

Inward - 5 mm

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3. 11. 4 MEASUREMENT & PAYMENT

1. Measurement

The quantity of stair landings shall be measured in cubic meter of insitu concrete, in kg of reinforcing bars, in cubic meter of precast concrete blocks inclusive of reinforcing bars and in number of sets of mooring rings.

Payment for the rock filler to be used in the preparation of rock bedding for precast concrete block shall be included under Pay-item for the Supply and Place of Armour Rock.

2. Payment

Stair landings measured as provided above shall be paid at contract prices which prices and payment shall constitute full compensation for the furnishing of all labor, equipment and tools and materials and constructing complete as per drawings and specifications and accepted.

3. 12 REPAIR AND REHABILITATION OF EXISTING PORT FACILITIES

3. 12. 1 DESCRIPTION

1. The work consists of furnishing all labor, materials, equipment and incidentals necessary to undertake rehabilitation of existing port facilities, in accordance with the Specification, the Drawings and to the approval of the Engineer.
2. The Contractor shall be deemed to have satisfied himself of the site conditions and to have included in his unit prices all risks that may arise during or in connection with the work.
3. This Section shall be read together with the Section on concrete works, piling, fender systems of these Specifications.
4. The location and position for repair and rehabilitation works shall be in accordance with the Drawings and as directed by the Engineer.
5. The Contractor shall submit his proposal of work methods for the approval of the Engineer prior to the commencement of the works.

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3. 12. 2 MATERIAL REQUIREMENTS

1. All the materials to be used for the works described in this Section shall have the same strength as, or more than, that of the original materials which are to be repaired, unless otherwise specifically stated. The materials shall be approved by the Engineer before use.
2. Fill repair materials shall be non-shrinkage type of either concrete, cement mortar or epoxy mortar. The selection of materials as well as the mix design shall be approved by the Engineer.
3. Adhesive bond shall be of epoxy type especially manufactured for the purpose of the concrete repair. Its application shall be in accordance with the manufacturer's specifications.
4. Mortar for concrete lining and repair of existing damaged grouted riprap, shall consist of cement, sand and water conforming to the requirements given under Section 3.2, "Concrete Works," mixed in the proportion of one part cement to two parts sand by volume, and sufficient water to obtain the required consistency.
5. Fiber Reinforced Plastic (FRP) are used for applications requiring high

strength to weight ratio and resistance to deterioration, such as Pile jackets for steel, concrete and timber piling to reduce corrosion or erosion, for reinforcement and to prevent marine borer attack. FRP systems are composed of several distinct chemical and components, including various primers, chemicals and components, including various primers, putties and adhesives, as well as the fibres fabrics and epoxy saturants that eventually become the FRP materials.

TYPICAL DRY FIBER PROPERTIES

Tensile Strength 550,000 psi (3.79 GPa)
Tensile Modulus 33.5×10^6 psi (231 GPa)
Ultimate Elongation 1.5%
Density 0.065 lbs./in.³ (1.81 g/cm³)
Volumetric Fiber Content 68%

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COMPOSITE GROSS LAMINATE PROPERTIES

PROPERTY ASTM

METHOD

TYPICAL

TEST VALUE

DESIGN

VALUE*

Ultimate tensile strength in primary fiber direction, psi
D-3039 326,000 psi (2.25 GPa)
293,400 psi (2.02 GPa)
Elongation at break D-3039 1.3% 1.3%
Tensile Modulus, psi D-3039 22.5×10^6 psi (155 GPa)
20.2 x 10⁶ psi (139 GPa)
Ultimate tensile strength fiber, psi
D-3039 0 0

Layer Thickness Varies Varies

TYPICAL FIBER PROPERTIES

Tensile Strength 470,00 psi (3.24 GPa)
Tensile Modulus 10.5×10^6 psi (72.4 GPa)
Ultimate Elongation 4.5%
Density 0.092 lbs/in.³ (2.55g/cm³)
Weight per sq. yd. 14.9 oz. (505 g/m²)
Fiber Thickness 0.0075 in. (0.19 mm)

COMPOSITE GROSS LAMINATE PROPERTIES

PROPERTY ASTM

METHOD

TYPICAL TEST

VALUE

DESIGN**VALUE***

Ultimate tensile
strength in primary
fiber direction, psi

D-3039 83,400 psi

(575 MPa)

(2.17

kip/in.width)

66,720 psi

(460 MPa)

(1.7 kip/in.

width)

Elongation at break D-3039 2.2% 2.2%

Tensile Modulus,psi D-3039 3.79×10^6 psi

(26.1 GPa)

3.03×10^6 psi

(20.9 GPa)

Ultimate tensile

strength 90 degrees

to primary fiber, psi

D-3039 3750 psi (25.8

MPa)

3,00 psi

(20.7 MPa)

Laminate Thickness 0.026 in. (0.66

mm)

0.026 in. (0.66

mm)

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EPOXY MATERIAL PROPERTIES

Curing Schedule 72 hours post cure at 140°F (60°C)

PROPERTY ASTM**METHOD****TYPICAL TEST****VALUE***

Tg 140 °F (60 °C) 180°F (82 °C)

Tensile Strength₁, psi ASTM D-638

Type 1

10,500 psi

(72.4 MPa)

Tensile Modulus ,psi 461, 000 psi

(3.18 GPa)

Elongation Percent ASTM D-638

Type 1

5.0%

Flexural Strength, psi ASTM D-790 17,900 psi

(123.4 MPa)

Flexural Modulus, psi ASTM D-790 17,900 psi

Flexural Modulus, psi ASTM D-790 452,000 psi
(3.12 GPa)

6. Underwater Petrolatum Tape System with High Density Polyethylene (HDPE) jacket

(a) Petrolatum Marine Piling Tape

Petrolatum Marine Piling Tape is a synthetic filament fabric coated with a neutral compound based on saturated petroleum hydrocarbons and inert mineral fillers with additional inhibitors and water displacing agents.

It is primarily used for the protection of jetty piles particularly in the splash and inter-tidal zones.

It is an anti-corrosion tape that can be applied to metal under water that adheres and remains attached to all cleaned, sound, wet or dry metal surfaces.

(b) Petrolatum Paste

Petrolatum Paste is a soft paste containing water displacing, corrosion inhibiting and flow control additives with broad-spectrum biocides. It does not dry, harden or crack.

Applicable to badly corroded and fitted steel above and below water surface prior to the application of the marine piling tape. It fills pits and depressions on the steel pile surface and does not contain volatile organic components.

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Specially designed for underwater applications.

Properties:

Flash point = 180°C (minimum)

Specific Gravity = + 1.08

Temperature Range:

For Application = 0°C to 40°C

For Service = - 30°C to 55°C

3. 12. 3 EXECUTION

1. Preparatory Work

The Contractor shall verify the dimensions and locations of damaged portions of existing structures and confirm the type of repair works prior to the commencement of works.

Within twenty eight (28) days from the commencement of the work, the Contractor shall submit to the Engineer for approval his detailed methodology and sequence of construction including the mix proportion and materials he proposes to use for the works.

The Contractor shall carry out all the necessary preparatory works needed such as setting out, marking, temporary staging etc., prior to the commencement of such works.

The Contractor shall also clean all the surfaces to be repaired by means of brushing, sand blasting or any other appropriate means for rust, dust, weathered materials or any other deteriorated part of structures.

2. Records of Repair Works

The Contractor shall take photographs including underwater photographs for all the places to be repaired prior to the commencement of such works.

These photographs shall be in the monthly reports with identification numbers for each location, namely bay number for slab, etc.

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Photographs after repairing works shall be also taken at the same locations and from the same directions. The Contractor shall submit two (2) copies of color photos to the Engineer upon the completion of such works.

3. Rehabilitation of Concrete Slabs (For Causeways & Piers)

a. Repair and rehabilitation works of concrete slabs shall be carried out according to the specified type of repair works as shown on the Drawings.

b. The location and position of each type of repair and rehabilitation works of damaged slabs at existing piers and causeways, shall be in accordance with the drawings and as directed by the Engineer.

c. Type of repair works:

Type Application Repair Method

SA/SB

SC/SD

SE/SF

SG

Medium to wide crack at location directed by the Engineer.

Spalled concrete without exposed rebars at location directed by the Engineer

Spalled concrete with exposed rebars not more than 50% of the panel at location directed by the Engineer

Spalled concrete with exposed rebars more than 50% of the panel and depth of spalled concrete more than 150 mm

Patching of mortar to level.

Patching of mortar to level.

Replacing of corroded rebars and injection of mortar.

Replacing concrete and rebars for entire slab panel.

d. Particulars:

1) The surface of the damaged part of the concrete shall be removed by chipping as indicated on the drawings, without damaging other parts, until fresh concrete appears.

2) The exposed concrete shall be brushed clean and free from concrete debris. Heavily corroded rebars shall be replaced with the same size and quality as the original rebars.

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3) Before casting new concrete, the old concrete shall be saturated by water sprays for at least 24 hours.

4) After applying epoxy bond onto the surface of the fresh concrete and rebars, temporary formwork shall be provided and fixed in position, if necessary, by either hole-in anchors or temporary supports.

5) The temporary form prefabricated on land with injection and exhaust pipes shall be rigid enough to support the cast concrete or mortar.

6) The non-shrink concrete or mortar shall be cast in by pumping through injection pipes.

4. Rehabilitation of Concrete Beam

a. Repair and rehabilitation works of concrete beams shall be performed following to the specified type of repair works as shown on the Drawings.

b. The location and position for each type of repair and rehabilitation works on damage beam at existing piers and wharf shall be in accordance with the Drawings and as directed by the Engineer.

c. Type of repair works.

Type Application Repair Method

BA/BB

Medium to wide
crack at location

directed by the
Engineer.

Patching of mortar to
level.

BC

Spalled concrete
without exposed
rebars at location

directed by the
Engineer.

Patching of mortar to
level

BD

Spalled concrete
with exposed rebars
but at the side of
beam at location

directed by the
Engineer

Replacement of
corroded rebars and
mortar injection.

BE

Spalled concrete
with exposed rebars
at the bottom of
beam

Replacement of
corroded rebars and
mortar injection.

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d. Particulars

Particular for this works are described in Sub-section 3.12.3.3,
Urgent Rehabilitation of Concrete Slab, paragraph “d” 1 to 6.

5. Rehabilitation of Pile Cappings

a. Repair and rehabilitation works of pile cappings shall be applied to
the following specified type of repair works as shown on the
Drawings.

b. The location and position for each type of repair and rehabilitation
works of damaged concrete pile cappings at existing piers and
wharf shall be in accordance with the Drawings and as directed by
the Engineer.

c. Type of repair works.

Type Application Repair Method

PA/PB

Fine to wide crack at
location directed by
the Engineer.

Patching of mortar
to level.

PC

Spalled concrete
without exposed
rebars at location
directed by the
Engineer

Patching of mortar
to level.

PD/PE

Spalled concrete
with exposed
rebars.

Pile jacket by
injection of mortar.

d. Particulars:

Refer to Sub-section 3.12.3.3, Rehabilitation of Concrete Slab,
paragraph “d”

6. Rehabilitation of Damaged Piles

Rehabilitation works shall be applied following to the specified grade of
repair works for each pile as described in Sub-section 3.12.3.5.

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7. Installation or Demolition of Bollards

a. The specified existing bollards installed at the existing piers and
wharf shall be removed from their existing positions in accordance
with the Drawings or as directed by the Engineer.

b. The removed bollards shall be stored in the Contractor’s storage
for re-use or dumped in the disposal area, as directed by the
Engineer.

c. The Contractor shall repair the concrete base after the removal of bollards.

d. Strengthening of existing concrete slab and/or beam for installation of bollards, shall be undertaken if instructed by the Engineer.

8. Installation of Rubber Fenders

a. Concrete base for installation of rubber fenders shall be provided to the existing marginal wharf in accordance with the Drawings.

b. The face line of the rubber fenders after installation shall be straight for safe ship operation.

c. Rubber fender shall be set as shown on the Drawings with anchor bolts as specified in Section 3.13 "Mooring and Fender System".

9. Replacement of Timber Fender Piles

a. Existing fender piles shall be removed or cut at the design seabed elevation and then stored in the yard for re-used or dumped in the disposal area if instructed by the Engineer.

b. Setting-out shall be made by the Contractor to maintain straight faceline as indicated on the Drawings.

10. Strengthening of Concrete Structures using FRP

a. Only trained and certified Specialty Contractors should be used for strengthening of concrete structures using FRP.

b. Concrete Preparation

(1) Concrete substrate must be in a clean and sound condition.

(a) Remove unsound concrete

(b) Repair corroding reinforcing steel

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(c) Patch large voids

(d) Inject large cracks

c. Surface Preparation

(1) The surface must be prepared to receive the FRP system.

(a) Level the concrete surfaces with epoxy putty

(b) Round sharp edges where required

d. Adhesive mixing

Well mixed resin is critically important, and manufacturer recommendations should be followed.

e. FRP Installation

FRPs are bonded to the surface of the concrete

(1) Pre-cured laminate and Strip System

Rigid FRP plates or strips are bonded to the surface of the concrete with an epoxy adhesive.

(2) Fabric System

Flexible fibre fabrics are bonded to the concrete using epoxy adhesives/saturants

For Dry lay-up Systems, Fabric is saturated during lay-up operation.

(3) Protective Coatings

Aesthetics, fireproofing, UV Radiation, or otherwise protective coatings are often applied to install FRP systems.

(4) Curing Conditions

The following must be carefully monitored and controlled during curing of the epoxy saturants/ adhesives.

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11. Repair of Damaged Tape or Coating on Steel Piles

- a. Remove damaged tape or non-adhering coating. Remove corrosion materials. Apply thin coat of petrolatum paste. Begin the application of tape a minimum of 50 mm back from the damaged area utilizing the recommended overlap. Complete wrapping of repair area so that the tape overlaps at least 50 mm onto the original coating.
- b. When repairing petrolatum tape, the damaged area frequently can be repaired by applying a patch or full circumferential wrap. The new petrolatum tape can readily be pressed onto the old tape. Patches should only be installed on the top half of a pipe surface.

3.12.4 MEASUREMENT AND PAYMENT

1. Measurement

All items for the repair and for the rehabilitation of the existing structure shall be measured based on actual quantities and on the item included in the bill of quantities. The Contractor shall measure the work at the presence of the Engineer and submit the unit for approval.

2. Payment

All payments shall be done in quantity as mentioned above. All unit prices shall include (if under the Bill of Quantities there is no specific price applicable) excavation, clearing, chipping, materials with accessories, reinforcing bars, forms, scaffolding, backfilling and other related works to be carried out in the works specified.

3.13 MOORING AND FENDER SYSTEMS

3.13.1 GENERAL

3.13.1.1 SCOPE OF WORK

1. The work includes furnishing of all labor, materials and equipment to complete the installation of mooring bollards, bitts, cleats and fenders in new piers.
2. The work shall include the supply, transport, handling, storage and installation of fender systems in the newly constructed piers.
3. The work shall include the furnishing, driving, cutting off and binding of timber piles in clusters (dolphins) in the new trestles as shown on the drawings and in accordance with this specification.

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4. The Contractor shall furnish and install the necessary fittings for a complete job as shown on the drawings and/or as specified. Supplementary parts necessary to complete and install each item of works shall be included whether or not shown or specified. The Contractor shall furnish to relevant trades all anchors, fastenings, inserts, fittings, fixtures or the like to be installed on or required for securing the works.

The Contractor shall submit shop drawings of all fitting works prior to placing orders and commencement of any fabrication.

3.13.1.2 MOORING SYSTEM

1. Designated load capacity of mooring bollards, bitt and cleats shall be as shown on the drawings, and shall refer to the safe working load. The bollards shall be capable of withstanding a proof test load of 1.5 times the safe working load.
2. The following publications listed below shall form a part of these

Specifications to the extent indicated by the reference thereto.

Publication

G 5101 SC 46, Carbon Steel

G 3101 SS 41, Rolled Steel for General Structures

JIS B0205 Standard M Screw

JIS B1181 Hexagon Nut

3. Bollards at the new berth shall be installed at the edge of concrete decks of piers.

3.13.1.3 RUBBER FENDER SYSTEMS

1. Material for fender systems such as rubber fenders, anchor bolts and templates shall be supplied by the Contractor.

2. The Contractor shall install the fender system properly according to the drawings and the instructions prepared by the Engineer.

3. Performance Requirements

The fenders shall be procured in accordance with the performance characteristics, under 45%-50% fender deflection, specified hereunder:

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Type of Fender

Min. Energy

Absorption

(Ton-M)

Max. Reaction Force

(Ton)

(1)

(2)

(3)

1.0

1.8

2.8

15

20

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4. Types of Fenders

Type (1) = 200 mm in height and 1000 mm in length

Type (2) = 250 mm in height and 1500 mm in length

Type (3) = 300 mm in height and 1500 mm in length

5. Manufacturing Rubber Main Body

Rubber fenders shall be manufactured at the factories of approved makers.

