

- (a) *Chart datum (CD)* — the preferred datum for surveys and mapping of marine works and offshore topography, as it provides direct correlation to navigable water depths.
- (b) *Australian Height datum (AHD)* — the preferred datum for terrestrial surveys, but this often does not have a definitive correlation to CD at specific locations.

All survey and design levels within any project shall be reduced to the same datum. A diagram showing the correlation between survey marks, AHD and CD for the specific location shall be provided on the drawings.

2.1.2 Hydrographic survey

Where there is insufficient survey data to make an assessment of nearshore design waves, currents and clearances, a hydrographic survey shall be undertaken to cover the proposed site of works (assuming it is below high tide level), the approach channel route and any adjacent nearshore waters.

The hydrographic survey shall identify the survey reliability.

The hydrographic survey data should also contain sufficient detail to enable an assessment to be made of the coastal processes affecting the proposed marina and adjacent foreshores.

2.1.3 Terrestrial surveys

Terrestrial surveys shall be provided over any land areas that will be incorporated within the project site. Adjacent shoreline areas that could be affected by the proposed marina shall also be surveyed.

NOTE Where adjacent shorelines consist of beaches, beach profile data may be necessary.

All existing features such as jetties, ramps, parking, vehicle manoeuvring area, pathways, seawalls, stormwater outfalls, drains, rock outcrops, and the like shall be clearly identified.

2.1.4 “As constructed” documents

On completion of all works on the project, “as constructed” documents shall be prepared. The documents shall provide the information that will allow for the accurate positioning of all features.

2.2 Geotechnical

2.2.1 Geotechnical parameters

The geotechnical parameters of materials within a marina are necessary for determination of the following:

- (a) Support systems for marina structures, e.g. piles, cables or chains with anchors.
- (b) Stability and settlement characteristics for revetments, breakwaters, riverbanks and any reclamation works.
- (c) Response to prevailing natural coastal and estuarine processes, currents and waves, flooding and scour as well as susceptibility to artificial influences such as propeller wash and vessel wake.
- (d) Material characteristics for ease of excavation, transportation and disposal. Chemical tests may also be required.

2.2.2 Excavation of material

The nature of the seabed material should be determined for both engineering and environmental purposes.

The nature of the seabed and foreshore material should be defined in sufficient detail to enable methods of excavation, transportation, and disposal to be determined. The extent and properties of different soil types should be identified.

The nature of soils to be excavated or otherwise disturbed should be tested for contamination and the potential to undergo acid-sulfate reaction. Where this potential is proven, a soil treatment and disposal process, and management processes, should be developed.

2.3 Wind, hydrodynamics and sediment movement assessments

2.3.1 Sources of data

Wind, wave, tide, storm surge and any other water level data may be available from the following common sources:

- (a) Bureau of Meteorology.
- (b) Industry (particularly the oil industry).
- (c) State government departments responsible for ports, harbours, and foreshores.
- (d) Department of Defence.
- (e) Tertiary institutions.
- (f) Consulting firms working principally in the environmental data collection field.
- (g) Specialist consultants undertaking wind and wave data collection or producing wave hindcasts from meteorological data.
- (h) Shipping records of weather observations.

For sites where the fetches are more complicated in shape or where ocean swell may reach the site, wave measurement at the site or numerical modelling may be necessary.

Information on sediment transport tends to be limited since it is usually very site specific. The most useful sources are State government departments associated with beach protection, and historical

records of hydrographic surveys and aerial photography. Port, harbour and local government authorities often have local data as might local council authorities. Tertiary institutions undertake investigations into beach behaviour in most states and may hold useful information.

Information on water quality data may be available from State or local government departments covering the areas of health, water resources, the environment, fisheries, and pollution control.

For hydrographic and bathymetric survey data, the Australian Hydrographic Office has a wide range of historical charts that can be obtained as fair charts (collector sheets). State government departments responsible for ports and local port authorities are sources of mainly nearshore data.

2.3.2 Data required and collection methods

2.3.2.1 Wind

Wind design data should be obtained from AS 1170.2, and supplemented where necessary by a recording anemometer.

Wind measurement programs using anemometers are unlikely to measure extreme events in the time scale available for data collection before the implementation of a project. The data should be correlated to regional information.

Historical wind data are often necessary for the hindcasting of design waves. For this purpose a longer duration mean wind speed is required. The mean one-hourly, three-hourly or six-hourly wind speed is usually appropriate. The choice depends on the diurnal variability in wind patterns and the fetches over which the wind acts. Directional wind data are required for both the determination of wind loadings and for wave hindcasting.

2.3.2.2 Waves

The incident wave climate at the site may comprise wind waves, ocean swells and vessel wash. The assessment of wave climate at a marina site requires a knowledge of —

- (a) wind climate including regional winds and local topographic winds;
- (b) water areas and fetch lengths in all directions; and
- (c) water depths, not only at the marina site but average depths along each of the major fetch directions.

The exposure of marinas to ocean swells may be a direct exposure, but more probably will be ocean swells modified to some degree by —

- (i) diffraction (bending of waves around headlands or ends of breakwaters);
- (ii) refraction (bending of waves due to shoaling effects); or
- (iii) reflection (waves reflected from solid surfaces such as walls or breakwaters).

Waves may be measured or determined by hindcasting and wave transformation procedures.

The determination of wave height and wave periods by hindcasting for various return period wind events may be undertaken with the use of nomographs in published texts. The determination should be carried out by a competent person.

NOTE An example of a competent person is an experienced coastal engineer or oceanographer.

