# Boat Ramps and Barge Landings

DIPL Roadworks Master – March 2022

## General

### Cross references

Refer to the following worksections in Roadworks specification:

* MISCELLANEOUS PROVISIONS
* PROVISION FOR TRAFFIC
* CLEARING GRUBBING AND REHABILITATION
* EARTHWORKS
* CONFORMANCE TESTING
* MISCELLANEOUS CONCRETE WORKS

Refer to the following worksections in Bridgework Master Specification:

* CONCRETE
* REINFORCING STEEL
* PRECAST CONCRETE
* FABRICATION OF STEELWORK
* PROTECTION TREATMENT OF STEELWORK
* ROAD FURNITURE AND TRAFFIC CONTROL DEVICES

### Standards

AS 1012 (set) Methods of testing concrete

AS 1141 (set) Methods for sampling and testing aggregates

AS 1141.25.1 - Degradation factor - Source rock

AS 1141.26 - Secondary minerals content in igneous rocks

AS 1141.29 - Accelerated soundness index by reflux

AS 1141.60.1 - Potential alkali-silica reactivity - Accelerated mortar bar method

AS 1170 (set) Structural design actions

AS 1379 Specification and supply of concrete

AS/NZS 1664 (set) Aluminium structures

AS/NZS 1664.1 - Limit state design

AS/NZS 1664.2 - Allowable stress design

AS 1665 Welding of aluminium structures

AS 1720 (set) Timber structures

AS 1720.1 - Design methods

AS 1726 Geotechnical site investigations

AS 1742 (set) Manual of uniform control traffic devices

AS 1743 Road signs – specifications

AS 1744 Standard alphabets for road signs

AS 2758 (set) Aggregates and rock for engineering purposes

AS 2758.1 - Concrete aggregates

AS 3600 Concrete structures

AS 3706 (set) Geotextiles - Methods of test

AS 3706.2 - Determination of tensile properties - Wide strip and grab method

AS 3706.3 - Determination of tearing strength - Trapezoidal method

AS 3706.4 - Determination of burst strength - California bearing ratio (CBR) - Plunger method

AS 3706.9 - Determination of permittivity, permeability and flow rate

AS 3850 (set) Prefabricated concrete elements

AS 3850.1 - General requirements

AS 4100 Steel structures

AS 4133 (set) Methods of testing rocks for engineering purposes

AS 4133.2.1.2 - Rock porosity and density tests - Determination of rock porosity and dry density - Saturation and buoyancy techniques

AS 4133.4.1 - Rock strength tests - Determination of point load strength index

AS 4133.4.2.1 - Rock strength tests - Determination of uniaxial compressive strength of 50 MPa and greater

AS 4997 Guidelines for design of maritime structures

BS 1881 Testing concrete

IALA E-108 Surface colours used as visual signals on marine aids to navigation

IALA E-200-1 Marine signal lights-colours

Steel: Steel structures must be designed in accordance with AS 4100 and AS 4997, as appropriate. All steel to be protected using a corrosion protection system.

Aluminium: Aluminium structures to be a marine grade alloy. Any structure to be designed in accordance with AS/NZS 1664.1 and AS/NZS 1664.2. Welding of aluminium structures to AS 1665.

Timber: Timber structures must be designed in accordance with AS 1720.1.

Structural design actions in accordance with AS 1170.

### Definitions

| **Table - Definitions – Boat Ramps and Barge Landings** | |
| --- | --- |
| **TERM** | **DEFINITION** |
| **Core** | Nominal 75 mm crushed rock compacted and contained within geogrid. |
| **Dolphin** | A pylon, or a pylon array, to which a vessel can be moored, in addition to a primary mooring, to prevent unwanted vessel movement whilst moored to the primary mooring. |
| **Full tide access** | The facility is usable across the full tidal range.  A full tide access ramp has:   * The head of the ramp at HAT + 0.5 m. * The toe of the ramp is at LAT – 1.0 m.   [Depth of ramp toe below LAT will be site specific.] |
| **HAT** | Highest Astronomical Tide. |
| **IALA** | International Association of Marine Aids to Navigation and Lighthouse Authorities. |
| **LAT** | Lowest Astronomical Tide. |
| **MSL** | Mean Sea Level. |
| **MHWS** | Mean High Water Springs. |
| **MSB** | Northern Territory Marine Safety Branch |

## Inspections

### Notice – Witness Point

**Witness Point -** Give sufficient notice so that inspections may be made at the following stages:

* Notice to the Superintendent if unsuitable material is encountered.
* Foundation inspection prior to geotextile and geogrid placement.
* Compaction of 75 mm crushed rock.
* Pre-pour inspections and placement of all concrete.
* Manufacture of precast planks.
* Before grouting of rock protection works.
* Construction of fully grouted shoulders and shoulder batters.
* Rock armour sourcing.

[Delete stages not in project. Add stages that are in project but not in list.]

## Contractor Submissions

### Dredging strategy – Witness Point

**Witness point -** Provide details of any Dredging Strategies for all dredging works required during the execution of the works.

### Survey – Witness Point

**Witness point -** Provide copies of survey reports prepared for the works. This is not required for survey reports commissioned by the Principal or the Superintendent.

[A land survey and a hydrographic survey are required with enough detail and extent to locate services, natural and artificial features and determine contours].

### Geotechnical investigation – Witness Point

**Witness point -** Provide copies of geotechnical investigation reports prepared for the works. This is not required for geotechnical investigation reports commissioned by the Principal or the Superintendent.

### Acid sulfate soil investigation – Witness Point

**Witness point -** Provide copies of acid sulfate soil investigation reports prepared for the works. This is not required for acid sulfate soil investigation reports commissioned by the Principal or the Superintendent.

[An acid sulfate soil investigation for the determination of the liming rate or management strategy should be undertaken dependent on the volume of cut or site conditions].