Basic manufacturing methods shall be as follows:

- Shape of rubber main body: refer to the Drawings
- Fabrication of rubber main body shall be completed at the factory
- No connection of main body shall be permitted out of the factory
- Steel plate shall be embedded in the deck sides of rubber main body.
- The Contractor shall submit manufacturer's methods of manufacturing for approval by the Engineer.

3.13.1.4 TIMBER PILE DOLPHINS

1. Materials for timber pile dolphins such as creosoted apitong timber piles, connection wire rope, staples and protector shall be supplied by

the Contractor subject to approval of the Engineer.

2. The Contractor shall install the dolphins properly according to the drawings and instructions prepared by the Engineer.

3. Related specification will be provided in Section 3.3, "Piling Works."

3.13.1.5 SUBMITTALS

1. Shop drawings and/or catalogues of mooring bollards, bitts, cleats and rubber fenders indicating size, weight and mounting requirements shall be submitted for approval of the Engineer.

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2. No materials or fitting shall be ordered without prior approval of the Engineer.

3.13.2 MATERIAL REQUIREMENTS

3.13.2.1 MOORING SYSTEM

1. Mooring bollards, bitts and cleats shall be of the dimensions, weights, capacities and design in accordance with shop drawings approved by the Engineer and shall be fabricated by approved manufacturers with cast steel conforming to the following requirements or approved equivalent.

Part Spec.

(JIS or its equivalent) Grade

Body

Anchor

Bolts

Nut

Washer

Foundation Plate

JIS G5101 3

JIS G3101 2

JIS B0205

JIS B1181 1

Class 3

JIS B1256

JIS G3101 2

or JIS G5101

Grade SC46

Grade SS41

M64-6

Grade 1

4T, N64-6

Steel Bars

Grade SS41

Grade 3 SC46

The size of the bolts, nuts and washers shall be in accordance with the specifications of the manufacturer. However, the length of the bolts shall be as indicated on the drawings. The anchor plate shall be connected to the holding down bolt with 12.5 mm weld, as shown on the drawings. All bolts, nuts, washers, etc. that are exposed shall be galvanized to the satisfaction of the Engineer. Provide lead cover for exposed threads of galvanized anchor bolts.

Samples of the bolts, nuts, washers and anchor plates shall be

submitted to the Engineer for approval before being used in the Works.

a) The upper parts of bollards, bitts, and cleats not embedded in concrete shall be painted. The surface of bollards and bitts shall be cleaned thoroughly by wire brush or other means prior to painting to remove rust or any other contamination which may interfere with bond of paint to metal.

The exposed surface shall be coated with rust proof paint and finishing paint, which shall be coal-tar epoxy of 120 micron thickness in accordance with JIS K5623 or the approved standard.

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b) Alternative

The Contractor can submit to the Engineer's approval cleats, bitts or bollards different from these specifications but with the capacities indicated in the drawings.

c) Concrete foundations/base of bollards and bitts shall conform to the requirements of Section 3.2, "Concrete Works."

d) Visual Inspection

All bollards, bitts and cleats delivered to site shall be inspected by the Engineer for any signs of flaws or defects inimical to usage.

e) Mill Test Certificates

Two (2) copies of mill test reports shall be submitted certifying that materials meet the specified standards.

f) Tests and Inspection

Inspection of all materials and methods of fabrication shall be carried out by the Contractor. However, the Engineer reserves the right to inspect all facilities at any time during the manufacture to ensure that the materials and workmanship are in accordance with the specifications and the best workmanship.

3.13.2.2 RUBBER FENDER SYSTEM

1. Concrete with reinforcing bars on which the fenders are fixed shall conform to the requirements of Section 3.2, "Concrete Works."

2. Physical Properties

Material for rubber fenders will be one of the international accepted materials.

Test methods shall conform to JIS K6301 or equivalent.

The rubber material used for rubber fenders shall be a compound of natural rubber and synthetic rubber of high quality having sufficient resilience, anti-aging, weather and wear resistant property according to the following table.

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Property Requirement Test Method

(JIS K6301)

Tension test

(before aging)

Hardness (HS)

Tensile Strength

(kg/cm²)

77 max.

160 min.

Spring type

Hardness type

Test piece
 Dumbell No. 3
 Tension test
 (after aging)
 Tear resistance
 (kg/cm²)
 Compression Set
 (%)
 Oil Resistance
 (volume change)
 Elongation (%)
 Hardness
 Tensile Strength
 (kg/cm²)
 Elongation
 Inner rubber
 Outer rubber
 Industrial
 gasoline (%)
 350 min.
 +8 max. from
 original value
 not less than
 80% of original
 value
 not less than
 80% of original
 value
 70 min.
 60 min.
 30 max.
 60 max.
 20 max.
 Air heating 70 °C
 x 96 hrs.
 Test piece
 25 °C x 24 hrs.

3. Anchor

Anchor Bolts and connecting hardware shall be fabricated from type SUS 304 stainless steel to the required shapes and sizes as shown on the approved shop drawings, and conforming to JIS G 4303 or equivalent.

4. Testing

The Contractor shall be required to submit test certificates showing compliance to the above requirements. The test certificates should be certified by an independent inspection organization recommended by the Contractor and approved by the Engineer.

One fender of each type (1, 2 & 3) selected at random shall be tested for performance. The fender shall be compressed repeatedly three times to the minimum deflection at speed from 2 to 8 cm. per minute.

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The load and deflection values shall be recorded with a precision of 0.5 mm. The results shall be plotted in the form of load-deflection-energy

absorption curves. The average data obtained in the second and third test loadings shall be considered as performance values. The tests and reporting shall be carried by an approved laboratory and shall be supervised and certified by the independent inspection organization. The performance shall satisfy the requirements indicated in Subsection 3.13.1.3 paragraph 3.

If any of the tested fenders fail to satisfy the performance requirements, retesting shall be conducted on one piece for every 10 fenders of the same type. If the second sample still fails the test, all the remaining fenders of this type shall be tested.

5. Sampling of Specimen

The specimens of rubber shall be taken at the mixing stage directly from each batch of rubber compound for manufacturing of fenders. The specimens shall be tested for compliance with requirements as specified in paragraph b of this Sub-section.

6. Inspection for Dimension

The fenders shall be inspected by the independent inspection organization.

One fender out of five fenders of each type shall be inspected for compliance with dimensions.

Five percent (5%) of anchor bolts and fittings shall be selected at random and inspected. Materials for bolts and fittings to be covered by certified steel manufacturer's mill sheet shall be verified by the independent inspection organization.

7. Acceptance Tolerance

The acceptance tolerances shall be as stipulated in the following:

a. Fender Dimension

Length Width Height Thickness

Tolerance

+4%

-2%

+4%

-2%

+4%

-2%

+8%

-2%

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b. Anchoring Bolt Holes in Fender

Diameter of the Hole Pitch of the Hole

Tolerance +2 mm +4 mm

c. Performance requirements shall conform to paragraph c of Subsection 3.13.1.3

As basis for acceptance of all finished fenders supplied, a tolerance of +10% on the performance requirements indicated will be acceptable.

The cost of tests and inspection required herein are all for the Contractor's account.

8. Marking

All fender units shall be clearly numbered and marked. Each fender

shall have the following marking:

- a. Fender type and manufacturer's name or trademark
- b. Production serial number
- c. Date of manufacturing
- d. Main dimensions (length, height)
- e. Bill number in accordance with the project code specified in the Bill of Quantities.

9. Warranty

The Contractor shall guarantee the fenders against any defects that are attributable to faulty design and manufacture and shall also guarantee the performance of the fenders under normal working conditions. The guarantee shall be for a minimum period of 12 months from the date of the issuance of Taking-Over Certificate of the Works. During the period of guarantee, repairs and replacement of defective fender units and/or material shall be carried by the Contractor at his own cost.

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3.13.2.3 TIMBER PILE DOLPHINS

1. Timber piles shall be "Creosoted Apitong" (*Dipterocarpus Grandiflorus*) of the best grade. It shall be free from loose knots, splits, worn holes, decay, warp, ring separation or any defects which will impair its strength or render it unfit for its intended use. Creosoted Timber Piles shall have the diameter and length shown on the drawings. No cracks will be permitted in any pile.

Timber treatment shall consist of the forcing of creosote oil into the outer fiber of the timber by a heat and pressure process. The treatment shall be so regulated that the curing process will not induce excessive checking.

The minimum penetration of the preservative with the surface of the timber shall be 20mm. The minimum retention of preservative per cubic meter of timber shall be 320 kg. By "Full Cell Process" for treated timber intended for marine use.

The Engineer shall be notified at least ten (10) days in advance of the date that the treating process will be performed in order that the untreated timber, the treatment process and the finished treated timber may be inspected. The Engineer will inspect the timber prior to treatment to determine conformance with the specifications and suitability of conditions for treatment. He shall be permitted free access to the plant in order that temperatures, pressures and quantities and types of treatment materials used may be observed. Samples of the creosote oil shall be furnished as required for tests. After completion of the treatment, the timber shall be checked to determine penetration of treatment, amount of checking, quantity of free preservative remaining on the timber and any other visual evidence that the treatment has been performed in a satisfactory manner. The penetration of treatment shall be determined by boring a sufficient number of well distributed holes to determine the average penetration. All such holes shall be plugged with plugs approximately 2 mm larger in diameter than the bit used in boring the holes.

If the penetration of preservative is less than the required amount, the

entire charge, or such parts thereof as are determined by the Engineer to be unsatisfactory, shall be retreated. If after retreatment, the penetration is still insufficient, the retreated pieces shall be rejected. Any excessive checking caused by the treating process shall be cause for rejection of the pieces in which the excessive checking occurs.

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The treating plant shall be equipped with adequate thermometers and pressure gages so that the process can be accurately controlled and a continuous record made of stages of the treating process. If requested by the Engineer, records shall be furnished showing the duration, maximum and minimum temperatures and pressures used during all stages of the process.

All timber which is to be stored on the job for any length of time prior to its use in the structure shall be neatly stacked in piles to prevent warping or distortion. Creosote treated timber shall be open-stacked and piled to prevent warping. The ground underneath and in the vicinity of all material piles shall be cleared of all weeds and rubbish. Care shall be exercised in handling treated timber so as not to break or penetrate the treatment with any tool or handling equipment. Any piece of timber that has been damaged by the Contractor shall be replaced by him without extra compensation.

2. Connection wire shall be 6 x 9 galvanized wire rope with fiber core, 25 mm diameter, weight 1.98 kg/m, breaking load 27.6 tonnes (160 kg/mm²).

3. Preservative shall be creosoted oil and shall conform to ASTM D-1760 "Standard Specification for Pressure Treatment of Timber Products."

Creosoted petroleum oil blend shall not be used for timber piles intended for marine use.

4. All staples, caps, bolts shall be of galvanized steel.

3.13.3 EXECUTION

3.13.3.1 MOORING SYSTEM

All bollards, bitts and cleats shall be installed at the locations shown on the drawings and in accordance with the approved manufacturer's recommendations and shop drawings, and as directed by the Engineer.

3.13.3.2 RUBBER FENDER SYSTEM

All fenders shall be installed at the locations shown on the drawings and in accordance with the approved manufacturer's recommendations and shop drawings.

3.13.3.3 TIMBER PILE DOLPHINS

All timber piles shall be installed at the location shown on the drawings and connected to each to form a cluster piles.

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The timber pile should be driven to a penetration below seabed to a depth indicated on the drawings. This penetration may increased or decreased depending upon the nature of the material encountered and as directed by the Engineer.

Bind the piles as shown on the drawing to form a pile clusters with galvanized wire rope which should be secured to every pile in contact with galvanized staples and the ends of wire rope to be looped securely fastened. The top of the pile and wire rope after cutting and placing respectively shall be treated with two (2) thick coats of hot tar before

placing of the metal cap. The top of the cap should be painted with one (1) coat of tar.

All works shall be carried out in accordance with the approved shop drawings. Pile driving shall conform to requirements of Section 3.3, "Piling Works."

3.13.4 MEASUREMENT AND PAYMENT

1. Measurement and payment of the quantities of bollards, bitts and cleats shall each be based on the number of sets of bollards, bitts and cleats completely installed (excluding concrete base/foundation) with anchor bolts and certified by the Engineer.

Reinforced concrete base/foundation of mooring bollards and bitts to be installed on piers shall not be paid separately and such shall be included under pay-item for Concrete Works of pier.

Separate measurement shall be made for reinforced concrete base/foundation of mooring bollards and bitts to be installed on structures other than pier which shall be paid for per cubic meters of concrete and per kilograms of reinforcing bars.

2. Measurement and payment of the quantities of rubber fender system shall be based on the number of sets of rubber fender systems completely installed with anchor bolts with necessary sleeves and certified by the Engineer.

3. The furnishing of creosoted timber piles for fender cluster/breasting dolphins to be paid for shall be measured by the number of pieces as ordered in accordance with the Contract and as specified and accepted by the Engineer.

The installation of timber pile dolphins (with specified number of piles per cluster) shall be measured and paid for by the number of sets of timber pile dolphins placed in accordance with the Contract and accepted in completed work.

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4. Payment stated above shall be full compensation for all labor, materials and equipment and all preparatory and incidental works necessary to complete the work.

3.14 STEEL AND METAL WORKS

3.14.1 GENERAL

3.14.1.1 SCOPE OF WORK

The work includes the furnishing of all labor, material and equipment required for performing all operations in the fabrication and installation of structural steel and miscellaneous metal work as specified and shown on the drawings.

Materials shall conform to the requirements hereinafter specified.

Connections for which details are not indicated shall be designed in accordance with the American Institute of Steel Construction, Manual of Steel Construction, latest edition, and shall be welded or bolted, except as shown otherwise.

Bolted connections for structural steel work shall be made with high strength steel bolts. Holes shall be provided where necessary for securing other work to steel framing. Steel less than 4.75 mm thick shall be in accordance with the American Iron and Steel Institute's light gauge Steel Design Specification.

Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Miscellaneous bolts and anchors, supports, braces and connections necessary for completion of the work shall be provided.

3.14.1.2 STANDARDS INCLUDED IN THE SPECIFICATIONS

The following publications listed below form a part of these Specifications to the extent indicated by the reference thereto.

1. American Institute of Steel Construction (AISC) Publication:
Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. American Society for Testing and Materials (ASTM) Publications:
A-123 Zinc (Hot-Galvanized) Coating Products Fabricated from Rolled Pressed and Forged Steel Shapes, Plates, Bars and Strips

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- A-153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A-386 Zinc Coating (Hot-Dip) on Assembled Steel Products

3. American Welding Society (AWS) Publications:
D1.1 Structural Welding Code

4. Japanese Industrial Standard (JIS) Publication:
JIS B 1186 Sets of High Strength Hexagon Bolts, Hexagon Nuts, and Plain Washers for Friction Grip Joints
JIS G 3101 Rolled Steel for General Structures
JIS G 3444 Carbon Steel Tubes for General Structural Purposes
JIS G 3445 Carbon Steel Tubes for General Structural Purposes
JIS G 3452 Carbon Steel Pipes for Ordinary Piping
JIS G 3454 Carbon Steel Pipes for Pressure Services
JIS G 4303 Stainless Steel Bars
JIS G 4313 Cold Rolled Stainless Steel Strip for Spring
JIS G 4051 Carbon Steel for Machine Structural Use

3.14.1.3 STORAGE

Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids or other supports. Materials shall be kept free from dirt, grease and other foreign matter and shall be protected from corrosion.

3.14.1.4 SUBMITTALS

1. Shop Drawings

The Contractor shall submit shop drawings for the whole of the steelwork to the Engineer for approval. All such drawings shall show the dimensions of all parts, method of construction, spacing of rivets, bolts, welding, sectional areas and all other details. Riveted or welded construction may be employed subject to approval and neatness of design. Where welds are used, either at works or on site, they shall wherever possible, be continued and returned around any meeting face to ensure that the joints are completely sealed against corrosion.

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The details of connections on shop drawings shall be such as to minimize formation of pockets to hold condensation, water or dirt and a minimum gap between abutting angles and the like shall be provided wherever possible to eliminate any traps and facilitate maintenance painting.

No material shall be ordered nor fabrication commenced until such drawings are approved by the Engineer in writing.

The Contractor shall be responsible for all errors of detailing fabrication and for correct fitting of the structural members.

2. Erection Procedures

The Contractor shall submit work program and statement to illustrate the structural steel erection and temporary staying and bracing and to give clarification on data submitted by him should the Engineer requested the same. He shall also submit the data on welding equipment he proposes to use in the field, such data shall include the type, voltage and amperage of the said equipment and be subject to approval of the Engineer.