2.3.2.3 Tides

Where the project site is in an area where tidal levels and predictions are not available, these may be identified from —

- (a) installation of a tide recorder with continuous recording for at least 28 days, and use of a properly calibrated hydrodynamic model; or
- (b) comparison of the recorded tide with that from a nearby permanent tide gauge with interpolated level tie-in between these two stations.

The above will enable tidal planes at the project site to be established.

2.3.2.4 Storm surge

Storm surge data for the period for which tide records are available may be obtained by the comparison of predicted versus recorded water levels at tide recording stations. Storm surges are the result of cyclones or other extreme meteorological events and, as with extreme winds and waves, are unlikely to be observed during the data collection phase for a project.

Storm surge levels are usually established by means of hydrodynamic numerical modelling that is calibrated using the available historical data.

2.3.2.5 Flood levels

Where flood level data has not been recorded historically, levels may be established by the use of calibrated mathematical or physical river models. Flood information shall include —

- (a) the flood level;
- (b) flood velocities at and adjacent to the berth;
- (c) scour depth and extent in plan; and
- (d) flood debris.

2.3.2.6 Climate change

Changes in water levels, storm intensity and frequency due to climate change shall be considered in marina design at least over the period of time of each structure's design life.

2.3.2.7 Currents

The major currents within a marina are usually due to either tidal effects or river flow.

Tidal current data are required over both neap and spring tides for force calculations and for flushing estimates for the marina.

Currents during floods may provide design loads for marinas sited within rivers.

Other sources of currents (e.g. density, wind or seiche induced or long waves) should be quantified. These currents may often form an important mechanism for marina flushing.

Some tidal flow information is available from hydrographic charts, but generally this information is not sufficiently site-specific to be suitable for the design of marinas. In most instances detailed measurements or mathematical analyses are necessary whether the currents relate to tides, storm surge, or stream run-off.

Current measurements may be undertaken either by current meters or by the tracking of water movement by dye tracing or float drogues.

2.3.2.8 Sediment movement

A marina frequently forms some form of protrusion from the banks of a river or estuary or from the shoreline. Consequently, it will have some influence on sediment movement in its vicinity. Data should be obtained on the —

- (a) stability of the existing shoreline;
- (b) stability of the existing seabed including bar, scour, and sand wave features;
- (c) concentration and frequency of suspended sediment; and
- (d) nature of the seabed and its mobility under current and wave action.

A method of estimating sediment transport is the comparison of historical survey data for the area of interest. For example, the accumulation of sand behind a groyne immediately after its construction will indicate a littoral transport rate. The comparison of shoreline changes from historical aerial photography can be used in a similar manner.

Where historical measured survey or photographic data does not exist, sediment transport may be estimated. Specific data should include —

- (i) sediment grain size distribution;
- (ii) sediment density;
- (iii) *in situ* bulk density;
- (iv) suspended sediment concentration as a function of river flow, tidal currents, and wave energy; and
- (v) wave climate and current regime.

This physical information may be used in simple empirical equations or in more sophisticated mathematical models to obtain estimates of sediment behaviour.

2.3.2.9 Water quality

An analysis of the exchange of water between the marina and the surrounding water body should be undertaken. The effects of this exchange (including in-flows from any outfalls) on that water body should be taken into account during the design phase of marinas.

NOTE Information on water quality Standards may be obtained from the relevant statutory authority.

2.3.3 Hydrodynamic assessments

The effects of the structure on the hydrodynamics of the waterway shall be considered.

Section 3 Dimensional criteria

3.1 Channel widths

3.1.1 Entrance channel

3.1.1.1 Overview

The width of the entrance channel to a marina is dependent on a number of factors, including —

- (a) exposure to wind, wave and currents, which all reduce the manoeuvrability of vessels;
- (b) number of vessels in the harbour and usage levels;
- (c) type and size of vessels;
- (d) extent of navigation aids provided.

Where benched breakwaters are used at a marina entrance such that the bench is submerged at higher tides, markers shall be used to delineate the edge of the channel.

3.1.1.2 Minimum width

For an entrance channel, the minimum width should be the greatest of —

- (a) 20 m;
- (b) $(L + 2)$ m, where L is overall length of longest vessel in the marina, in metres; or
- (c) $5B$ m, where B is the beam of the broadest mono hull vessel in the marina, in metres.

In order to minimize the penetration of waves into a vessel harbour, the width of the entrance channel may be narrowed over a short length at protecting breakwaters. The minimum width of this narrow section shall be the greater of 15 m and $3B$ m, where B is the beam of the broadest mono-hull vessel in the marina, in metres.

Where an entrance channel is less than that derived from the above then warning signage shall be placed at the channel entrances to advise “Narrow Channel” and any cautionary advice.

3.1.1.3 Preferred width

An entrance channel should be 30 m or $6B$ m; whichever is the greater where B is the beam of the broadest mono-hull vessel in the marina, in metres.

Widening of the channel may be necessary where the channel changes direction.

3.1.2 Internal channels and fairways

Channels and fairways within the marina are not as greatly influenced by the wind, waves, and currents at any site, as they are by the size, number and type of vessels, and the frequency of vessel usage.

Any non-motorized sailing vessel or multihull vessel using the harbour shall be considered when determining the internal channel and fairway widths. In some locations, there may be climatic conditions, such as prevailing winds, which shall be considered when internal channel and fairway widths are being determined.

Where currents exceed 0.5 m/s, the width of internal channels and fairways shall be increased to allow for the effect of the current on a vessel as it moves along the channel and turns into its berth.