### Contaminated land investigation – Witness Point

**Witness point -** Provide copies of contaminated land investigation reports prepared for the works. Appropriately scope contaminated land investigations with consideration of the past history and use of the site. Investigations may include, but not be limited to, reporting on hydrocarbons, asbestos, and Perfluoroalkyl and polyfluoroalkyl substances (PFAS) contamination. This is not required for contaminated land investigation reports addressing the listed contaminants or other identified contaminants commissioned by the Principal or the Superintendent.

### Samples – Witness Point

**Witness Point -** Submit to the Superintendent a 300 mm x 300 mm sample of the proposed geotextile, and geogrid. Do not commence work until the samples have been received by the Superintendent, and the type of geotextile, and geogrid have been approved.

### Geotextile and geogrid placement – Witness Point

**Witness Point -** Before placement of the geotextile, and geogrid submit to the Superintendent:

* The geogrid layout, lapping, and braiding plan.
* The geotextile layout, and lapping plan.

### Precast panel lifting and placement procedure – Witness Point

**Witness Point -** Submit to the Superintendent a precast panel lifting procedure for approval.

**Witness Point -** Submit to the Superintendent a precast panel placement procedure for approval.

## Boat Ramp Geometry

Design loading: Dual axle trailer – 2 tonnes per axle at 750 mm centres.

Lane width:

* Single lane boat ramp; 4.0 m.
* Dual lane boat ramp; refer to the project drawings.
* Boat ramp not perpendicular to the embankment; refer to the project drawings.

HAT: +0.5 m.

LAT: -1.0 m.

[Depth of ramp below LAT will be site specific.]

Maximum slope: 1:8

Minimum slope: 1:10

## Barge Landing Geometry

For the barge landings refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ for barge landing geometry if not shown on drawings.

## Components and Materials

Ramp to include, but not be limited to, the following components and materials:

* Geotextile, and geogrid for separation of the subgrade and containment of the core.
* 75 mm crushed rock core or base.
* 10 mm gravel blinding layer.
* Cast insitu concrete approach slab.
* Cast insitu anchor beam. Finish to match cast insitu concrete approach slab.
* Precast concrete ramp planks.
* Cast insitu shoulders, and shoulder batters, and/or fully grouted stone shoulders, and shoulder batters. These are to extend to the MSL as a minimum. When in cut construction to include a spoon drain.
* Stone pitched shoulders and shoulder batters.
* Rock armour to shoulders and shoulder batters.
* Flexmat.

[Subject to site and availability of materials with consideration as to whether it is an urban or remote location.

Delete components not in project. Add components that are in project but not in list].

Refer to Project Drawings.

### Coffer Dams, Timbering, Shoring, and Sheeting – Witness Point

**Witness point -** Provide details of coffer dams, timbering, shoring, and sheeting proposed to be used in the execution of the works.

**Witness point -** Provide copies of Safe Work Method Statements for the installation, use, and removal of any coffer dams, timbering, shoring and sheeting proposed to be used in the execution of the works.

Design any coffer dams required for the execution of the works.

Construct coffer dams to adequate height and depth and as waterproof as necessary for proper performance.

Provide adequate clearance for:

* Construction of forms.
* Inspection of interiors.
* Pumping from outside the forms.

Remove timbering, shoring, and/or sheeting from inside excavations when they are no longer required in-situ.

Remove coffer dams, timbering, shoring, and sheeting, and associated materials and components, and the like, from the site when no longer required.

Do not damage the finished structure or disturb adjacent in situ material.

Remove obstructions from waterways.

Do not incorporate (or cast in) any portion of these temporary works in the final structure without Superintendent approval.

[Delete items not required in the works. Add details to items included in the works.]

[Delete this clause if not required in the works.]

## Earthworks in Cut

### Methodology – Witness Point

Carry out the excavation works in an environmentally sensitive manner under the requirements of the Environmental Management Plan (EMP).

The Superintendent may require adjustments to the method during the course of the Contract to minimise environmental impacts.

In the proposed method of excavations and re-profiling, the Contractor must make allowance for:

* The extent of work and sequence.
* Existing water depths and tidal range.
* Final profiles.
* Nature and character of material to be removed.
* Transporting the excavated spoil to the nominated disposal or nourishment area.
* Possibility of encountering lenses of different materials, such as fine cohesive material or cemented material.
* If acid sulfate soils are confirmed, treat acid sulfate soils as per the Acid Sulfate Soils Management Plan.
* Constraints offered by seabed geometry of the site.
* Artificial obstructions (fishing nets, anchors etc.).
* The operational limitations imposed by winds, waves, and currents.

#### Erosion and Sediment Control

The Contractor will be responsible for surveillance and management of sediment plumes and any other monitoring associated with sediment plumes under the EMP.

Refer to the **Erosion and Sediment Control Plan** clause in the Standard Specification for Environmental Management latest edition:

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/environmental-management>

#### Excavation Equipment Selection

The Contractor is to nominate the type of equipment to carry out the excavation. Equipment must be sized to match the:

* Material to be removed.
* Required production rate.
* Distance to transport the material.
* Time for completion of the work.

Land based earthmoving equipment may be used to undertake excavation work if achievable under low tide conditions.

If a dredge is used, the Contractor must have a competent and experienced dredge master in charge of material dredging and placement activities. The dredge master must be on site, or on the dredge at all times during dredging plant operation.

If a pipeline is to be used, the Contractor will be required to place the pipeline in an area which has the least environmental impact. Contractor to warn the public of potential safety hazards to the satisfaction of the Superintendent.

**Witness Point -** Submit to the Superintendent a list of the type of equipment to be used to carry out the excavation.

### Unsuitable Material – Hold Point

Unsuitable material below the structure consists of:

* Loose and very loose sands/coarse grained soils according to AS 1726.
* Soft and very soft clays/fine grained soils according to AS 1726.
* Uncontrolled fill.
* Poor quality existing foundations.
* Acid sulfate soils when exposed to air.

Unsuitable material below the design excavated surface to be removed before constructing foundations and replaced with crushed rock core fill.

**Hold Point -** Obtain directions from the Superintendent before works commence.

### Excavated Material

All excavated material is to be transported to the nominated disposal or nourishment area.