3. Proof of Compliance with the Specifications for Materials

The Contractor shall submit the following test results as a proof that the materials he will use complies with the requirement of the specifications.

a. Reports of ladle analysis for steel

- 1) Mill tests reports for main members
- 2) Fabrication's affidavit for secondary and detail members.

b. Reports of tensile properties and bed tests for:

- 1) Steel shapes
- 2) Steel bars
- 3) Steel plates

c. Certification of conformance for:

- 1) Structural steel tubing
- 2) Steel bar grating
- 3) Filler metals for welding

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d. Reports of mechanical properties of headed stud type shear connectors.

e. Reports of mechanical tests for high strength threaded fasteners.

4. Manufacturer's Literature

The Contractor shall submit manufacturer's literature describing the type of welding studs and arc shields used.

5. Inspection Report

The Contractor shall likewise submit the result of inspection tests specified in this Sub-section 3.14.3.4.

3. 14. 2 MATERIAL REQUIREMENTS

All materials shall be of new stock, free from surface imperfections and shall conform to the applicable ASTM, JIS, AISC or other equivalent standards.

Structural steel plates, shapes, grating and bars shall conform to JIS G 3101 SS 41.

Structural carbon steel shall conform to ASTM designations A 36 or equivalent. Shapes of structural members shall be as given in AISC, Manual of Steel Construction or equivalent.

High strength structural bolts, nuts and washers shall conform to JIS B 1186 F 11T.

Electrodes for arc welding shall conform to American Welding Society Specification A5.1.

Chains and fittings for fender systems shall conform to JIS F 3303 "Electrical Welded Anchor Chain Cables". All chains and accessories shall be hot-dip galvanized.

3. 14. 3 EXECUTION

3.14.3.1 QUALIFICATION

1. Steel Fabricator

Steel Fabricators shall have a minimum of 5 years experience in fabrication of structural steel for projects of similar size. The Contractor shall submit a written description of fabrication ability including facilities, personnel and lists of similar completed projects,

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including quality control capability and specifically the type and extent of quality control procedure which the fabricator intends to employ on this project.

2. Steel Erector

Steel Erectors shall have a minimum of 5 years experience in the erection of structural steel structures of similar size to the proposed structure. The Contractor shall submit a written description of structural steel erection ability including equipment, personnel and a list of completed projects.

3. Qualified Welders and Welding Procedures

Welders, tackers, welding procedures and operations shall be in accordance with AWS D1.1. The Contractor shall submit for the Engineer's approval the welding procedure, welder's qualifications and the test results of each type of welding to be performed.

Procedures shall be developed for welding all metals included in the work. The Contractor shall not start welding until procedures, welders, welding operator and tackers have been qualified as specified herein.

The Contractor shall perform qualification testing by an approved testing laboratory, or by the Contractor if approved by the Engineer.

Cost of such testing shall be borne by the Contractor.

The Contractor shall qualify each welder, welding operator and tacker assigned to work on this project by tests using equipment, positions, procedures, base metal and electrodes that will be encountered in their assignment. The Contractor shall furnish to the Engineer for approval certification that each welder, welding operator and tacker is qualified in accordance with the requirements of AWS D1.1 or approved equal.

3.14.3.2 WELDING

1. General

All welders, welding operators and tackers to be employed on the Works shall have been qualified by tests prescribed by the Structural Welding Code of American Welding Society (AWS D1).

Before the work is started the welding procedure of each type of joint shall be approved by the Engineer and the Contractor shall make such trial welds and tests as required for the proposed method.

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2. Equipment

Machine welding shall be used wherever possible. All shop welds shall be carried out by qualified operators under proper supervision. The work shall be properly prepared for welding and the correct sequence adhered to.

All site welding shall be carried out by the electric arc process, with coated electrodes.

The welding plant shall be of modern design and with ample capacity to provide the required current to each welding point without appreciable fluctuations.

3. Welding Material

The Contractor shall employ only welding electrodes, welding wire and fluxes capable of producing satisfactory welds when used by qualified welders or welding operators using qualified welding procedures. Filler metals for welding may be any or combination of the following:

- a. Shielding metal-arc welding: AWS A5.1 or A 5.5
- b. AWS A 5.18 and Article 417 of AWS Building code
- c. Flux core arc welding: AWS A5.2 and article 418 of AWS Building Code.

4. Welded Construction

Welded connection shall be permitted only where indicated on the approved shop drawings. Welded construction shall conform to the following:

a. Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint and any other foreign materials except that mill scale which withstands vigorous wire brushing may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by a mechanically guided torch.

b. Parts to be fillet welded shall be brought in as close contact as practicable and in no event shall be separated by more than 4.75 mm. If the separation is 1.6 mm or greater, the size of the filler welds shall be increased by the amount of the separation. The separation between facing surfaces of lap joints and the butt joints on a backing structure shall not exceed 1.6 mm. The fit of joints at contact surfaces which are not completely sealed by welds shall be close enough to exclude water after painting.

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c. Abutting parts to be butt welded shall be carefully aligned.

Misalignments greater than 3.2 mm shall be corrected and in making the correction, the part shall not be drawn into a sharper slope than 2 degrees. Prior to welding, all parts shall be held securely in position by tack welds, clamps or other means.

d. The work shall be positioned for flat welding whenever practicable.

e. The technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to Section 4 - Workmanship, of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society.

3.14.3.3 FABRICATION

The Contractor shall fabricate structural steel in the shop to the greatest extent possible for transporting in accordance with AISC Building Code with the modifications and additional requirements specified in this section.

Bolted or welded connections shall be provided whether constructed in the shop or in the field as shown on the drawings or as approved by the

Engineer. High strength threaded fasteners for all bolted connections shall be used unless otherwise shown on the drawings or approved by the Engineer.

Connections shall be as shown on the drawings or as approved by the Engineer. Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Draw allowance shall be made for draw in all tension bracing.

All sharp edges and corners be ground to a minimum radius of 1 mm and all sharp irregularities, burrs, slag and spatters on welds shall be removed. Bearing plates shall be provided under beams resting on concrete walls.

3.14.3.4 TEST AND INSPECTION

Welds shall be inspected visually. A min. 10% of all butt welds and a min. 5% of all fillet welds to be designated by the Engineer shall be examined by radiographic, liquid penetrant, magnetic particle or ultrasonic method, alone or in combination to determine conformance to the acceptance specified herein. All testing shall be performed by an approved testing agency performed in the presence of the Engineer. All tests shall be certified and submitted to the Engineer.

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3.14.3.5 DELIVERY TO SITE

Anchor bolts and other anchorage devices which are to be embedded in cast-in-place concrete construction shall be delivered to site before the start of the said work.

The Contractor shall number in accordance with shop drawings the materials tested and approved by the Engineer before delivery to the site, and prepare a list showing number, size, quality and quantities of materials. Material shall be transported in accordance with material list and transportation schedule approved by the Engineer.

Materials shall be protected to prevent damage during transportation. The Contractor shall package and label small parts such as bolts and rivets.

3.14.3.6 FIELD ERECTION

Steel erection shall conform to the requirements of these Specifications and to the applicable requirements of AISC, "Specification for the Design, Fabrication, and Erection of Structural Steel for Building" and the AISC "Code of Standard Practice for the Steel Building and Bridges".

The Contractor shall set and wedge or shim loose bearing plates and erect individual pieces not deviating from vertical level and alignment more than 1 in 500.

For the field assembly the Contractor shall:

1. Assemble structural steel frames accurately to the lines and elevations indicated and within the specified erection tolerance.
2. Align and adjust accurately various members forming parts of a complete frame of structure before fastening.
3. Fasten splices of compression members after the abutting surfaces have brought completely into contact.
4. Clean bearing surfaces in permanent contact of all rust and scale and surface coated with the required corrosion protection before members are assembled.
5. Provide splices only where indicated.
6. Provide bolted and welded field connections as specified in this

Section.

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7. Remove run-off tabs and grid surfaces where requested by the Engineer.

8. Clean weld spatter from contact surface.

Field correction of fabrication by gas cutting shall not be permitted on any major member of the structural framing without prior approval of the Engineer.

Structural steel members of high strength steel shall be marked to permit visual verification of the grade of steel used.

3.14.3.7 BOLTING

Bolts shall be driven accurately into the holes without damaging the thread. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing to the head or nut. Where self-locking nuts are not furnished, bolt threads shall be upset to prevent the nuts from backing off.

Unfinished bolts transmitting shear shall be threaded to such a length that not more than one thread will be within the grip of the metal. The bolts shall be of the length that will extend entirely through but not more than 6.4 mm beyond the nuts. Bolts heads and nuts shall be drawn tight against the work with a suitable wrench not less than 80 mm long. Bolt heads shall be tapped with a hammer while the nut is being tightened. After having been finally tightened, nuts shall be locked.

Alternatively, bolts shall be tightened with a torque wrench to the appropriate torque for the bolt diameter.

3.14.3.8 GALVANIZING

Galvanizing, where called for, shall conform to the requirements of ASTM A 123. The required weight of the zinc coating for each type of material category with corresponding range of thickness is shown below in compliance with ASTM A 123.

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Minimum Average Coating Thickness Grade by Material Category

Materials

Category

All Specimens Tested (Steel Thickness Range (Measured), in. (mm))

<1/16

(<1.6)

1/16 to <

1/8 (1.6 to

<3.2)

1/8 to <3/16

(3.2 to 4.8)

>3/16 to <1/4

(>4.8 to <6.4) ≥1/4 (≥6.4)

Structural

Shapes & Plate 45 65 75 85 100

Strip & Bar 45 65 75 85 100

Pipe & Tubing 45 45 75 75 75

Wire 35 50 60 65 80

Coating Thickness Grade

Coating

Grade mils Oz/ft² μ m g/m²

35 1.4 0.8 35 245

45 1.8 1 45 320

50 2 1.2 50 355

55 2.2 1.3 55 390

60 2.4 1.4 60 425

65 2.4 1.5 65 460

75 3 1.7 75 530

80 3.1 1.9 80 565

85 3.3 2 85 600

100 3.9 2.3 100 705

Conversion Factors

Mils = μ m x 0.03937

Oz/ft² = μ m x 0.02316

g/m² = μ m x 7.067

3.14.3.9 PAINTING

Shop paint for all structural steel shall be carried out in accordance with Sub-section 4.5.5, "Painting".

3.14.3.10 INSPECTION

1. Recommendation and procedures governing inspection are in general described in API RP 2A Section 7 - Inspection, and description in this Section.

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2. Inspection by the Engineer does not relieve the Contractor of his responsibility to provide the necessary inspection of his own work, and that of his sub-contractors, to ensure compliance with Contract Drawings and Specifications.

3. All sub-contractors, used for steel fabrication work by the Contractor shall be subject to the approval of the Engineer prior to their start of any work for this project.

4. The fabrication and erection facilities, materials and quality workmanship of the Contractor and his sub-contractors shall be available for inspection by the Engineer at all times during the progress of work. The Engineer shall have the right to reject work not satisfying the requirements of their governing references as mentioned herein before.

3.14.4 MEASUREMENT AND PAYMENT

The unit price of structural steel shall be measured and paid for by the kilograms and shall include procurement, transportation, fabrication, painting, erection and all related works. The unit prices shall constitute full payments for all labor, materials, scaffoldings, etc. necessary for the successful completion of the work.

3.15 RUBBLE CONCRETE

3.15.1 GENERAL

Division 1, "General Requirements" contain provision and requirements essential to these specifications, and apply to this section, whether or not referred to herein.

3.15.1.1 SCOPE OF WORK

This section shall consist of the furnishing and placing of rubble concrete

for breakwater and other structures called for on the drawings, constructed on the prepared foundation bed, in accordance with these specifications and in conformity with the lines, grades, and dimensions shown on the drawings.

Rubble concrete shall be Class C concrete with stones embedded therein.

3.15.1.2 GENERAL REQUIREMENTS

Concrete works shall conform with the requirements of Section 3.2, "Concrete Works."

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3.15.1.3 SURVEY AND SETTING OUT

Contractor shall set out works and shall be solely responsible for accuracy of such setting out. Prior to placement of any materials, the Contractor shall establish visible construction markers to clearly define horizontal/vertical limits of works.

Applicable requirements under Section 2.3, "Surveys, Soundings, Soil Investigations, Installation of Markers, etc.," shall apply to his section.

3. 15. 2 MATERIAL REQUIREMENTS

3.15.2.1 STONES

Stones for rubble concrete shall consist of rocks as nearly rectangular in section as is practical. The stones shall be sound, tough, durable, dense, resistant to the action of air and water and suitable in all respects for the purpose intended.

Unless otherwise indicated on the drawings, stone for rubble concrete shall have a minimum weight of 5kg. to a maximum of 20kg. with at least 50 percent of the stones weighing more than 15 kg.

3.15.2.2 CONCRETE

Concrete shall be Class C, conforming to the requirements given under Section 3.2, "Concrete Works."

3.15.2.3 FORMWORK

Formwork shall conform to the requirements given under Section 3.2, "Concrete Works."

3. 15. 3 EXECUTION

All stones shall be cleaned thoroughly and wetted immediately before being set. Stones shall be laid firmly on prepared foundation bed starting from the base or bottom laying upslope. Concrete, 300 mm thick shall be laid first prior to placement of stones. Stones shall be carefully hand laid and thoroughly incorporated into the mass at least 300mm below the outside surface of the concrete. Horizontal and vertical spacing of stones shall not be less than 30 mm. Class C concrete shall be placed and spread to properly filled all the voids and up to the required sections, grades and elevations shown on the drawings. Finish surface of rubble concrete shall be smooth and no portion where stone is visible after completion of the works. Minimum covering of concrete shall be 300 mm all throughout.

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3. 15. 4 MEASUREMENT AND PAYMENT

The quantities of rubble concrete to be measured for payment shall be the number of cubic meters of rubble concrete in place including preparation of foundation bed, in close conformity with the drawings and accepted by the Engineer.

The computation of the quantities will be based on the volume within the

limiting dimensions designated on the drawings or as determined by the Engineer.

The quantities measured as provided above shall be paid for at the contract unit prices as shown in the Bill of Quantities, which price and payment shall be full compensation for the necessary excavation and preparation of the foundation bed, for furnishing and placing materials including all labor, equipment, tools and incidentals necessary to complete this item.

3.16 NAVIGATIONAL AID

3.16.1 SCOPE OF WORK

This Section covers the procurement and installation of light beacons and buoys for navigational aid including sinkers and reinforced concrete foundation. Unless otherwise instructed by PPA, the Contractor shall procure and install beacons at the location as indicated on the drawings. The Buoy system shall be in accordance with the International Association of Lighthouse Authorities (IALA) Maritime Buoyage System B.

3.16.2 MATERIAL REQUIREMENTS

3.16.2.1 GENERAL DESCRIPTION

For reference and guidance, hereunder are the general descriptions of the light beacons to be procured and installed by the Contractor.

3.16.2.2 DESCRIPTION OF NAVIGATIONAL AIDS

Materials shall conform with the specified material or approved equivalent.