Disposal site/nourishment area: *[complete/edit]*

#### Stockpile Management – Hold Point

Stockpile the material and test to enable classification of soil waste in reference to the NSW Waste Classification Guidelines (or similar Superintendent approved method).

**Hold Point -** Contractor to supply Sampling, Analytical and Quality Plan (SAQP), to the Superintendent for approval prior to commencing soil testing.

Do not place stockpiles within 50 m of any drains, drainage lines, creeks, or other waterways. Stockpiles are not to exceed 2 m in height. For stockpiles install all necessary erosion, and sediment control measures to effectively manage sediment laden runoff, and wind erosion. Temporary stockpiles are not to be subject to tidal inundation.

Refer to the **Stockpile Management** clause in the Standard Specification for Environmental Management latest edition:

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/environmental-management>

### Treatment of Acid Sulfate Soils

#### Treatment – Witness Point

**Witness Point -** If acid sulfate soils are confirmed, the contractor must develop an Acid Sulfate Soils Management Plan and submit to the Superintendent for review. Treat the acid sulfate soils as per the plan. The plan is to be developed, implemented, and monitored by a suitably qualified independent organization.

Refer to the **Acid Sulfate Soils Management Plan** clause in the Standard Specification for Environmental Management latest edition:

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/environmental-management>

#### Temporary bunding – Witness Point

If contaminated acid sulfate soil spoil is not treated on the same day as excavation, construct temporary bunding from compacted uncontaminated soil to prevent acidic drainage entering watercourses.

**Witness Point -** Advise the Superintendent of bunding location for approval.

Remove all bunds after completion of the works and reinstate disturbed areas to existing condition prior to commencement.

[Edit this sub clause as required in accordance with the Acid Sulfate Soils Management Plan.

Delete this sub clause if not required in the works.]

### Extent of Access Channel Extraction Works

Refer to the project drawings for the extent of the extraction area.

The sequence of extraction to be agreed between the Contractor and the Superintendent. In principle the Contractor may elect to follow a re-profiling sequence which is the most efficient in terms of movements of the equipment used.

The Contractor must endeavor to leave buffer zones as large as practicable between his operations and any environmentally sensitive areas (fish habitats etc.).

[Delete this sub clause if not required in the works].

### Access Channel Final Profiles - Hold Point

Access channel final profile to be in accordance with the project drawings. Re-profiled depths across basin at the toe of the ramp must achieve minimum depths.

No deep holes or sudden changes in grade to remain in the final profile.

Provide clear vessel access to ramp toe.

Maximum final gradients on side slopes to be 1 in 6 through sand. It is acceptable to collapse wall excavations to achieve this profile in sandy materials.

Determined design profile is based on the anticipated geotechnical conditions. The Contractor may need to amend the batter in consultation with the Superintendent during construction to suit the actual conditions encountered.

**Hold point -** Submit to the Superintendent a hydrographic survey demonstrating that the least depth, lines and levels of all navigation zones and re-profiling areas have been achieved. Do not disestablish plant required for the re-profiling works until approval from the Superintendent has been given.

Areas which do not attain minimum design depth must be re-excavated to the required depth and must be re-surveyed.

[Delete this sub clause if not required in the works].

### Excavation and Re-Profiling of Difficult Material

Should re-profiling of material which is difficult to excavate (too cohesive, cemented etc.) be encountered, the Contractor to employ a different technique of removing the material which is to be approved by the Superintendent.

[Delete this sub clause if not required in the works].

## Geotextile and Geogrid

Standard: To AS 3706.

### Geotextile

Geotextile to be Texcel 900R or Superintendent approved equivalent.

Material: Non-woven needle punched staple fibre polyester or polypropylene meeting minimum strength Class D and Filtration Class 1.

Elongation: ≥ 30%.

Grab strength: 1200 N.

Tear strength: 450 N.

G rating: 3000.

### Geogrid

Geogrid to be BIAX3030 or Superintendent approved equivalent.

Material: Manufactured from polypropylene sheet with transverse and longitudinal ribs of minimum thickness 1.3 mm

Aperture size: 37 mm x 37 mm to contain 75 mm crushed rock.

Quality control strength: 30 kN/m with a peak strain of 10% in both directions.

Junction strength between the longitudinal and traverse ribs: Greater than 95% of the quality control strength in both directions.

### Storage, Packaging, and Handling

Geotextiles and geogrid to be stored as follows:

* Within an opaque, protective, waterproof and UV-resistant cover.
* Must not be stored directly on the ground or where they could be affected by heat.
* To manufacturers specifications.

The protected geotextile and geogrid rolls must be clearly labelled showing manufacturer, type, and batch identification number.

Handle rolls with forklifts or similar, using dedicated slings, free of sharp hooks or tongs. Rolls that are dropped, dragged, or pushed around on the ground will be rejected.

### Delivery and Product Certification – Witness Point

Delivered geotextile and geogrid to site at least 5 days prior to scheduled commencement of installation.

**Witness Point -** Provide to the Superintendent:

* A Certificate of Compliance that the geotextile, and geogrid comply with all the requirements as specified.
* Test results reported on NATA endorsed test documents.

The Certificate of Compliance to include:

* Quality control documentation for the relevant batch/lots.
* Physical properties sheet.
* Manufacturer’s letter of certification stating compliance.

The certificate must not be more than 12 months old.

### Placement – Witness Point

Geotextile: 1000 mm laps unless noted otherwise.

Geogrid: 250 mm minimum laps and braided together so that both edges are fixed to the lapped sheets.

To the layout, lapping, and braiding plan. Refer to the **Contractors Submission** clause in this worksection.

The area for geotextile and geogrid placement must be prepared by clearing and removing all sharp objects. Cut trees and shrubs must not protrude above the surface but existing soil and vegetation mat may remain.

Geotextiles and geogrid must be placed just ahead of advancing construction work, and where they are affected by wave action they must be covered with construction materials on the same working day.

Repair punctures and tears.