1. Light Buoy (Entrance Buoy) : Solar and Turbine
(Wave Activator)

a. Buoy Data

- 1) Main material : Steel plate
- 2) Height overall : Approx. 8.9 m
- 3) Focal plane height : Approx. 4.8 m

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- 4) Outside diameter of float : Approx. 2.6 m diameter
- 5) Total weight : Approx. 5.5 tons
- 6) Total buoyancy : Approx. 8.7 tons
- 7) Reserved buoyancy : Approx. 3.2 tons

b. Body

- 1) Material : 9 mm thick rolled steel plate
- 2) Cathodic Protection : Anode plate
- 3) Lifting eye : 40mm steel plate (2 places)
- 4) Mooring eye : 40mm steel plate (2 places)
- 5) Counter weight : Cast steel
- 6) Bolts and Nuts : Stainless steel
- 7) Buoy color : Starboard hand (RED)

Port hand (GREEN)

8) Rubber fender : Marine grade fender

c. Superstructure

- 1) Material : Steel angle
- 2) Bolts and nuts : Stainless steel
- 3) Top mark : Steel

d. Mooring Equipment

- 1) Main chain : 32mm dia. Stud link chain
with end link 30M x 1 pc JIS

Grade 2

- 2) Bridal chain : 32mm dia. Stud link chain with end link 9M x 1 pc JIS Grade 2
- 3) 3 eyes piece : for 32mm dia. Chain x 1 pc
- 4) Swivel piece : for 32mm dia. Chain x 1 pc
- 5) Joining shackle : for 32mm dia. Chain x 6 pcs
- 6) Anchor shackle : for 32mm dia. Chain x 1 pc
- 7) Sinkers (not to be supplied) : 10 ton concrete sinker x 1 pc

e. Lighting Equipment

- 1) Lantern : 4 layer LED model
- 2) Lens : Polycarbonate 4 layer type Fresnel lens

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- 3) Light color : Starboard hand (RED) Port hand (GREEN)
- 4) LED load : 12V 19.2W (RED colored light/ Green color)
- 5) Flasher : Solid state system Pre-programmed with 256 flashing characters (248 preprogrammed, 8 as specified by customer). And 256 flashing characters are filled adjustable. At least 248 flashing characters should be preprogrammed.
- 6) Sun Switch : Photo electric cell system
- 7) Luminous intensity (fixed) : 258 cd for Red light 265 cd for Green light
- 8) Effective Range ($T=0.74$) : 6.3 N.M. for Red 6.4 N.M. for Green
- 9) Light Character : FI 4 sec. ($0.5+3.5=4$ sec)
- 10) Protection for Stealing : Consideration must be taken for securing lantern to avoid loss after installation at sea.

f. Power Source

- 1) Solar cell module : (12V, 26.2W) x 2 pcs
Total output power 17.4V 52.4W
- 2) Charging controller : Over voltage, over current and reverse current protection type
- 3) Wave activated generator : maximum output power 12V 100W. Average output, power, more than 55W (in case wave height 40 cm and wave period sec)
- 4) Storage battery : Sealed lead acid battery (12V, 40Ah) x 3 pcs
- 5) Battery life (without charge) : More than one month operation

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6) Protection form theft : Consideration must be taken for securing power source to avoid loss after installation at sea.

g. GPS Synchronizer

GPS synchronizer can control for synchronize group flashing period.

- 1) Model : (GPS receiving type)
- 2) Receive frequency : 1575 42 MHz
- 3) Receiving channel : 8 Channel
- 4) Signal pulse voltage : 5V +- 0.1V (p-p)
- 5) Signal pulse time : 2.0ms +- 0.5 ms
- 6) Shape signal pulse : Rectangular shape
- 7) Interval time of signal pulse : 1 time every 2 hours
- 8) Signal pulse accuracy : Within 3 ± 3 ppm /sec.
- 9) Power voltage : DC 12V
- 10) Power consumption : 0.125Ah / day 12V D.C. power supply

h. Lens Reflector

a. Model : (equivalent area 10 square meter)

b. Weight : Approx. 6.5 kg

c. Main Material : F.R.P. resin

i. Paint Schedule

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Process Kind of Paint Number of Coat Thickness

Above water line Total 338 microns

Under coat Epoxy zinc rich primer 1 18 microns

Epoxy resin primer 2 200 microns

Final coat Epoxy Topcoat 2 120 microns

Under water line Total 418 microns

Under coat Epoxy zinc rich primer 1 18 microns

Epoxy resin primer 2 200 microns

Final coat Epoxy Topcoat 2 200 microns

Interior Total 36 microns

Under coat Epoxy zinc rich primer 1 18 microns

Epoxy resin primer 1 18 microns

2. Light Buoy (Channel Buoy)

a. BUOY DATA

- 1) Main material : Steel plate
- 2) Height overall : Approx. 5.7 m
- 3) Focal plane height : Approx. 3.0 m
- 4) Outside diameter of float : Approx. 1.5 m diameter
- 5) Total weight : Approx. 1.7 tons
- 6) Total buoyancy : Approx. 2.7 tons
- 7) Reserved buoyancy : Approx. 1.0 tons

b. BODY

1) Material : 4.5 mm thick rolled steel plate

2) Cathodic Protection : Anode plate

- 3) Lifting eye : steel plate (2 places)
- 4) Mooring eye : steel plate (2 places)
- 5) Counter weight : steel plate
- 6) Bolts and Nuts : Stainless steel
- 7) Buoy color : Starboard hand (RED)
Port hand (GREEN)
Hazard (YELLOW)
- 8) Rubber fender : Marine grade fender

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c. Superstructure

- 1) Material : Steel angle
- 2) Bolts and nuts : Stainless steel
- 3) Top mark : Steel

d. Mooring Equipment

- 1) Main chain : 24mm dia. Stud link chain with end link 20M x 1 pc JIS Grade

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- 2) Bridal chain : 24mm dia. Stud link chain with end link 4M x 2 pcs JIS Grade

2

- 3) 3 eyes piece : for 24mm dia. Chain x 1 pc
- 4) Swivel piece : for 24mm dia. Chain x 1 pc
- 5) Joining shackle : for 24mm dia. Chain x 6 pcs
- 6) Anchor shackle : for 24mm dia. Chain x 1 pc
- 7) Sinkers (not to be supplied) : 10 ton concrete sinker x 1 pc

e. Lighting Equipment

- 1) Lantern : 1 layer LED model
- 2) Lens : Polycarbonate 1 layer type
Fresnel lens
- 3) Light color : Starboard hand (RED)
Port hand (GREEN)
Hazard (YELLOW)
- 4) LED load : 12V 4.8W (RED colored light/
Green color)
- 5) Flasher : Solid state system
Pre-programmed with 256
flashing characters (248 preprogrammed,
8 as specified by
customer). And 256 flashing
characters are filled adjustable.
At least 248 flashing
characters should be preprogrammed.

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- 6) Sun Switch : Photo electric cell system
- 7) Luminous intensity (fixed) : 38 cd for Red light
48 cd for Green light
37 cd for Yellow light
- 8) Effective Range ($T=0.74$) : 4.0 N.M. for Red
4.8 N.M. for Green
4.0 N.M. for Yellow
- 9) Light Character : Fl 4 sec. ($0.5+3.5=4$ sec)

for green and red

: Fl.5 sec. (0.5+4.5 = sec)

for yellow

10) Protection for Stealing : Consideration must be taken for securing lantern to avoid loss after installation at sea.

f. Power Source

1) Solar cell module : (12V, 11.5W) x 1 pc

Total output power 17.4V

11.5W

2) Charging controller : reverse current protection type

3) Wave activated generator : maximum output power 12V 100W. Average output, power, more than 55W (in case wave height 40 cm and wave period sec)

4) Storage battery : Sealed lead acid battery (12V, 40Ah) x 1 pc

5) Battery life (without charge) : More than one month operation

6) Protection form theft : Consideration must be taken for securing power source to avoid loss after installation at sea.

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g. Paint Schedule

Process Kind of Paint Number of Coat Thickness

Above water line Total 338 microns

Under coat Epoxy zinc rich primer 1 18 microns

Epoxy resin primer 2 200 microns

Final coat Epoxy Topcoat 2 120 microns

Under water line Total 418 microns

Under coat Epoxy zinc rich primer 1 18 microns

Epoxy resin primer 2 200 microns

Final coat Epoxy Topcoat 2 200 microns

Interior Total 36 microns

Under coat Epoxy zinc rich primer 1 18 microns

Epoxy resin primers 1 18 microns

3. Light Beacon

a. Beacon Data

1) Main material : Mild Steel

2) Height overall : Approx. 3.3 m

3) Focal plane height : Approx. 3.2 m

4) Outside diameter of body : Approx. ϕ 318.5 mm & ϕ 508mm

5) Total weight : Approx. 407 kg

b. Body

1) Material : 8.0 mm thick steel pipe

2) Bolts and nuts : Stainless steel

3) Buoy color : White

c. Superstructure

1) Material : Steel pipe

2) Bolts and nuts : Stainless steel

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d. Lighting Equipment

1) Lantern : (1 layer LED model)

2) Lens : Polycarbonate Fresnel lens

3) Light color : White

4) LED load : 12V 4.8W White color light

5) Flasher : Solid state system

Pre-programmed w/ 256

flashing characters. (248 preprogrammed

8 as specified by

customer). And 256 flashing

characters are field adjustable.

At least 248 flashing

characters should be preprogrammed.

6) Sun Switch : Photo electric cell system

7) Luminous intensity (fixed) : 40 cd for White

8) Effective luminous intensity : 28 cd for White

9) Effective Range ($T=0.74$) : 3.7 N Miles for White

10) Light Character : Fl 4 sec. ($0.5+3.5 = 4$ sec)

for white

: Fl.6 sec. ($0.5+5.5 = 6$ sec) for

white

e. Power Source

1) Solar cell module : 12V, 11W) x 1 pc

2) Charging controller : Over voltage charger

3) Storage battery : Sealed lead acid battery

(12V, 40Ah) x 1 pc

4) Battery life (without charge) : Approx. 30 days operation

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f. Paint Schedule

Process Kind of Paint Number

of Coat Thickness

Interior of battery

box body

Total more than 220

microns

Under coat Epoxy zinc rich primer 1 more than 25 microns

Epoxy resin 2 more than 125 microns

Final coat Polyurethane resin 1 more than 35 microns

Polyurethane resin 2 more than 35 microns

Exterior of body

Total more than 220

microns

Under coat Epoxy zinc rich primer 1 more than 25 microns

Epoxy resin 2 more than 125 microns

Final coat Polyurethane resin 1 more than 35 microns

Polyurethane resin 2 more than 35 microns

4. Light Beacon

a. Beacon Data

- 1) Main material : Mild Steel
- 2) Height overall : Approx. 3.6 m
- 3) Focal plane height : Approx. 3.5 m
- 4) Outside diameter of body : Approx. $\phi 216.3$ mm
- 5) Total weight : Approx. 150 kg

b. Body

- 1) Material : 5.8 mm thick steel pipe
- 2) Bolts and nuts : Stainless steel
- 3) Buoy color : White

c. Superstructure

- 1) Material : Steel pipe
- 2) Bolts and nuts : Stainless steel

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d. Lighting Equipment

- 1) Lantern : (1 layer LED model)
- 2) Lens : Polycarbonate Fresnel lens
- 3) Light color : White
- 4) LED load : 12V 4.8W White color light
- 5) Flasher : Solid state system

Pre-programmed w/ 256

flashing characters (248 preprogrammed,
8 as specified by

customer). And 256 flashing
characters are field adjustable.

At least 248 flashing
characters should be preprogrammed.

- 6) Sun Switch : Photo electric cell system
- 7) Luminous intensity (fixed) : 40 cd for White
- 8) Effective luminous intensity : 28 cd for White
- 9) Effective Range ($T=0.74$) : 3.7 N Miles for White
- 10) Light Character : Fl.4 sec. ($0.5+3.5 = 4$ sec)

for white
: Fl.6 sec. ($0.5+5.5 = 6$ sec)

for white

e. Power Source

- 1) Solar cell module : (12V, 11W) x 1 pc
- 2) Charging controller : Over voltage charger
- 3) Storage battery : Sealed lead acid battery
(12V, 40Ah) x 1 pc
- 4) Battery life (without charge) : Approx. 30days operation

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f. Paint Schedule

Process Kind of Paint Number

of Coat Thickness

Interior of battery

box body

Total more than 220

microns

Under coat Epoxy zinc rich primer 1 more than 25 microns

Epoxy resin 2 more than 125 microns

Final coat Polyurethane resin 1 more than 35 microns

Polyurethane resin 2 more than 35 microns

Exterior of body Total more than 220

microns

Under coat Epoxy zinc rich primer 1 more than 25 microns

Epoxy resin 2 more than 125 microns

Final coat Polyurethane resin 1 more than 35 microns

Polyurethane resin 2 more than 35 microns

3. 16. 3 EXECUTION

1. Prior to procurement of light beacons and bouys, the Contractor shall submit the manufacturer's catalogue, with detailed information of the product, for approval of the Engineer. The Contractor shall carry out detailed hydrographic survey in the vicinity of the place where light beacons and bouys are intended to be installed for Engineer's approval. The Contractor shall also secure permit/clearance to install the light beacons from the Philippine Coast Guard.

2. After installation, the actual location of light beacons as installed shall again be surveyed and the results thereof shall be submitted to the Engineer for approval.

3. 16. 4 MEASUREMENT AND PAYMENT

Measurement and payment of quantities of light beacon and bouys shall be based on the number of sets of light beacon completely installed including reinforced concrete base certified by PPA.

The work includes the furnishing of all labor, materials, and equipment required to install all navigational aids, in accordance with these Specifications and where shown on the Drawings and to the approval of the Engineer.

The Contractor shall satisfy himself and shall be deemed to have satisfied himself as to the nature of the sub-soil conditions, topographic and hydrographic conditions.

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The Contractor shall be deemed to include in his unit prices allowances to cover all risks, except noted otherwise, for any contingencies that may arise during or in connection with the works.

3. 17 PRECAST CONCRETE

3. 17. 1 GENERAL

Work under this Contract shall be in accordance with Division 1 "General Requirements" of these Specifications and shall be applicable to this Section, whether herein referred to or not.

Precast concrete to be used shall comply generally with the sections relating to concrete and reinforcement concrete and the following clauses, including those for prestressed concrete where applicable.

Concrete members so specified shall be fabricated as precast units with concrete for the specified class placed into a grout-tight mould. If so required, the mould shall be laid on the vibrating table and vibration applied while the concrete is placed.

Permanently exposed surfaces shall have a finish given by moulds of

closely-jointed steel material. The surface shall be improved by carefully removing all fins and other projections. After inspection by the Engineer, any concrete surfaces which have been accepted but contain blemishes filled with a cement and fine aggregate paste matching the color of the concrete.

Surfaces which will subsequently receive grout or concrete to complete a structural connection or other composite structural component of which the precast unit forms a part, shall be prepared for surface treatment as early as possible after casting. This preparation shall be carried out preferably when the concrete has set but not hardened, by jetting with a fine spray of water or rushing with a stiff brush, just sufficient to remove the outer mortar skin and to expose the larger aggregate without its being disturbed. Where this treatment is impractical, sand blasting or a needle gun should be used to remove the surface skin and laitance. Hacking shall be avoided.

The Contractor will be permitted to obtain precast concrete units from outside suppliers provided that they comply with the Specification and that the Contractor obtains the Engineer's approval for each supplier.

The Contractor shall give to the Engineer full details of proposed methods of handling and stacking precast concrete units. The Engineer will examine these details and will either approve the methods or cite other modifications design to ensure that no excessive stresses are set up in the units. The finally approved methods shall be adhered to at all times and the

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Contractor shall be deemed to have included in his rates for all measures required to handle and stack beams and units safely and without undue stressing.

3. 17. 2 CASTING BED AND MARKING

All precast units shall be cast on a suitably prepared level, unyielding paved area or on suitable platforms. A suitable serial number indicating the date of casting shall be impressed or painted on each unit or portions cast.

3. 17. 3 CONSTRUCTION JOINT

Every unit shall be cast in one continuous operation. Construction joints shall be avoided.

3. 17. 4 TOLERANCES FOR INDIVIDUAL UNITS

Precast concrete units shall be true to the size and dimensions shown on the Drawings within the following limits:

Lengths

up to 3 meters ± 6

More than 3 meters but

less than 6 meters ± 9

6 meters or more ± 12

Cross Section (each direction)

up to 0.5 meters ± 6

More than 0.5 meters but

less than 0.75 meters ± 9

0.75 meters or more ± 12

Straightness or bow (deviation from intended line)

up to 3 meters ± 6

More than 3 meters but

less than 6 meters ± 9

6 meters or more ± 12

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3. 17. 5 SQUARENESS

When measuring the squareness of a corner, the longer of the two adjacent sides shall be taken as the base line. The shorter side shall not vary in its distance from a perpendicular so that the difference in mm. between the greatest and shortest dimensions exceeds :

Lengths of short side

up to 1.2 meters ± 6

More than 1.2 meters but

less than 3 meters ± 9

3 meters or more ± 12

3. 17. 6 TWIST

Any corner shall not be more than the tolerance stated in mm. from the plane containing the other three corners:

up to 0.7 meter wide and up to

6 meters in length ± 6

over to 0.7 meter wide and for

any length ± 9

3. 17. 7 MEASUREMENT AND PAYMENT

1. Prices to be paid shall constitute full payment for all labor, materials, and equipment and all testing and incidental works necessary for the completion of the work.

2. Precast concrete shall be measured either by the number of each precast unit or by volume in cubic meter whichever is called in the Bill of Quantities. Payment shall include the cost of reinforcing steel bar needed for each precast units.

No deduction shall be made for volume of concrete displaced by reinforcing steel, structural steel or steel piles.

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3. 18 PRESTRESSED CONCRETE

3. 18. 1 GENERAL

Work under this Contract shall be in accordance with Division 1 "General Requirements" of these Specifications and shall be applicable to this Section, whether herein referred to or not.

3.18.1.1 SCOPE OF WORK

The sections relating to concrete, reinforced concrete and precast concrete shall be read in conjunction with the following clauses.

The work shall consist of furnishing, transportation, storage and placing of prestressed concrete, stressed by pretensioning or post-tensioning method.