Do not allow construction equipment to stand or travel directly over geotextile.

**Witness Point -** Contact the Superintendent at placement completion. Do not cover with construction materials until approval from the Superintendent.

## Compaction of 75 mm Crushed Rock (Under Slabs)

### Grading

To **Table - 75 mm Crushed Rock Core Grading**. Grading to be large enough so that it is:

* Contained within the geogrid aperture.
* Small enough to allow flat, even surfacing for load distribution under precast planks.

### 75 mm Crushed Rock Core Grading Table

|  |  |
| --- | --- |
| Table - 75 mm crushed rock core grading | |
| **Australian standard sieve size** | **Percent passing** |
| 100 mm | 100 |
| 53 mm | < 30 |
| 37.5 mm | 0 |

### Compaction – Hold Point - Witness Point

Compact the 75 mm crushed rock fill using vibrating compacting plant (drum rollers) in lifts proportional to the capacity of the roller, and within the minimum and maximum layer thicknesses defined in **Allowable Compaction Layer Thicknesses** sub-clause in this worksection. Each layer of 75 mm crushed rock must be compacted until no further visible reduction in volume or vertical displacement occurs.

**Witness Point -** Contact the Superintendent so that each layer of 75 mm crushed rock can be witnessed.

For specific projects and locations where tidal movements inhibit the use of land based compaction equipment, an alternative method of crushed rock compaction may be used subject to Superintendent’s approval. Such methodology may involve compacting crushed rock in layers of up to 200 mm thickness by pressing down on the crushed rock material with an excavator bucket.

**Hold Point –** Obtain Superintendent's approval before commencing alternative method of crushed rock compaction.

The design surface levels must be restored if distortion occurs during compaction so that precast planks and cast insitu concrete slabs are evenly supported across their full length and width.

### Allowable Compaction Layer Thicknesses

Minimum thickness: 115 mm.

Maximum thickness: 400 mm.

## 10 mm Gravel Blinding Layer

Requirement: Under cast insitu slab on top of the 75 mm compacted crushed rock core.

Thickness: 30 mm.

Do not use the blinding layer as a level corrector for the crushed rock under the slabs.

Do not use blinding layer under precast planks.

## Concrete Components

### General

Durability: 50 year design life and exposure classification C2

Reinforcement:

* Hot dipped galvanised with 65 mm cover.
* Stainless steel Grade 316 for all penetrations (link bars, dowels and lifters).

The project drawings take precedence over this clause.

All embedded steel must be protected from corrosion. Protection methods include, but are not limited to:

* Applied protective coatings,
* Hot-dip galvanising
* Use of stainless steel,
* Additives to the concrete mix,
* Cathodic protection systems,
* Other appropriate, approved methods.

### Concrete Design Mix – Boat Ramps

Strength grade: 50 MPa at 28 days.

Minimum cementitious content: 450 kg/m³.

Maximum water cement ratio: 0.4.

Nominal maximum aggregate size: 20 mm.

Target slump range: 50-150 mm.

Natural sand content of fine aggregates: Minimum 40%.

Contractor to provide a mix design for approval by the Superintendent prior to commencing.

### Concrete Design Mix – Barge Landings

For the barge landings refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ for strength grade.

Contractor to provide a mix design for approval by the Superintendent prior to commencing.

### Corrosion Inhibitor

Calcium nitrate corrosion inhibitor to be added to the concrete mix at a dosage level of 25 L/m³.

Proprietary item: DCI Corrosion Inhibitor or Superintendent approved equivalent.

The project drawings take precedence over this clause.

### Testing Frequency – Hold Point

Refer to **Table - Performance criteria and testing of concrete**.

**Hold Point -** Submit all test results to the Superintendent.

### Performance Criteria and Testing of Concrete Table

| **Table - Performance criteria and testing of concrete** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Criterion** | **Value** | **Issue** | **Test Method**  **Mix Approval Stage** | **Test Method**  **Construction** | **Frequency**  **Construction** | |
| Strength | 50 MPa | Strength, Durability | AS 1012 or Q455A&B | AS 1012 or Q455A&B | AS 1379 Clause 6.5 | |
| Slump | 80 mm | Workability, Consistency | AS 1012  A451A | AS 1012  A451A | AS 1379 Clause 5.2.1. Additional slump tests as directed by Superintendent | |
| Shrinkage | Max. 600 microstrain at 56 days | Cracking, durability & prestress loss | AS 1012.13 | AS 1012.13 | Set of 3 per 1000 m3 | |
| Bleed | Max. 2% | Durability, Appearance | AS 1012.6 | AS 1012.6. Not Required (refer frequency) | Trial mix and then to be determined by Superintendent. | |
| Air content and plastic unit weight | Max 2% | Durability, consistency | AS 1012.4 Method 1 | AS 1012.4 Method 1. Not Required (refer frequency) | Trial mix and then to be determined by Superintendent. | |
| Chloride and Sulphate content | chloride 0.4 kg/m3  sulphate 5% by weight of binder | Durability | AS 1012 Method 20 | AS 1012 Method 20 | 1 per 1000 m3 | |
| Temperature at delivery | Less than 10o or exceeds 35o | Control of thermal cracking and durability | AS 1012 | AS 1012 | 1 per 3 loads (1 per batch min) at site as directed by Superintendent. Additional temperature tests as directed by Superintendent. | |
| Alkali Aggregate Reaction | Refer AS 2758.1 Clause 10 | Reactive Aggregates | AS 1141.60.1 | Not Required, (refer frequency) | Superintendent will review available quarry assessment records (max 1 year old) for all aggregates and decide the need for additional testing. | |
| Total Alkali content | less than 2.8 kg/m3 sodium oxide equivalent | Reactive Alkali | Cement & Concrete Association NZ Report TR3 | Not Required, (refer frequency) | Per mix Design (and when significant source of cement or raw material changes) | |
| Cover | Refer Drawings | Durability | BS 1881: Part 204 | BS 1881: Part 204 | After each concrete pour. Representative areas directed by Superintendent. | |
| Cement | Compliance Test Certificates | Durability, Strength | Review of records held from cement Manufacturers | Not Required  (refer frequency) | To be determined by Superintendent after process review | |
| Admixtures | Compliance Test Certificates | Durability | Review of records held from cement Manufacturers | Not Required  (refer frequency) | To be determined by Superintendent after process review | |

## Cast Insitu Concrete Approach Slab

Standard: To AS 3600.

Finish: Medium broom finish perpendicular to direction of traffic. Exposed edges to have 20 mm x 20 mm chamfers or a 20 mm radius trowelled edge. The aggregate to be lightly or medium exposed and level with or slightly above the concrete matrix.

Refer to the **Concrete Components** clause and CONCRETE worksection.

The project drawings take precedence over this clause.

Contractor to provide a mix design for approval by the Superintendent prior to commencing.

## Cast Insitu Concrete Anchor Beam

Standard: To AS 3600.

Finish: Medium broom finish perpendicular to direction of traffic. Exposed edges to have 20 mm x 20 mm chamfers or a 20 mm radius trowelled edge. The aggregate to be lightly or medium exposed and level with or slightly above the concrete matrix.

Refer to the **Concrete Components** clause and CONCRETE worksection.

The project drawings take precedence over this clause.

Contractor to provide a mix design for approval by the Superintendent prior to commencing.

## Precast Planks

Standard: To AS 3600 and AS 3850.1.

Finish: Concrete to be cast with deep grooves moulded into the boat ramp surface. Grooves to be at an angle of 45 degrees to the ramp contours and at 200 mm centers.

Mass of the precast plank to be clearly and permanently marked on a side surface.

Refer to the **Concrete Components** clause and PRECAST CONCRETE worksection.

The project drawings take precedence over this clause.

Contractor to provide a mix design for approval by the Superintendent prior to commencing.

## Shoulders and Shoulder Batters – Cast Insitu Concrete and Fully Grouted Stone Pitched

Length: shoulders and shoulder batters that are either cast insitu concrete or fully grouted stone pitched to extend from the top of the ramp to the MSL as a minimum. Refer to the project drawings.

For structures that are not free draining above minimum MSL (for example boat ramps or barge landings with a cast insitu concrete ramp instead of precast panel ramp construction), include weep holes in the shoulders and shoulder batters if they are either concrete or grouted stone pitched construction. Exclusion of weep holes is to be approved by the Superintendent.

Weep holes: Provide 75 mm diameter uPVC pipe sections to form weep holes penetrating the full thickness of the shoulders and shoulder batters if they are either concrete or grouted stone pitched construction. Provide one weep hole every 5 square metres.

### Shoulders – Ramps in Cut

Drainage channel to have a medium broom finish perpendicular to the slope to reduce slipping down the ramp.

Drainage channel to have 30 mm clearance below the invert of the plank or ramp drainage groove to ensure free drainage of the ramp surface.

Refer to the project drawings.

### Shoulders – Ramps in Fill

Shoulder surface is to be 30 mm below the ramp surface. Drainage grooves to be free draining.

Refer to the project drawings.

### Cast Insitu Concrete Shoulder and Shoulder Batters

[Delete this clause if no cast insitu concrete shoulder and shoulder batters are required in the project.]

Standard: To AS 3600.

Finish: Medium broom finish.

Refer to the **Concrete Components** clause and CONCRETE worksection.

The project drawings take precedence over this clause.

Contractor to provide a mix design for approval by the Superintendent prior to commencing.

### Fully Grouted Stone Pitched Shoulders and Shoulder Batters

[Delete this clause if no fully grouted stone pitched shoulder and shoulder batters are required in the project.]

#### Stone – Witness Point

Provide clean, dry, durable crushed stone of uniform quality, free from noxious weeds, vegetable matter and other deleterious materials. Stone to be graded 150 mm to 200 mm with flat faces.

Particles must have at least 2 crushed faces and comply with the following standards:

* AS 1141.25.1 Degradation factor – Source rock (Washington Degradation Test). Basic igneous rocks, eg. Basalt aggregates, must have a minimum value of 50.
* AS 1141.26 Secondary minerals content in basic igneous rocks, eg. Basalt aggregates, must not exceed 25.
* AS 1141.29 Accelerated soundness index by reflux. Basic igneous rocks, eg. Basalt aggregates, must have a minimum value of 94.

**Witness Point –** Contractor to notify Superintendent if suitable stone is not available in reasonable proximity to the site(s) of the works.

#### Construction – Hold Point

Footings: 600 mm when in fill.

Batters: 400 mm thickness minimum.

Grout: 20 MPa cement mortar made from 1:3 GP cement/sand mixture.

Methodology: Construct by placing alternate layers of grout and rock so that the grout extends through the full design thickness of the shoulders. Place rocks to form irregular joints and interlocked with smaller sized rock so that there are no large voids and individual rocks cannot be dislodged.

The finish surface must:

* Have a generally flat, even and neat appearance, and will not have any sharp or angular points which will be hazardous to ramp users.
* Have a minimum of 80% of exposed rock with a close faced maximum mortar setback of 10 mm.

Do not construct shoulders by placing rock and then grouting or shotcreting only the outer surface.

**Hold Point -** Obtain Superintendent's approval before grouting.

Cure the mortar for at least 48 hours.

Remove defective mortar and re-grout any loose stones.

## Shoulders and Shoulder Batters - Stone Pitched

[Delete this clause if stone pitched shoulder and shoulder batters are not required in the project.]

### Stone – Witness Point

To conform to the **Shoulders and Shoulder Batters – Cast Insitu Concrete and Fully Grouted Stone Pitched** clause, **Fully Grouted Stone Pitched Shoulders and Shoulder Batters** sub-clause, **Stone** sub-sub-clause in this section.

**Witness Point –** Contractor to notify Superintendent if suitable stone is not available in reasonable proximity to the site(s) of the works.

### Construction

Length: From the MSL to the ramp toe. Refer to the project drawings. The project drawings take precedence over this clause.