It shall be in accordance with the Drawings and as specified herein Also the work shall be in accordance with Section 3.2, "Concrete Works" of these Specifications.

Unless otherwise ordered by the Engineer, the Contractor shall certify for the Engineer's approval that a technician skilled in the required prestressing method will be available during its implementation to give aid and instruction in the use of prestressing equipment and installation of materials as maybe necessary to produce prestressed concrete.

3.18.1.2 DEFINITION

1. Post-tensioning is defined as any method of prestressing concrete in

which tensioned reinforcement is stretched after the concrete has hardened.

2. Pretensioning is defined as any method of prestressing concrete in which the tensioned reinforcement is tensioned before the concrete is placed.

3. Prestressing reinforcement is defined as any reinforcement to which prestress is applied by post-tensioning or pre-tensioning method.

3.18.2 MATERIAL REQUIREMENTS

3.18.2.1 TYPES OF CONCRETE

The concrete shall be of the types as specified on the Drawings and at the time of prestressing shall have reached the specified strengths as determined by the test cylinders which have matured under the same conditions as the units to which the cylinders shall be marked conspicuously with the date of casting and other identification marks as directed by the Engineer.

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3.18.2.2 PRESTRESSING STRAND

Prestressing strand to be used shall be high-tensile strand conforming to JIS G 353G, SWPR 19 (AASHTO M 203, "Steel Strand, Uncoated Seven-Wire for Prestressed Concrete" or ASTM A 416, "Steel Strand, Uncoated Seven-Wire for Prestressed Concrete").

3.18.3 EXECUTION

3.18.3.1 GENERAL

Prestressed concrete structural members shall be constructed and placed in accordance with the requirements of Section 3.2, "Concrete Works".

3.18.3.2 PRESTRESSING METHODS

The methods of prestressing to be used shall be optional but shall be subject to all requirements herein after specified.

The Contractor, prior to casting any members to be prestressed shall submit in advance for approval of the Engineer complete details of the methods, materials and equipment proposed to be used in the prestressing operations. Such details shall outline the method and sequence of prestressing, complete specifications and details of the prestressing steel and anchoring devices proposed for use, anchoring stresses, type of sheath, and all data pertaining to the prestressing operations including the proposed arrangement of the prestressing units in the members pressure grouting materials and equipment.

3.18.3.3 PRESTRESSING EQUIPMENT

Hydraulic jacks shall be equipped with accurate pressure gauges. The Contractor may elect to substitute screw jacks or other types for hydraulic jacks. In which case, proving rings or other approved devices shall be used in connection with the jacks. All devices, whether hydraulic jack gauges or otherwise shall be calibrated so as to permit the stress in the prestressing steel to be computed at all times. A certified calibration curve shall accompany each device. Safety measures shall be taken by the Contractor to prevent accidents due to possible breaking of the prestressing steel or the slipping of the grips during the prestressing process.

3.18.3.4 CASTING YARD

The precasting of prestressed concrete structural members may be done at

a location selected by the Contractor, subject of the approval of the Engineer

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3.18.3.5 PLACING ENCLOSURES

Enclosures for prestressed reinforcement shall be accurately placed at locations shown on the Drawings or approved by the Engineer.

3.18.3.6 PLACING OF STEEL STRANDS

All steel strands units shall be accurately and firmly placed in the position shown on the drawings or as instructed by the Engineer.

Steel strands clearance from the forms shall be maintained by stays, blocks, ties or hangers approved by the Engineer. Blocks for holding units from contact with the forms shall be precast mortar blocks of approved shape and dimensions. Layers of units shall be separated by mortar blocks or other equally suitable devices. Wooden blocks shall not be left in the concrete.

Suitable horizontal and vertical spacers shall be provided if required to hold the wire and strand correctly in place in the sheath.

3.18.3.7 PLACING OF CONCRETE

Concrete shall be deposited in the forms only after the Engineer had inspected and approved the reinforcement, enclosures, anchorages, and prestressing steel. The concrete shall be vibrated internally or externally or both with care as ordered by the Engineer in such a manner as to avoid displacement of reinforcement, enclosures, or prestressing strand.

3.18.3.8 CONTRACTION/CONSTRUCTION JOINT

Concreting for single prestressed concrete units shall be done continuously without any contraction joint.

Construction joints shall not be allowed unless permitted by the Engineer in writing.

3.18.3.9 CURING

Concrete shall be adequately cured to prevent the harmful effects of drying and rapid change in temperature. Curing shall be done by methods approved by the Engineer. Proper care shall also be exercised to insure that fresh concrete will not be damaged by vibration, impact or lifting or loading.

Prestressed concrete slabs shall be adequately cured before the application of tensioning.

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3.18.3.10 PRE-TENSIONING

The prestressing elements shall be accurately held in position and stressed by jacks. The Contractor shall record the jacking force and the elongations produced. Several units may be cast in one continuous line and stressed at one time. Sufficient space shall be left between ends of units to permit access for cutting after the concrete has attained the required strength. No bond stress shall be transferred to concrete, nor end anchorages released until the concrete has attained a compressive strength, as shown by cylinder tests, of at least 28 MPa. The elements shall be cut or released in such an order that lateral eccentricity or prestress will be a minimum.

3.18.3.11 POST-TENSIONING

Tensioning of the prestressing reinforcement shall not be commenced until tests on concrete cylinders, manufactured from the same concrete and

cured under the same conditions has attained a compressive strength of at least 28 Mpa.

The steel strands shall be stressed by means of jacks to the required tension and the stressed transferred to the end anchorages. The tensioning process shall be conducted in a manner that the tension being applied and the elongation of the prestressing elements may be measured at all times.

To minimize possible irregularity in quality the tensioning operation shall be closely supervised for each group of strands to insure that tension applied will not go under the specified value.

During the tensioning operation the Contractor shall monitor the amount of tension and the elongation of strand to insure that they are proportional.

The tension applied to the strand shall be measured by the load gauge and the elongation by approved method. The tensioning operation shall be reexecuted if the relationship between the applied tension and the elongation vary from the allowed proportion. In the event that any abnormality is found after re-execution of tensioning the operation shall be suspended and the cause determined taking into account friction loss, deformation or slippage of anchors and other causes allowed by the Engineer. Where tension is applied to each piece of strand or group of strands, care shall be exercised so that no harmful stress is allowed to concentrate at any stage of operation. The tension to be applied at the end of strands shall be determined taking into account the change in tension applied to each group of strand due to elastic deformation of concrete.

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3.18.3.12 GROUTING

Grouting shall be done in such a way that it will fill up the duct while the strands are well protected and concrete and strands are firmly bonded.

The grout shall be tested in accordance with the test methods for consistency, bleeding ratio, expansion ratio and concrete strength recommended by the Japan Society of the Civil Engineers or other equivalent standards of tests.

The test results shall comply with the following requirements:

- Consistency, Flow Time
15-30 sec (JA funnel) or 6-12 sec (J funnel)
- Expansion ratio, Less than 10%
- 28 - day compressive strength more than 200 kg./cm².

The cement ratio of the grout shall less be than 45%.

All prestressing strands to be bonded shall be free of dirt, loose rust, grease, or other deleterious substances. Before grouting, the ducts shall be free of water, dirt or any other foreign substance. Cleaning may be done preferably by bombarding with compressed air until no water comes through the duct. The grout pump shall be capable of pumping grout gradually and without any air bubble. The duct shall be thoroughly cleaned and wet with water before commencing the grouting operation. Pouring of grout shall be done slowly, using the grout pump. The grout shall be filtered through suitable sieve before grouting. Sufficient pressure shall be used in grouting to force the grout completely through the duct, care being taken that rupturing of the ducts does not occur.

The grout mixer shall be of sufficient capacity and capable of mixing grout

for a 5 minutes continuous grouting operation. Grout of uniform consistency shall be delivered through the outlets in sufficient amount. The outlets shall then be closed one by one along the direction of grouting. The grout shall be of fluid or thick paint consistency proportioned so that free water will not separate from the mix. Commercial plasticizers used in accordance with the manufacturer's recommendation may be used provided they contain no ingredients that are corrosive to steel.

3.18.3.13 PREMOLDED EXPANSION JOINT FILLER

Premolded expansion joint filler used for the wharf widening section, distance beam and the landside crane rail foundation beam shall be soft fiber strips impregnated with bitumen, conforming to Item 405-2.8, Standard Specifications for Highway and Bridges of the Department of Public Highways, revised 2004.

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3. 18. 4 MEASUREMENT AND PAYMENT

1. The quantity of precast prestressed members to be measured shall be the actual number of members, of types installed in place, level completed and accepted before placement of any in-situ concrete.
2. The work measured as provided above shall be paid for at the unit rates entered into the Bill of Quantities.
3. The unit rates for precast prestressed members shall include for:
 - a. Concrete, formwork, non-prestressed and prestressed reinforcement, enclosures for prestressing steel, anchorages, grouting curing plates, nuts and other such incidentals necessary to complete the work.
 - b. Delivery and Settings: The payment shall be fully compensated for furnishing and placing of all materials including all labor, tools, equipment, testing and incidentals thereto.

3. 19 PAINTING OF PORT FACILITIES

3. 19. 1 GENERAL

VOLUME I, preceding these Technical Specifications and Section these Technical Specifications and Section I, - GENERAL REQUIREMENTS contain provisions and requirements essential to these specifications; and apply to this Section, Whether or not referred to herein.

3.19.1.1 SCOPE OF WORK

This Section covers the surface preparation, coating materials and application of coatings system required for the Works.

3.19.1.2 GENERAL PROVISIONS

1. All exposed metal surfaces, except metal surfaces embedded in concrete or galvanized shall be painted unless otherwise specified. All tools and equipment shall be suitable for the work and shall be maintained in good order.
2. Applicable Publications: The following publications listed below, but referred to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:

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Steel Structures Painting Council (SSPC) U.S. Specification.
JIS K 5628 Red-lead Zinc Chromate Anti-Corrosive Paint.

3.19.1.3 STORAGE AND DELIVERY

1. The Contractor shall deliver all materials to the job site in the original

labeled sealed cans and containers, with labels intact and seal unbroken.

a. Seals shall remain unbroken until after inspection and acceptance of materials by the Engineer.

b. The Contractor shall deliver materials in ample quantities in advance of the need to avoid any delays or interruptions in the Work.

2. Storage: Paint and thinner shall be stored in accordance with the manufacturer's printed instructions.

a. Observe all regulations required for storage of paint and post all necessary safety signs required by governing codes.

b. Repair any damage caused by failing to exercise proper precautions in paint storage.

c. All containers of paint shall remain unopened until required for use; containers which have been opened shall be used first, otherwise the oldest paint shall be used first.

d. No paint material shall be used which has exceeded the manufacturer's recommended shelf life.

3.19.1.4 QUALITY ASSURANCE

1. Surface preparation and painting work shall be carried out in accordance with the requirements specified herein.

2. The paint manufacturer's instructions shall be observed at all times, with particular reference to storage, mixing, thinning, application and the time interval between paint coats.

3. The Contractor shall ensure that his shop and site personnel, have at all times, available for the Engineer copies of all above mentioned standard Specifications and the applicable manufacturer's instructions and data sheets.

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3.19.2 MATERIALS

3.19.2.1 GENERAL

Paints for the protective coating system shall be the product of a manufacturer, approved by the Engineer.

3.19.2.2 GENERAL PAINT SCHEDULE

1. Protective shop coating for metal works shall be as follows:

a. Primer: One (1) coat of red-based zinc chromate anti-corrosive paint 3 mils (76 microns) conforming to JIS K 5628 or approved equal.

b. Coating: Two (2) coats of anti-corrosive paint 6 mils conforming to JIS K 5621 or approved equal.

2. Protective shop coating for exposed general metal structures.

a. Primer: One (1) coat of red-lead zinc chromate anti-corrosive paint 3 mils (76 microns) conforming to JIS K 5628 or approved equal.

b. Coating: Two (2) coats of anti-corrosive paint for general use 6 mils conforming to JIS K 5621 or approved equal.

c. Color: As shown on the Drawings or as requested by the Engineer.

3. Cement Mortar Wall and Wood as shown on the Drawings or as directed by the Engineer shall be painted with one coat of linseed oil and two coats of oil paint of approved quality.

4. Equipment

- a. Paint Mixers: Mechanical mixers shall be employed for all paint mixing operations, except that the Engineer may allow hand mixing of small quantities at his discretion.
- b. Compressed air supply for blast cleaning and paint spraying shall be adequate in pressure and volume.

3. 19. 3 EXECUTION

- 1. Steel surface shall be cleaned in accordance with the approved method as described below:

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- a. All ground welds, burrs and sharp surface projection shall be ground smooth and all weld splatter shall be removed prior to blast cleaning.
- b. The grit size shall be 20-40 mesh Ottawa Fint Silica or equivalent. Grit or shot blasting which obtain the desired profile and degree of cleaning are also acceptable.
- c. Blast cleaning operations shall not be conducted on surfaces that will be wet after blasting and before coating, or when the surfaces are less than 10°C above degree points, or when the relative humidity of the air is greater than 95 percent.
- d. Any oil grease, soil, dust or other foreign matter deposited on the cleaned surfaces shall be removed prior to painting. In the event that rusting occurs after completion of the surface preparation, the surfaces shall be cleaned again in accordance with the specified method.
- e. Particular care shall be taken to prevent contamination of cleaned surfaces with the salt, acids, alkali or other corrosive chemicals before the application of the paint. Such contamination shall be removed from the cleaned surface by flash blasting and the paint applied immediately.
- f, Care shall be taken to prevent contamination of cleaned and painted surfaces by cleaning operations in an adjacent area.
- g. Surfaces not included to be painted shall be suitably protected from the effects of cleaning and painting operation.

- 2. All loose mill scaled and all loose or non-adherent rust and all loose paint, shall be removed by one or more of the following methods; but large areas of tight, well adhered paint, even though they may be removable, shall be removed only if specified. The methods for such removal are:

- a. Power wire brushing using rotary radial or cup brushes of suitable size, entering all accessible openings, angles, joints, and corners. The steel wire of such brushes shall have sufficient rigidity to clean the surface. Brushes shall be kept free of excess foreign matter, and shall be discarded shall be cleaned but not burnished to a detrimental degree.
- b. Power impact tool cleaning using power driven needle guns, chipping or scaling hammers, scalers, or other similar impact cleaning tools. Cutting edges of such tools shall be kept in effective condition.

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- c. Power grinding using abrasive wheels or power sanding using

abrasive materials. Sanding or abrasive materials shall be discarded when they become ineffective.

3. Mill scale, rust and paint are classified as "loose mill scale", "loose and non-adherent rust," and "loose" or "removable paint" if they can be removed from a steel surface by power wire brushing using a commercial air or electric wire brushing machine operated at a speed under load of 3450 RPM and equipped with a 150 mm diameter cup brush, of double row knotted construction made of No. 20 gauge music wire (Osborn Manufacturing Company), Cleveland, Ohio, Brush No. 4503 or equal. The brush shall be held against the steel surface with a force of 35.2 kgs. And the rate of cleaning shall be 0.186 square meters of surface per minute. This test must be conducted on an area not previously brushed, scrapped, or sanded, but from which all detrimental stratified rust (rust-scale), oil and grease, if present, have been removed. This test establishes a standard for surface preparation and shall not be considered as establishing the production rate of cleaning.

4. Regardless of the method used for cleaning under this specification, the surface shall be cleaned at least as well as the surface resulting from the test as specified in this specification or to match the alternatively specified visual standard.

5. In preparing surfaces for repainting, all loose paint shall be removed. Thick edges of remaining old paint shall be feathered so that the repainted surface can have a smooth appearance. The remaining old paint shall have sufficient adhesion so that it cannot be lifted as a layer by inserting the blade of a dull putty knife under it.

6. All accessible weld flux and spatter shall be removed by blast cleaning or by power tools. Any remaining detrimental weld flux deposits shall be removed by blast cleaning, thorough power tool cleaning, or by washing with water or with phosphate solution as described in the approved standard specifications.

7. The accessible portions of all partially enclosed steel members shall be cleaned. On new work, areas which will be inaccessible after assembly shall be cleaned before assembly.

8. Rivet heads, cracks, crevices, gap joints, filler welds, and re-entrant angles shall be cleaned by the use of power wire brushes, needles, guns, sharp chisels used in chipping, scaling hammers, rotary grinders, or sanders, or by a combination of such tools.

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9. All tools shall be operated in such a manner that no burns or sharp ridges are left on the surface and no sharp ridges are left on the surface and no sharp cuts are made into the steel.

10. Areas inaccessible for cleaning by power tools but accessible for hand cleaning shall be cleaned by the approved methods.

11. After the aforesaid operations are completed, dust and other loose matter shall be removed from the surface. If detrimental amounts of grease or oil are still present, these areas shall be spot cleaned with solvent.