Hand place the stones so that they are firmly bedded in layers.

## Ramp Toe

### Depth

The ramp surface to extend down to a depth of 1.0 m below LAT level, and the waterway bed to be continued at the ramp gradient to a minimum depth of 1.25 m below the LAT.

[Depths of ramp surface and waterway bed below LAT will be site specific.]

### Scour Protection – Boat Ramps

Stone: Unweathered, clean, hard, and durable, graded 150 mm to 200 mm with flat faces.

### Scour Protection – Barge landings

Flexible concrete mattress: The flexible concrete mattress to be Marecon Flexmat FM150 or Superintendent approved equivalent. Manufacture and installation in accordance with the supplier’s specification.

Refer to the project drawings.

## Rock Armour

### Properties – Witness Point

Rock to be incorporated in the works must comprise of individual unfoliated igneous and metamorphic rocks which are:

* Dense.
* Sound.
* Resistant to abrasion.
* Angular.
* Free of cracks and fissures, cleavage planes, foliation planes, seams and other defects which would result in breakdown of the stone.
* Free from minerals which will expand, or otherwise alter, in contact with sea water, causing individual rocks to breakdown.

Material which will undergo physical change causing spalling, weathering or fracturing in the environment of the site will be rejected.

**Witness Point -** Provide to the Superintendent a list of nominated projects where rock from the proposed quarry source has performed well in similar applications.

Alternatively submit a report from an experienced petrologist or geotechnical engineer to certify that rock used in the proposed manner will be durable in a marine environment.

### Source of Rock – Witness Point

**Witness Point -** Before delivery of the rock submit to the Superintendent for approval documentation on the source of the rock. Include the following:

* The location of the quarry.
* A method statement outlining how the proposed quarry operations will produce the specified grading of rock and quarry materials for the works.
* Demonstrable evidence that the proposed blasting pattern will minimise the production of latent fractures.
* Evidence of a system for inspection and testing to identify rock which does not comply with the requirements of this specification. Nominate testing frequency.
* Details of how non-compliant rock will be quarantined from stockpiles of rock proposed for incorporation in the works.

The rock must be available in enough quantity to meet the necessary rate of production and delivery to be achieved.

Do not alter the location of a source of rock without approval from the Superintendent.

### Size of Rock

Refer to the project drawings.

[If the rock sizes are not shown on the drawings enter properties here. Consider:

* Primary rock.
* Secondary rock.
* Toe rock.
* Core rock.]

Rock to be:

* Rough angular shaped.
* Well graded in size.
* The maximum dimension must not exceed 1.5 times the minimum dimension when measured at right angles to the minimum dimension.

### Rock Testing Requirements – Hold Point

Have an experienced petrologist or geotechnical engineer test representative samples to determine:

* The mineral composition of the rock.
* Any other necessary tests recommended by the petrologist or geotechnical engineer to determine the suitability of the rock for use on site.

Refer to **Table - Rock testing requirements.**

**Hold point -** Submit all test results to the Superintendent.

### Rock Testing Table

|  |  |
| --- | --- |
| Table - Rock testing requirements | |
| Characteristic | Requirements |
| Visual inspection | Degree of weathering, shape, grading, rock quality, and Integrity in accordance with this specification. |
| Length-to-thickness ratio | Rock armour must not contain more than 50% by weight of tone with a length to thickness (L/d) ratio greater than 2. Not more than 5% of the rocks must have a length to thickness (L/d) ratio greater than 3. |
| Saturated surface-dry relative density | Sampled, tested, and reported in accordance with AS 4133.2.1.2 – Rock Density tests.  Average >2,680 kg/m3  90% of the stones > 2,650 kg/m3 |
| Water absorption | Sampled, tested and reported in accordance with AS 4133.2.1.2 – Rock Porosity tests  2% Maximum |
| Los Angeles  abrasion test | AS 1141, Section 23  Loss must not exceed 20%. |
| Crushing  resistance | The Point Load Index (IS50) (determined to AS 4133.4.1) must be a minimum of 3.5 MPa for Armour, and a minimum of 2.5 MPa for all other quarry material  The ultimate compressive strength (UCS) (determined in accordance with AS 4133.4.2.1) must be a minimum of 100 MPa for Armour/Filter and 50 MPa for all other quarry material |
| Sodium sulphate soundness test | AS 1141, Section 24 for 5 cycles  Loss must not exceed 2.5% |

### Sample Production Loads – Witness Point

Supply rock samples of masses as specified on the project drawings before the works start. Weigh each sample of stone and mark with their mass.

Sample production loads to be set aside both at the site and at the quarry in areas approved by the Superintendent, for the duration of the works. The sample production to be used as a visual reference throughout the works.

Produce the sample production loads using the quarrying techniques proposed for full production. Test each sample load to demonstrate compliance. Refer to the **Rock testing requirements** clause in this worksection.

**Witness Point -** Submit all sample load test results to the Superintendent for conformance.

### Delivery

Load, transport, and unload rock in a manner which will not cause fracture or any other reduction in quality of the rock.

Contractor to indicate whether rock will be delivered and placed next to, or near the works, or be incorporated straight into the works.

Separate stockpiles to be made for different grades of rock. Form stockpiles so that they do not constitute a hazard.

Remove and dispose off-site any rock material:

* Not meeting the requirements of this Specification.
* Deemed not suitable for incorporation in the works by the Superintendent.

Removal to be at the Contractor’s expense.

### Placement – Hold Point

Place rock to the lines, levels and batters shown on the project drawings. The batter shown on the project drawings must be adhered to over the full height of the rock structure.

Placement of rock to start at the toe of the batter. All toe rock must be well embedded to form a secure foundation for the rock on the batters. Place rock layers to final thickness proceeding inwards and up the face.

Rock placed directly on geotextiles must be placed with a drop height of less than 1 m.

Place rock by crane, excavator, or other plant approved by the Superintendent. Place rock firmly onto previously placed layers.

Place all rock to minimise the breakdown of individual rocks. Placement must not cause disturbance or dislodgement of existing rock and underlying layers.

Bed all rock on the underlying materials and the lower rocks. Place rocks on the finished face stable whereby they:

* Do not create a hazard.
* Cannot be displaced by manual means which may pose a safety hazard to the public.

Reclaim any rock which rolls beyond the cross section profile and reinstate.

**Hold Point -** Before placing rock submit to the Superintendent a detailed Method Statements for approval. Method Statements to include:

* Work methods.
* Work sequences.
* Proposed plant.
* Safety measures.
* Contingency plans for inclement weather.
* Evidence that the excavator operator has experience in the construction of rock armour works.

## Ramp Signage

Standards: To AS 1742, AS 1743, and AS 1744, and in accordance with regulatory requirements.

Sign types: Refer to the project drawings. Sign types may include, but not be limited to:

* Marine Safety.
* Fisheries.
* Border Force.
* Health.
* Parks and Wildlife.
* QR code totems.
* Fixed variable message signs.

Location: Near the head of the ramp in a position that could reasonably be expected to be visible to ramp users. Confirm sign location with the Superintendent before installation.

## Retro-Reflective Raised Pavement Markers (RRPM)

Install RRPM where shown on the project drawings.

Support pavement markers on the precast planks without overhanging the grooves. Do not place markers over joints in concrete pavement. Align the reflective faces longitudinally so they face the water and the ramp approach.

Contact surfaces are to be ground back 1.2 mm, cleaned to remove all loose material and other contaminants, and dried before adhesion.

Spread a two part epoxy adhesive over the entire base of the marker with enough thickness to fill voids, and flow out the sides to provide full adhesion. Remove excess adhesive without contaminating or obscuring the reflective faces.

Ensure that the surface finish is smooth.

Discard markers which are not positioned correctly within the time recommended by the manufacturer for use of the adhesive.

[Delete this clause if not required in the works.]

## Navigational Aids

Navigational aids to IALA standards.

[Contact NT MSB for all details on navigational aids. Markings, colour, flash settings etc.]

### Navigational Buoys – Hold Point

Proprietary item: Sealite or Superintendent approved equivalent. Refer to IALA guidelines, and the CONDITIONS OF CONTRACT, **Proprietary items** clause.

Diameter: *[complete/edit]*

[Select from:

* 600 mm.
* 700 mm.
* 800 mm.
* 1200 mm.
* 1250 mm.
* 1400 mm.
* 1500 mm.]

Top marks: *[complete/edit]*

[For example:

* Port
* Starboard
* Safe water etc.]

Solar lantern: *[complete/edit]*

[Select from:

* SL-15.
* SL-60.
* SL-70.
* SL-75.
* SL-C310.
* SL-C410.
* SL-C415.
* SL-C510.

Refer to manufacturer’s datasheets.]

Mould-in graphics: *[complete/edit]*

[“Property of the NT Government” etc.]

Surface colours: To IALA E-108, and NT MSB requirements.

Material: Rotationally moulded UV-stabilised virgin polyethylene. 316 grade stainless steel internal bracing. Closed-cell polyurethane foam float section.

Mooring bush: 316 grade stainless steel with replaceable inserts.

Lifting bush: 316 grade stainless steel with replaceable inserts.

Assembly: To manufacturer’s recommendations.

Mooring: To manufacturer’s recommendations, IALA guidelines, and NT MSB requirements. Mooring for the bouy must be designed and selected to meet the prevailing environmental conditions for the location. Environmental conditions may include, but not be limited to:

* Wind.
* Swell.
* Waves.
* Tides - chain length to accommodate full tidal range.
* Currents.

The mooring bouy system design is to be approved by the Superintendent.

Positioning: To **Table - Buoy Positioning.**

Warranty: 5 years.

**Hold Point -** Submit to the Superintendent nominated buoy technical data for approval.

### Buoy Positioning Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table - Buoy positioning | | | | | |
| **Buoy number** | **Latitude** | **Longitude** | **Type** | **Colour** | **Design water depth** |
| 1 | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* |
| 2 | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* |
| 3 | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* |
| 4 | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* | *[complete/edit]* |

**[Latitude and Longitude:** Consult with NT MSB.

**Type:** SL-B1500, Aquafloat 800 etc.

**Colour:** Red, Green, White, Yellow, Blue.]

### Solar Marine Lantern – Hold Point

[Delete this clause if no solar marine lanterns are required in the project.]

Proprietary item: Sealite or Superintendent approved equal. Refer to IALA guidelines, and the CONDITIONS OF CONTRACT, **Proprietary items** clause.

Lantern to consist of the following:

* Bird deterrent spike.
* LED optic reflector.
* Internal solar module.
* Galvanized/stainless steel cage protecting solar panel
* Automatic night activation.
* Lens and base moulded from UV-stabilised polycarbonate.
* Integrated circuit protection.
* Internal user-replaceable battery in sealed compartment.
* Internal user-adjustable flash settings.

Solar module type: Monocrystalline.

Horizontal output: 360°.

Vertical divergence: 7°.

Temperature range: -40-80°C.

Visibility: *[complete/edit]*

[Select from:

* 1-2 NM.
* 2-3 NM.
* 3-5 NM.
* 5-9 NM.

Refer to manufacturer’s datasheets.

Visibility (nautical miles) to NT MSB requirements.]

Signal colour to IALA E-200-1: *[complete/edit]*

[Select from:

* Red.
* Green.
* White.
* Yellow.
* Blue.

Colour to NT MSB requirements.]

Flash settings: *[complete/edit]*

[Flash settings to NT MSB requirements.]

Ingress protection: IP68.

Installation to buoy: To manufacturer’s recommendations, IALA guidelines, and NT MSB requirements. Bolt to an even flat surface using the 4 flange mounting holes. Check lantern operation before installation. Cover the lantern and allow 60 seconds for the light to activate.

[Contractor may be required to install poles for lanterns or lights to be mounted to. Poles are to be located as per project specific drawings and designed to suit location of installation to Superintendent’s approval.]