12. The pretreatment (if any), or the prime coat of paint shall be applied as soon as possible after cleaning and before further deterioration of the

surface occurs.

3.19.3.1 ALTERNATIVE SURFACE PREPARATION OF STEEL

1. The procedures required for the pickling process of steel surfaces prior to the application of Inorganic zinc coating shall consist of the following sequences of operations:

a. Pretreatment: Remove soil, drawing compounds, salts or other foreign matter (other than grease or oil) by brushing with stiff fiber or wire brushes or by scraping.

1. Deposits of oil grease shall be completely removed by solvent wiping the surface with rags or brushes soaked in solvent.

The final cleaning shall be done using clean solvent and clean rags or brushes to provide an oil-free surface.

2. An alternate method may be used where heavy deposits are removed by the above method, followed by vapor degreasing using stabilized chlorinated hydrocarbon solvents.

b. Acid Baths: The steel shall then be dipped into a solution of 5 - 6 percent sulphuric acid that is maintained at a temperature of 71 - 82°C until all rust and scale is removed. The required time for removal of rust and scale can vary from 5 - 32 minutes, depending on thickness of the steel.

c. Water Rinse: The steel is then rinsed in a fresh water tank maintained at a temperature of 38 - 60°C for a minimum time of two minutes to completely neutralize the steel surface.

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d. Caution: Prolonged immersion in the acid bath will caused smut deposit on the surface. Steel surfaces shall be examined prior to coating and, if surface is contaminated with smut, the surface shall be cleaned with rags.

e. Requirements: The maximum allowable concentration of dissolved iron content shall not exceed 5 percent in the sulphuric acid bath. Water rinse tanks shall contain only fresh water. The rinse tank shall be continuously supplied with fresh water and the total sulphate shall not exceed 0.1 percent by weight.

3.19.3.2 SURFACE PREPARATION OF WOOD

1. Wood surfaces shall be sanded to a fresh surface. Surface mould where present, shall be removed by washing, rubbing down and burning off as necessary. Oily timbers shall be swabbed with white spirt. Resinous exudation and large knots shall be removed and replaced with filler or knotting.

2. Parts of timber to be enclosed in walls shall always be primed unless already impregnated. Priming shall be brushed on and a minimum of two coats applied to end grain. When the priming paint is hard, all cracks, holds, open joints, etc. Shall be made good hard stopping and rubbed down with fine abrasive paper. Priming of joinery shall be applied only on site after the Engineer has approved such joinery and before it is fixed. For internal surfaces primer coats shall be carefully flatted.

3.19.3.3 MIXING AND THINNING

1. Mixing and thinning of paint shall be done in accordance with the manufacturer's printed instructions. The pot life of each paint as stated

by the manufacturer shall not be exceeded.

3.19.3.4 WEATHER CONDITION

1. The paint shall not be applied when the relative humidity is above 85 percent. The paint shall not be applied in rain, wind, fog, dust or mist.

3.19.3.5 APPLICATION

1. Paint shall be applied in accordance with the manufacturer's printed instructions.

2. The paint work crew shall be properly trained in the use of the paint materials specified herein. Paint shall not be applied by personnel who are not familiar with the paint and its application.

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3. Each coat of paint shall be applied as a continuous film of uniform thickness free of pores. Any thin spots or missed areas shall be repainted and permitted to dry before the following coat of paint is applied.

4. During the application of the paint care shall be taken to prevent all runs or sags. Should either occur, they shall be brushed out. Paint shall be worked into all crevices and corners.

5. If during the application of the paint, there appears faulty paint, i.e., in color, consistency, dry lime or quality of finish, then the work shall be stopped by the Contractor and the manufacturer consulted. The Contractor shall also notify the Engineer in writing. The responsibility for such action lies solely with the Contractor.

6. Areas where field welds are to be made shall not be painted within the 150 mm of the edges to be field welded.

7. After the application of each coat, the dry film thickness shall be checked by means of a micrometer or magnetic thickness gauge.

8. Paint that curls or lifts after application shall be removed and the area shall be cleaned and repaired in accordance with these Specifications.

3.19.3.6 TOUCH-UP PAINTING

1. Touch-up painting shall be done with the same paint as used for the original coat. The resulting minimum dry film thickness shall be the same as for the original coat.

2. Touch-up painting shall include cleaning and painting of field connections, welds and all damaged or defective paint and rusted areas.

3. During touch-up painting, only loose, cracked brittle or non-adherent paint shall be removed during cleaning. All exposed edges shall be feathered. Touch-up painting shall be performed in a manner which will minimize damage to sound paint. Rust spots shall be thoroughly cleaned and edges of the existing paint shall be scraped back to sound material.

3.19.3.7 DRYING

1. No primer or paint shall be forced dried under conditions which will cause cracking, wrinkling, blistering, formation of pores which would detrimentally affect the condition of the paint.

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2. No drier shall be added to the paint unless specified in the manufacturer's printed instructions.

3. Painted surfaces shall be protected from dust, dirt, and the elements of the weather until dry to the fullest extent practicable.

4. After drying, any areas of paint damaged from any cause shall be removed, the surface again prepared and then repainted with the same paint and to the same thickness as the undamaged areas.

3.19.3.8 HANDLING

1. Paint which is damaged in handling shall be scraped off the touched up with the same paint and in the same thickness as was previously applied to the damaged area at Contractor's expense.

2. Precautions shall be taken to minimize damage to paint films resulting from stacking for drying.

3.19.3.9 INSPECTION

1. All work and materials supplied under this specification shall be subject to inspection by the Engineer.

2. The Contractor shall correct such work or replace such material as is found defective under this Specification at his own expense.

3.19.3.10 MEASUREMENT AND PAYMENT

1. Measurement for painting of Port facilities is included in the individual work items of structural steel, navigation aids and fender system.

2. Painting of port facilities will not be measured for payment and all costs thereof shall be deemed to be included in other items of work.

3. Payment for painting of buildings shall be by the square meter at the contract unit price for the pay items as shown in the Bill of Quantities which includes all other related works as prescribed in this Section.

3.20 CERAMIC-FILLED LIQUID MEMBRANE

3.20.1 GENERAL

Work under this Contract shall be in accordance with Division 1 "General Requirements" of these Specifications and shall be applicable to this Section, whether herein referred to or not.

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3.20.1.1 SCOPE

This work covers all the following requirements regarding the application of a ceramic-filled liquid membrane on the surface of concrete deck in accordance with the dimensions shown on the Drawings.

3.20.1.2 DELIVERY AND STORAGE

The ceramic-filled liquid membrane shall be delivered in pre-measured containers of 15 liter pails (net material volume). The containers must be appropriately sealed and boxed to protect from spillage and exposure to the elements.

3.20.2 MATERIAL REQUIREMENTS

The ceramic-filled liquid membrane shall meet the following requirements in full. If required, a sample of the material in 3 pieces of 150 mm x 150 mm in shall be supplied to the Engineering for approval and retention for purposes of comparative testing.

3.20.2.1 PHYSICAL PROPERTIES

1. The ceramic-filled liquid membrane shall be a single component with a vehicle type of water based vinyl terpolymer matrix, 56% volume solids.

2. The material furnished under this specification shall be moisture resistant, UV resistant, non toxic and non flammable.

3. The material furnished under this specification when mixed and applied in accordance with the manufacturer's instruction, shall produce a high quality, durable, seamless and flexible membrane.

4. The ceramic-filled liquid membrane shall have a flat finish.
5. The DFT of the applied ceramic-filled membrane shall be at least 12 mils applied in two coats at 6 mils per coat.

3.20.2.2 MECHANICAL AND CHEMICAL PROPERTIES

The ceramic-filled liquid membrane supplier is required to certify that materials delivered will have to meet or exceed the following properties:

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Drying Time Typical 1 hour under normal ambient conditions

Elongation 230% (ASTM D 2370)

Fire Retardancy Does not support combustion (ASTM D 1360)

Standing Water

Atlas Cell Test-No blistering, debonding or water penetration after 1 month submerged and at 100% humidity.

1. Installation of the ceramic-filled liquid membrane shall be in accordance with the manufacturer's instructions and recommendations. Suppliers shall be required to provide detailed descriptions of their proposed installation procedure for each unit of the material. These descriptions shall include the following:

- a. Surface preparation techniques to insure effective adhesion of the membrane to various substrates.
- b. Application procedures of the membrane.
- c. Time and temperature conditions to be obtained in order to completely solidify and cure the membrane.

2. To facilitate Quality Assurance, each unit of the material delivered to site shall be clearly labeled on the box with the manufacturer's name, product name, and production batch number.

3. The ceramic-filled liquid membrane shall be manufactured by a reputable manufacturer who shall confirm in writing that their material meets or exceeds the specification required herein. Such written confirmation must be attached to the bid for the bid to receive consideration.

4. To ensure proper handling and installation, each unit of the material shall have a Material Safety Data Sheet and installation Instructions Manual attached inside the carton/box

5. The Engineer reserves the right to sample and inspect the delivered materials for individual quality testing at the contractor's expense. Materials not meeting the manufacturer's certified values will be rejected.

3.20.2.3 WARRANTY

1. Manufacturer must submit a warranty for the ceramic-filled membrane against manufacturing defects for a period of one (1) year from the date of original purchase.

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2. Approved bidders must submit a warranty for all applications for no less than a one (1) year period for the installation of the materials.

3. 20. 3 MEASUREMENT AND PAYMENT

The quantity of waterproofing works shall be measured by the area of waterproofing in square meters including cement or concrete leveling and

topping (if required) , installed, completed and accepted by the Engineer. The quantity determined above shall be the basis of payment of the unit price for the pay items shown in the Bill of Quantities which price and payment shall be the full compensation for furnishing all materials, labor, equipment, tools and other incidentals necessary including tests to complete the waterproofing work, accepted and certified for payment by the Engineer.

3. 21 SLIP RESISTANT SYSTEM FOR ROLL-ON/ROLL-OFF CONCRETE RAMP

3. 21. 1 GENERAL

Work under this Contract shall be in accordance with Division 1 "General Requirements" of these Specifications and shall be applicable to this Section, whether herein referred to or not.

3.21.1.1 SCOPE

This work covers all the following requirements regarding the application of a slip/skid resistant system on the concrete RO-RO ramp in accordance with the dimensions shown in the drawings.

3.21.1.2 DELIVERY AND STORAGE

1. The polymer composite structural adhesive shall be delivered in premeasured containers of 5 kg units (net material weight). The containers must be appropriately sealed and boxed to protect from spillage and exposure to the elements. The Base component and activator component shall be packaged in separate and differently sized metal containers. The containers shall be packaged together in a cardboard carton.

2. The metallic oxide aggregates shall be delivered in pre-weighed 25 kg bags.

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3. 21. 2 MATERIAL REQUIREMENTS

3.21.2.1 GENERAL

The slip/skid resistant system shall meet the following requirements in full. If required, a sample of the material on a concrete block 150 mm x 150 mm shall be supplied to the Engineer for approval and retention for purposes of comparative testing.

3.21.2.2 PHYSICAL PROPERTIES

1. The slip/skid resistant system shall be composed of a polymer composite structural adhesive and metallic oxide aggregates.
2. The polymer composite structural adhesive shall be a two-component, 100% solids material comprised of a Base component and an activator component.
3. The polymer composite structural adhesive material furnished under this specification shall be of high molecular weight polymer base.
4. The polymer composite structural adhesive shall consist of a DGEBA polymer Base and an amidoamine Activator.
5. The polymer composite structural adhesive material furnished under this specification when mixed and applied in accordance with the manufacturer's instructions, shall produce a corrosion resistant, highly durable, waterproof bonding agent between the cured concrete and aggregates.
6. The polymer composite structural adhesive must be free of harmful

odors that could damage the environment as well as the personnel handling the application or installation.

7. The metallic oxide aggregates furnished under this specification shall be of grit size between # 16 to # 24.

8. The cured slip/skid resistant system shall be resistant to permanent immersion in sea water and shall be impervious to water. The manufacturer shall certify in writing that exposure of the cured material to such working environments will not affect its adhesive properties and corrosion resistance.

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3.21.2.3 MECHANICAL AND CHEMICAL PROPERTIES

The polymer composite structural adhesive supplier is required to certify that materials delivered will have to meet or exceed the following properties:

Shelf life Indefinite

% Volatile Not Volatile

(zero evaporation rate)

Minimum Pot life 45 minutes

@25°C

Mixing Ratio (by volume)5(Base): 1 (Activator)

Direct Tensile Adhesion (ASTM D-4541):

Substrate Bond

Strength (psi) Failure Mode

Unblasted Carbon Steel 1,500 Stud and panel adhesive failure

Unblasted Stainless Steel 1,400 Stud and panel adhesive failure

Dry Concrete 400 Concrete cohesive failure

Damp Concrete 400 Concrete cohesive failure

3. 21. 3 EXECUTION

1. Installation of the slip/skid resistant system shall be in accordance with the manufacturer's instructions and recommendations. Supplier shall be required to provide detailed descriptions of their proposed installation procedure. These descriptions shall include the following:

a. Surface preparation techniques to insure effective adhesion of the system to the concrete

b. Mixing and installation of the polymer composite structural adhesive and metallic oxide aggregates.

c. Time and temperature conditions required to completely solidify and cure the system.

2. The polymer composite structural adhesive shall be manufactured by a reputable manufacturer who shall confirm in writing that their materials meets or exceeds the specifications required herein. Such written confirmation must be attached to the bid for the bid to receive consideration.

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3. To ensure proper handling and installation, each unit of the material shall have a Material Data Sheet and an installation / instruction manual inside the carton/box.

3. 21. 4 WARRANTY

1. Approved bidder must submit a warranty for all applications for no less than a one (1) year period for the installation of the anti-skid system.

3. 21. 5 MEASUREMENT AND PAYMENT

The quantity of the application of a slip/skid resistant system on the concrete Ro-Ro ramp shall be measured by the area in square meters installed, completed and accepted by the Engineer.

The quantity determined above shall be the basis of payment of the unit price for the pay items shown in the Bill of Quantities which price and payment shall be the full compensation for furnishing all materials, labor, equipment, tools and other incidentals necessary including tests to complete the application of slip/skid resistant system on the concrete Ro-Ro ramp, accepted and certified for payment by the Engineer.

3. 22 FORGED WELDED GRATINGS

3. 22. 1 GENERAL

Work under this Contract shall be in accordance with Division 1 "General Requirements" of these Specifications and shall be applicable to this Section, whether herein referred to or not.

3.22.1.1 SCOPE

This work covers all the following requirements regarding the manufacture and installation of steel gratings and steel angle frames in accordance with the lines, grades, and dimensions shown in the drawings.

3.22.1.2 DELIVERY AND STORAGE

1. The steel gratings and steel angle frames shall be delivered at site in matching sets with the manufacturer's brand name, inspections tags, and production number to facilitate site quality assurance.

2. Upon delivery at site from the manufacturer, the hot dip galvanized steel gratings shall not be subjected to the following activities:

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a. Re-fabrication

b. Cutting

c. Grinding

d. Welding

e. Drilling

f. Sawing

g. Any hot works or similar activities

3. The steel gratings and steel angle frames shall not be exposed to sea water and other corrosive chemicals or substances prior to installation.

3. 22. 2 MATERIAL REQUIREMENTS

3.22.2.1 GENERAL

The steel gratings and steel angle frames shall meet the following requirements in full. If required, a 1.0 linear meter x required load bar span dimension sample shall be supplied to the Engineer for approval and retention for purposes of comparative testing against materials randomly sampled from the site.

3.22.2.2 PHYSICAL PROPERTIES

1. The steel gratings shall be manufactured using the forge-welding process wherein the steel load bars and the twisted cross rods become homogenously unified through fusion.

2. Manually welded load bars to twisted cross rods shall be rejected.

3. The steel gratings and steel angle frames shall all be hot dip galvanized in accordance with international standards BS EN1460.

4. Painted steel gratings shall be rejected. Likewise, painted steel angle

frames shall be rejected.

5. The end-banding of the steel gratings shall be attached using the Metal Inert Gas (MIG) Welding Process. Likewise, steel angle frames shall be manufactured using the Metal Inert Gas (MIG) Welding Process.