Warranty: 3 years.

**Hold Point -** Submit to the Superintendent the nominated solar marine lantern technical data for approval.

### Solar Marine Lantern Power Supply – Hold Point

[Delete this clause if no solar marine lanterns are required in the project.]

Proprietary item: Sealite or Superintendent approved equal. Refer to IALA guidelines, and the CONDITIONS OF CONTRACT, **Proprietary items** clause.

Battery: User-replaceable Nickel Metal Hydride (NiMH) in a sealed battery compartment.

Nominal voltage: 3.6 V

[Refer to manufacturer datasheets if a larger voltage is required.]

Battery capacity: *[complete/edit]*

[Select from:

* 2.4 Ah.
* 4.0 Ah.
* 8.0 Ah.
* 16.0 Ah.

Refer to manufacturer datasheets.

Battery capacity to NT MSB requirements.]

Warranty: 1 year.

**Hold Point -** Submit to the Superintendent nominated solar marine lantern power supply technical data for approval.

### Sector Lantern – Hold Point

[Delete this clause if no sector lanterns are required in the project.]

Proprietary item: Sealite or Superintendent approved equal. Refer to IALA guidelines, and the CONDITIONS OF CONTRACT, **Proprietary items** clause.

Lantern to consist of the following:

* Bird deterrent spike.
* Heavy-duty aluminium base.
* UV-stabilised polycarbonate lens.
* Integrated circuit protection.
* User-replaceable components.
* GPS synchronization.
* Bluetooth connectivity.

Horizontal output: 360°.

Vertical divergence: 3°.

Temperature range: -30-50°C.

Visibility: 7-11NM.

Colour: Red, white, and, green, to IALA E-200-1.

Intensity: *[complete/edit]*

[Select from:

* 25%.
* 50%.
* 75%.
* 100%.

Intensity to NT MSB requirements.]

Flash settings: *[complete/edit]*

[Contact NT MSB for desired settings.]

GSM communications: *[complete/edit]*

[NT MSB to advise if a global system for mobile communications is required for specific site.]

Ingress protection: IP67.

Installation: To manufacturer’s recommendations, IALA guidelines, and NT MSB requirements. Bolt to an even flat surface using the 4 flange mounting holes.

Warranty: 3 years.

**Hold Point -** Submit to the Superintendent nominated sector lantern technical data for approval.

### Sectored Port Entry Light

[Delete this clause if no sector port entry lights are required in the project.]

Proprietary item: Sealite or Superintendent approved equal. Refer to IALA guidelines, and the CONDITIONS OF CONTRACT, **Proprietary items** clause.

Sectored port entry light to consist of the following:

* Powder coated marine grade aluminium alloy.
* Anti-reflection coated achromatic lens.
* Remote monitoring.
* Vertical adjustment.

Vertical divergence: 0.85° at 50% peak intensity.

Temperature range: -40-80°C.

Visibility: 23.5 NM.

Colour: Red, white, and, green, to IALA E-200-1.

Intensity: *[complete/edit]*

[Select from:

* 25%.
* 50%.
* 75%.
* 100%.

Intensity to NT MSB requirements.]

Flash settings: *[complete/edit]*

[Contact NT MSB for desired settings.]

GSM communications: *[complete/edit]*

[NT MSB to advise if a global system for mobile communications is required for specific site.]

Ingress protection: IP67.

Installation: To manufacturer’s recommendations, IALA guidelines, and NT MSB requirements. Bolt to an even flat surface using the 4 flange mounting holes.

Warranty: 3 years.

### Leading Light

[Delete this clause if no leading lights are required in the project.]

Proprietary item: Sealite or Superintendent approved equal. Refer to IALA guidelines, and the CONDITIONS OF CONTRACT, **Proprietary items** clause.

Leading light to consist of the following:

* Extruded aluminium and injection moulded UV-stabilised polycarbonate chassis.
* Automatic night activation.
* UV-stabilised polycarbonate lens.
* Adjustable mounting attachment points.
* Marine grade gaskets.

Vertical divergence: 15°.

Temperature range: -40-80°C.

Length: *[complete/edit]*

[Select from:

* 600 mm.
* 1200 mm.]

Length to NT MSB requirements.]

Visibility: *[complete/edit]*

[Select from:

* Single row 8 NM.
* Double row 9 NM.
* Triple row 10 NM.

Visibility (nautical miles) to NT MSB requirements.]

Colour to IALA E-200-1: *[complete/edit]*

[Select from:

* Red.
* Green.
* White.
* Yellow.
* Blue.

Colour to NT MSB requirements.]

Intensity: *[complete/edit]*

[Select from:

* 25%.
* 50%.
* 75%.
* 100%.

Intensity to NT MSB requirements.]

Flash settings: *[complete/edit]*

GSM communications: *[complete/edit]*

[NT MSB to advise if a global system for mobile communications is required for specific site.]

Ingress protection: IP68.

Installation: To manufacturer’s recommendations, IALA guidelines, and NT MSB requirements. Bolt to manufactured navigational leads using the 4 adjustable mounting attachment points.

Warranty: 3 years.

## Completion

### Operation and Maintenance Manuals – Hold Point

**Hold Point -** Submit to the Superintendent on completion operation and maintenance manuals and maintenance schedules for the following:

* Ramp.
* Rock armour protection.
* Marine infrastructure.
* Navigational aids.

[Add and delete from this list as required for specific project.]

### As-Constructed Drawings – Hold Point

Provide as-constructed drawings as an electronic copy in the same format as the original drawings and PDF format.

**Hold Point -** Provision of as-constructed drawings is a condition precedent to Practical Completion.

### Documentation Detailing Navigational Aid Installation

For each installed navigational aid provide documentation that may include, but not be limited to:

* Location referenced using GPS coordinates.
* Photo record.
* Description.
* Date of manufacture.
* Date of installation.

### Warranties – Hold Point

**Hold Point -** Submit to the Superintendent the manufacturer’s published product warranties in the name of the Principal for all navigational aids.