6. The allowable tolerances on dimensions on the steel load bars shall not exceed the following:

a. Thickness - 0.2 mm

(i.e. for 5mm required load bar thickness, the allowable thickness is from 4.8 mm to above 5.0 mm only)

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b. Height - 0.5 mm

(i.e. for 65mm required load bar height, the allowable height is from 64.5 to above 65 mm only)

7. The allowable tolerances on dimensions on the twisted cross rods shall not exceed the following:

a. Thickness - 0.1 mm

(i.e. for 5.7mm required twisted cross rod, the allowable thickness is from 5.6 mm to above 5.7 mm only)

3.22.2.3 MECHANICAL PROPERTIES

The steel gratings supplier shall be required to submit test certificates for steel materials used in its manufacture; and for hot dip galvanizing which shall meet or exceed the following properties:

ASTM A36 Carbon Steel

Yield Strength Min 250 Mpa

Tensile Strength Min 400 Mpa

BS EN1460 Hot Dip Galvanizing

Minimum Coating Mass of 610 grams/sqm; or

Minimum Coating Thickness of 85 microns using the 5-Point

Elcometer Test

3. 22. 3 EXECUTION

Installation of the steel gratings and steel angle frames shall be in accordance with the manufacturer's instructions.

3. 22. 4 MEASUREMENT AND PAYMENT

1. Measurement of the total quantities of work completed under this section shall be per linear meter of steel gratings installed complete and accepted by the Engineer in compliance with the requirements as indicated on the Drawings and these Specifications.

2. The quantity determined above shall be the basis of payment of the unit price for the pay items shown in the Bill of Quantities which price and payment shall be the full compensation for furnishing all materials, labor, equipment, tools and other incidentals necessary including tests to complete the installation of forged welded gratings accepted and certified for payment by the Engineer.

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3. 23 CORROSION PROTECTION CLADDING FOR STEEL POLE

3. 23. 1 GENERAL

Work under this Contract shall be in accordance with Division 1 "General Requirements" of these Specifications and shall be applicable to this Section, whether herein referred to or not.

3.23.1.1 SCOPE

This work covers all the following requirement regarding the application of a corrosion resistant cladding material on the outside surface of floodlight steel pole in accordance with the dimensions shown ion the drawings.

3.23.1.2 DELIVERY AND STORAGE

The cladding material shall be delivered in pre-measured containers of 5kg units (net material weight). The containers must be appropriately sealed and boxed to protect from spillage and exposure to the elements. The Base component and activator component shall be packaged in separate and differently sized metal containers. The containers shall be packaged together in a cardboard carton.

3. 23. 2 MATERIAL REQUIREMENTS

3.23.2.1 GENERAL

The corrosion resistant cladding material shall meet the following requirement in full. If required, a sample of the material in 3 pieces of steel plate 150 mm x 150 mm shall be supplied to the Engineer for approval and retention for purposes of comparative testing.

1. PHYSICAL PROPERTIES

- a. The corrosion resistant cladding material shall be made of a twocomponent, 100% solids reinforced polymer composite system comprising of a Base component and an Activator component.
- b. The material furnished under this specification shall be of high molecular weight polymer base reinforced with abrasion resistant non-metallic fillers.
- c. The material furnished under this specification when mixed and applied in accordance with the manufacturer's instructions, shall produce a high quality metal resurfacing and protection application.
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- d. The cladding material shall be of Diglycidyl Ether Bisphenol A (DGEBA) Polymer Base.
- e. The cladding material shall have a smooth, high gloss finish.
- f. The cladding material must be highly resistant to damage against exposure to sea water/breeze. The manufacturer shall certify in writing that exposure of the material to such working environment will not affect its adhesive properties and corrosion resistance.
- g. The cladding material must be free of harmful odors that could damage the environment as well as the personnel handling the application or installation.
- h. The DFT of the applied cladding material shall be between 300 microns and 400 microns.

2. MECHANICAL AND CHEMICAL PROPERTIES

The corrosion resistant cladding material supplier is required to certify that materials delivered will have to meet or exceed the following properties:

Mixed Density 1.28 grams per cc

Shelf Life Indefinite

% Volatile Not Volatile

(zero evaporation rate)

Minimum Working Life 55 minutes

@30°C

Mixing Ratio (by volume) 5 (Base): 2(Activator)

Tensile Shear Adhesion (ASTM D-1002):

Steel 259kg/cm²

Stainless Steel 245 kg/cm²

3. 23. 3 EXECUTION

1. Installation of the corrosion resistant cladding material shall be in accordance with the manufacturer's instructions and recommendations. Suppliers shall be required to provide detailed descriptions of their proposed installation procedure for each unit of the cladding material.

These descriptions shall include the following:

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a. Surface preparation techniques to insure effective adhesion of the cladding material to various substrates including: steel, aluminum, copper, brass, bronze, cast iron, pvc, fiberglass, plastics, glass, wood, etc.

b. Mixing and Application of the cladding material.

c. Time and temperature conditions to be obtained in order to completely solidify and cure the cladding material.

2. To facilitate Quality Assurance, each unit of the material delivered to site shall be clearly labeled on the box with the manufacturer's name, product name and production batch number.

3. The corrosion resistant cladding material shall be manufactured by a reputable manufacturer who shall confirm in writing that their material meets or exceeds the specifications required herein. Such written confirmation must be attached to the bid for the bid to receive consideration.

4. To ensure proper handling and installation, each unit of the material shall have a Material Safety Data Sheet and installation Instructions Manual attached inside the carton/box.

5. The Engineer reserves the right to sample and inspect the delivered materials for individual quality testing at the contractor's expense. Materials not meeting the manufacturer's certified values will be rejected.

3. 23. 4 WARRANTY

1. Manufacturer must submit a warranty for the corrosion resistant cladding material against manufacturing defects for a period of one (1) year from the date of original purchase.

2. Approved bidder must submit a warranty for all applications for no less than a one (1) year period for the installation of the material.

3. 23. 5 MEASUREMENT AND PAYMENT

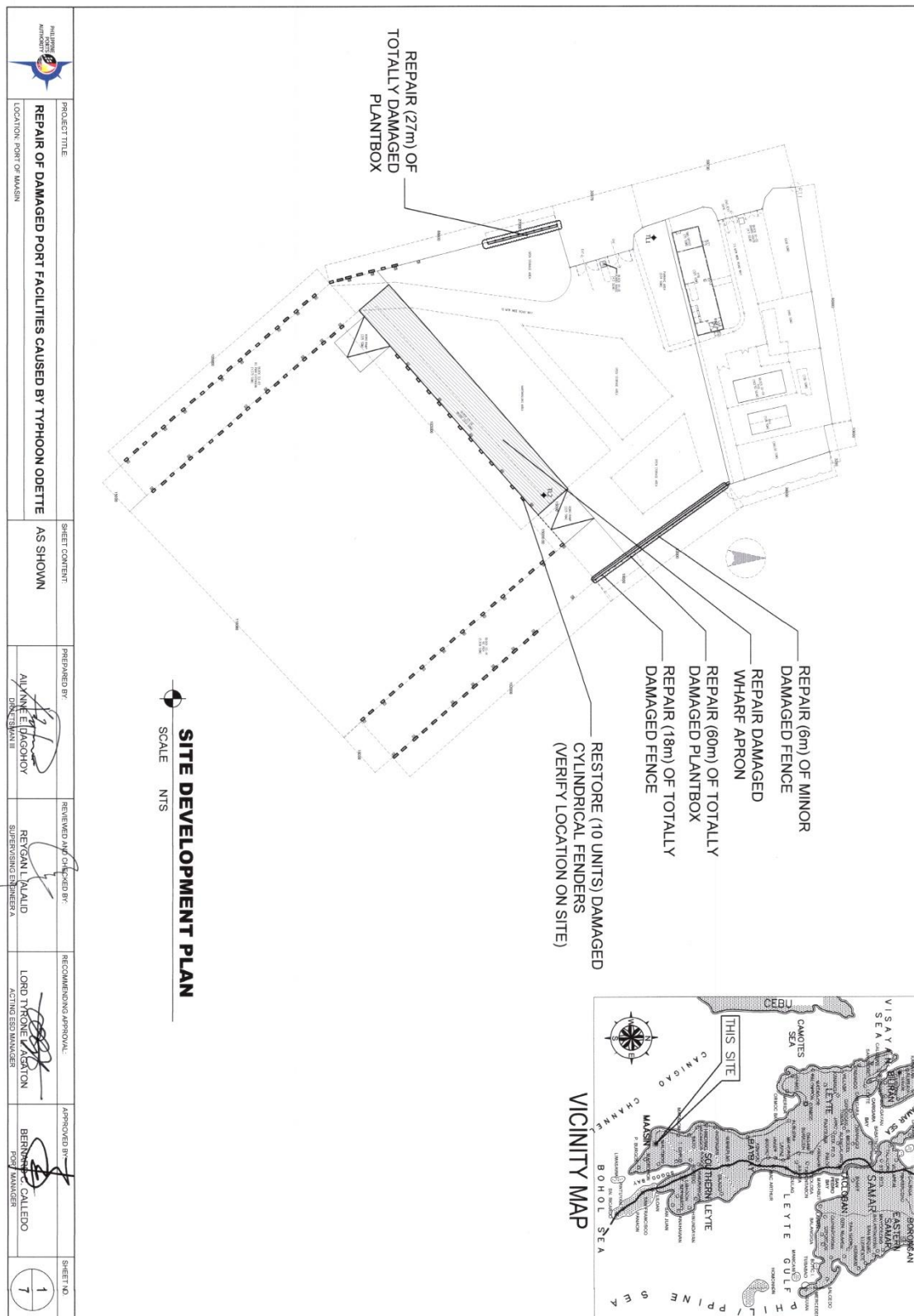
1. Measurement of the total quantities of work completed under this section shall be per square meter of the application of a corrosion resistant cladding material on the outside surface of floodlight steel pole cladding, installed complete and accepted by the Engineer in compliance with the requirements as indicated on the Drawings and these Specifications.

2. The quantity determined above shall be the basis of payment of the unit price for the pay items shown in the Bill of Quantities which price and payment shall be the full compensation for furnishing all materials,

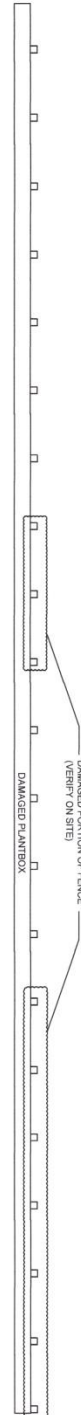
labor, equipment, tools and other incidentals necessary to complete the installation of corrosion resistant cladding material on the outside surface of floodlight steel pole accepted and certified for payment by the Engineer.

Section VII. Drawings

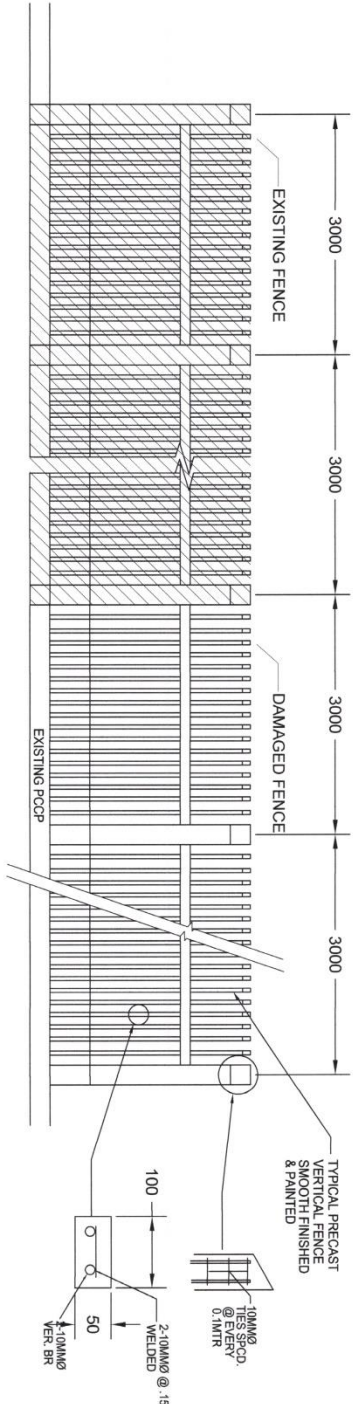
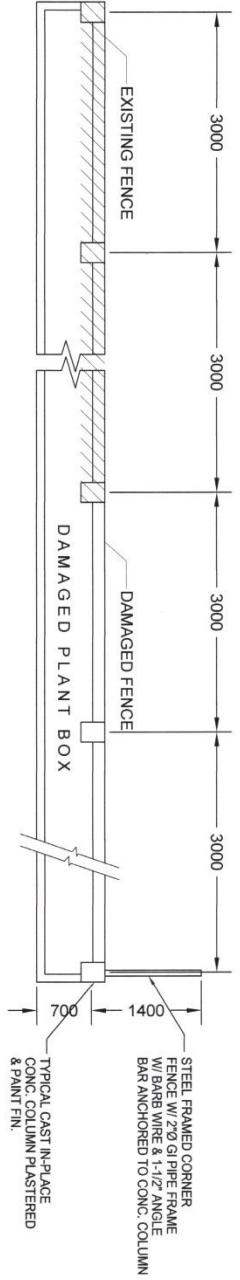
[Insert here a list of Drawings. The actual Drawings, including site plans, should be attached to this section, or annexed in a separate folder.]



	PROJECT TITLE: REPAIR OF DAMAGED PORT FACILITIES CAUSED BY TYPHOON ODETTE	SHEET CONTENT: AS SHOWN	PREPARED BY: ALYXINE E. DINGCOHOY CONSULTANT II	REVIEWED AND CHECKED BY: REYDAN L. MALUD SUPERVISING ENGINEER A	RECOMMENDING APPROVAL: LORD TYRONE L. GASTON ACTING ESD MANAGER	APPROVED BY: BERNARD CALLEDO PORT MANAGER	SHEET NO. 1 7
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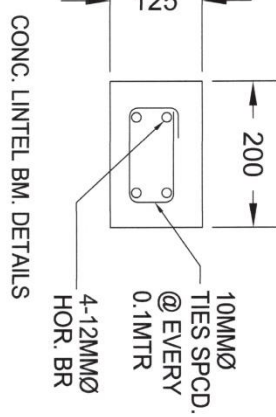
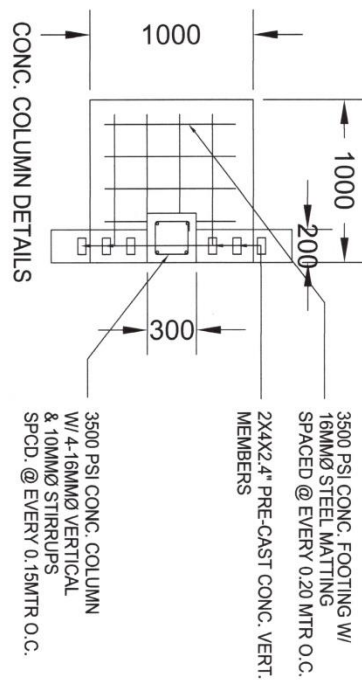
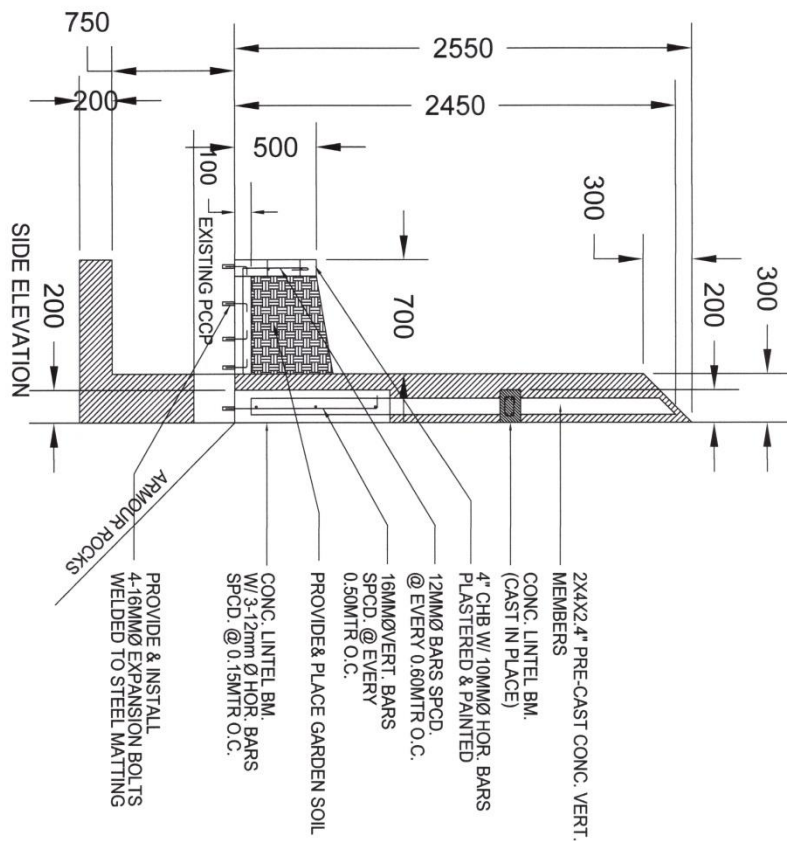


FENCE PLAN
SCALE NTS



FENCE TYPICAL ELEVATION
SCALE 1:50

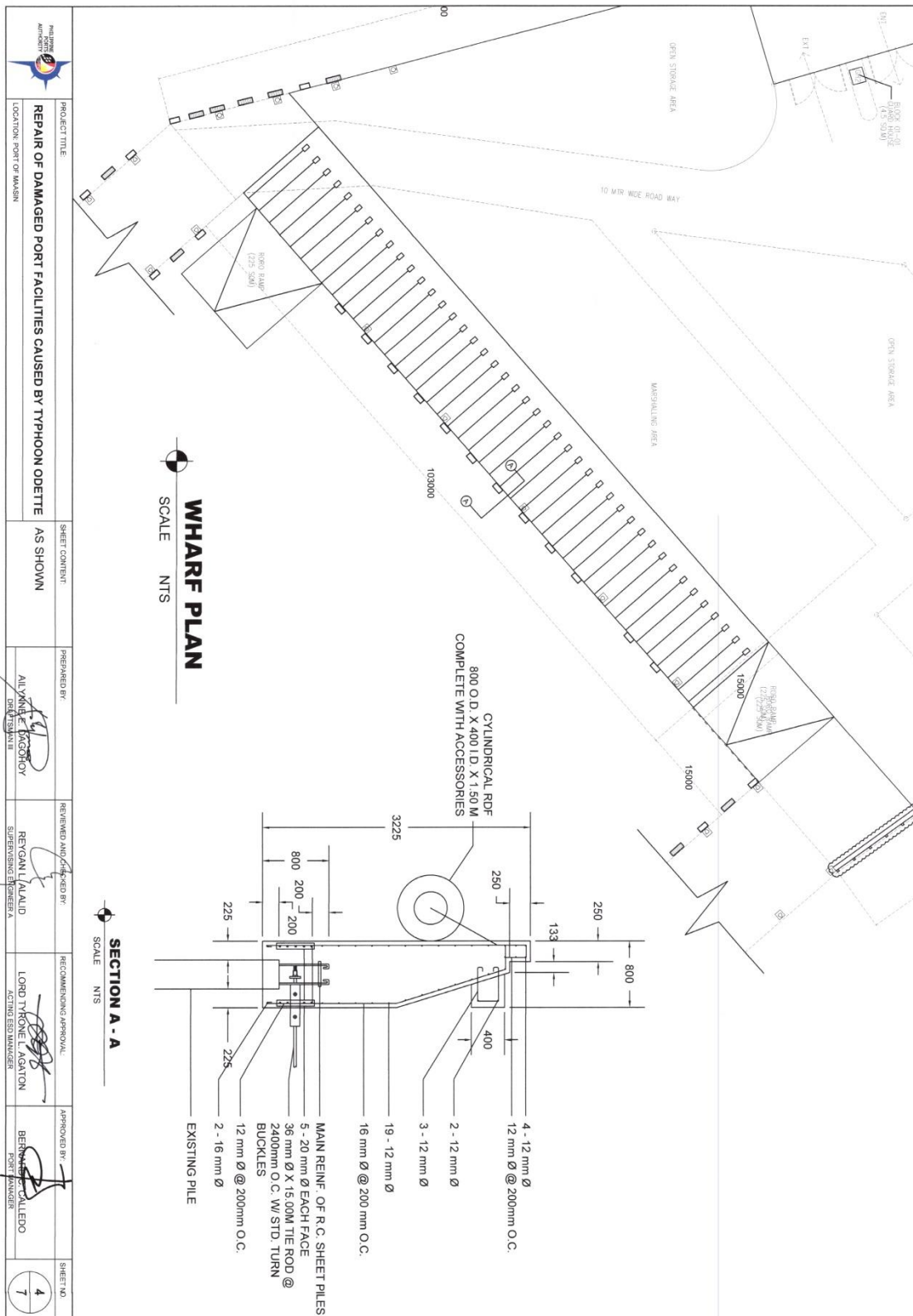
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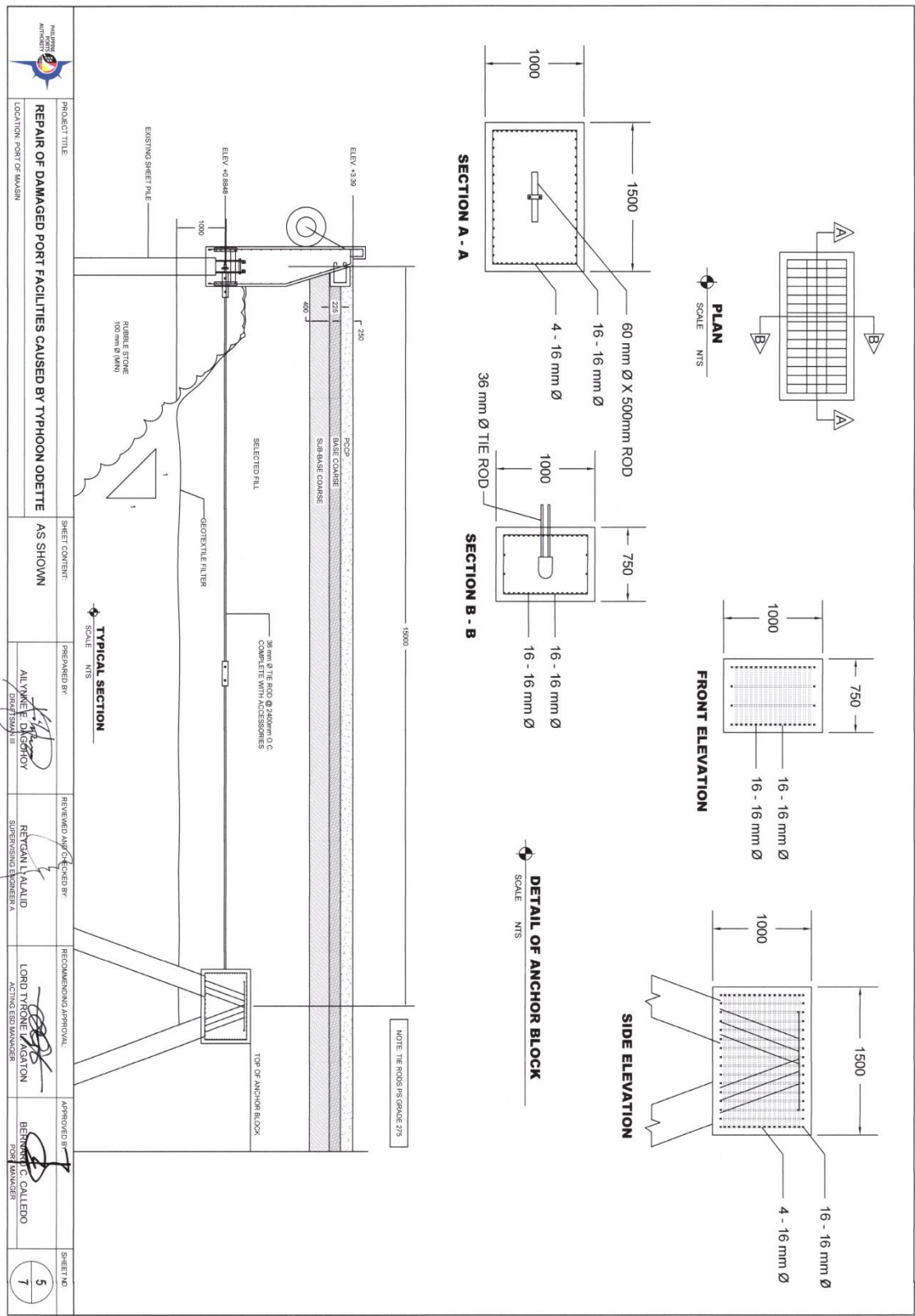


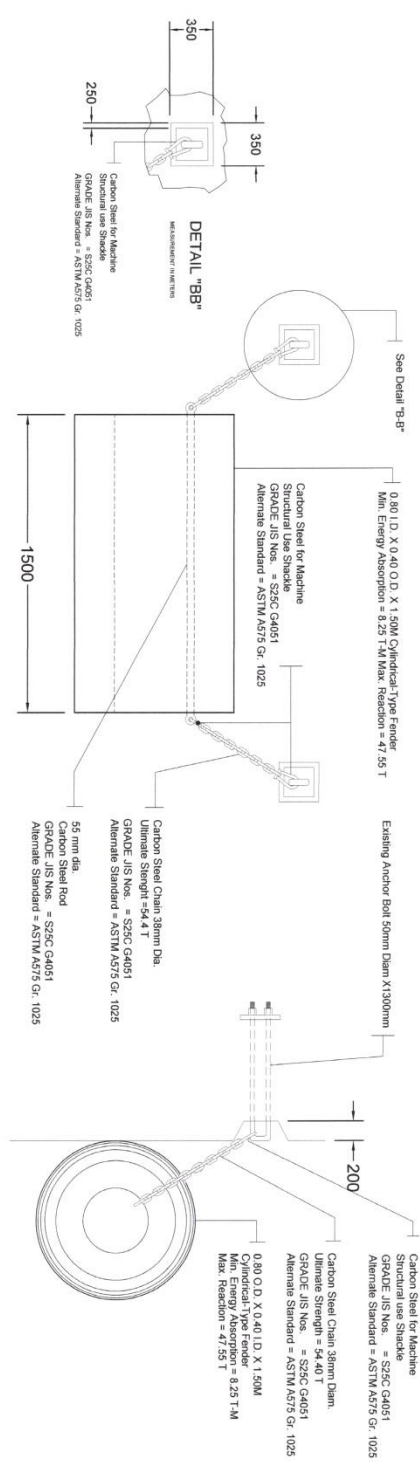
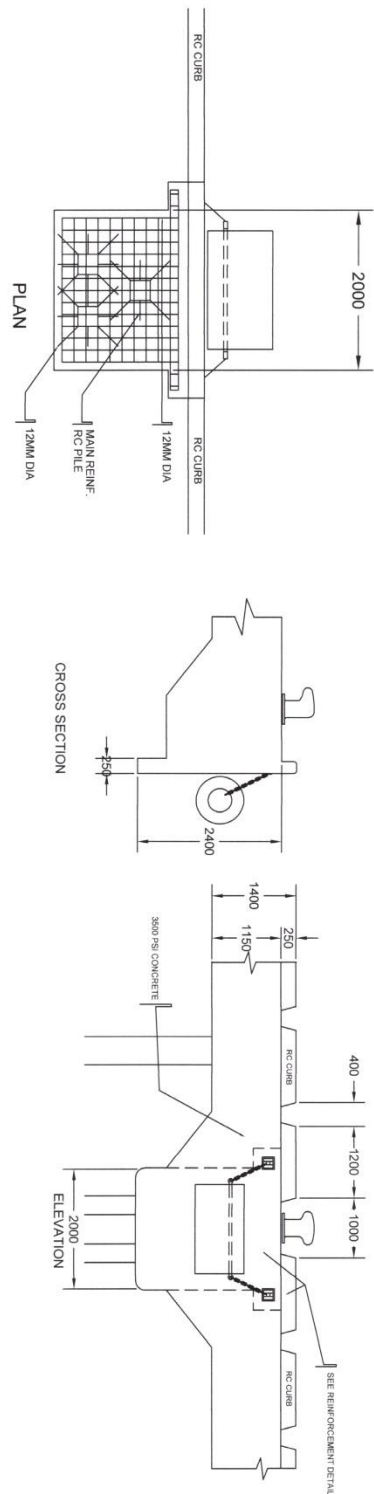
COLUMN AND LINTEL BEAM DETAILS

SCALE NTS

	PROJECT TITLE REPAIR OF DAMAGED PORT FACILITIES CAUSED BY TYPHOON ODETTE LOCATION: PORT OF MASIN	SHEET CONTENT AS SHOWN	PREPARED BY ALLAN E. MACABOY DRAWING MAN III	REVIEWED AND CHECKED BY REVGAN L. ALALID SUPERVISING ENGINEER A	RECOMMENDING APPROVAL LORD TYRONE AGATON ACTING ESO MANAGER	APPROVED BY BERNARD T. TALLEDO PORT MANAGER	SHEET NO. 3 7
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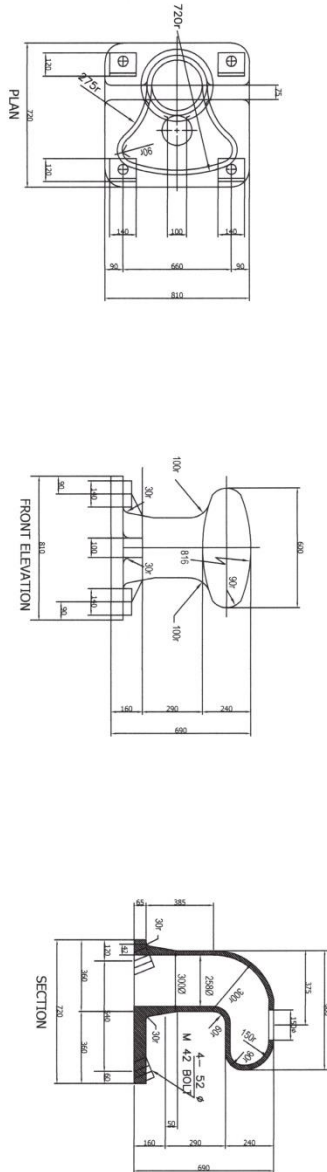
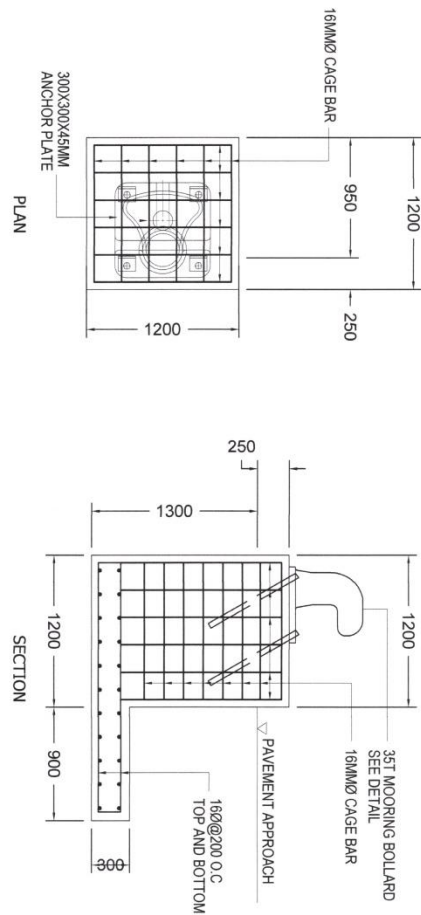






DETAIL OF 0.40 m X 0.80 m X 1.50 m CYLINDRICAL FENDER

	PROJECT TITLE: REPAIR OF DAMAGED PORT FACILITIES CAUSED BY TYPHOON ODETTE	SHEET CONTENT: AS SHOWN	PREPARED BY: ALYANNE D. GONZALEZ	REVIEWED AND CHECKED BY: REYDAN L. ANILLO	RECOMMENDING APPROVAL: LORD TYRONE L. AGOSTON	APPROVED BY: BENJAMIN C. CALLEDO	SHEET NO. 6
LOCATION: PORT OF MAJIN							7



35 TONS TEE HEAD BOLLARD CONNECTION DETAIL

SCALE: NTS

PROJECT TITLE:	SHEET CONTENT:	PREPARED BY:	REVIEWED AND CHECKED BY:	RECOMMENDING APPROVAL:	APPROVED BY:	SHEET NO.
REPAIR OF DAMAGED PORT FACILITIES CAUSED BY TYPHOON ODETTE	AS SHOWN	ALYANNE DORRHOY	REYCAN L. ALALID	LORD TYHON L. GATON	BERNARDO CALLEDO	7
LOCATION: PORT OF MAJIN		DRAFTSMAN II	SUPERVISING ENGINEER A	ACTING ESD MANAGER	PORT MANAGER	

Section VIII. Bill of Quantities

Notes on the Bill of Quantities

Objectives

The objectives of the Bill of Quantities are:

- a. to provide sufficient information on the quantities of Works to be performed to enable Bids to be prepared efficiently and accurately; and
- b. when a Contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, Works should be itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities should be as simple and brief as possible.

Daywork Schedule

A Daywork Schedule should be included only if the probability of unforeseen work, outside the items included in the Bill of Quantities, is high. To facilitate checking by the Entity of the realism of rates quoted by the Bidders, the Daywork Schedule should normally comprise the following:

- a. A list of the various classes of labor, materials, and Constructional Plant for which basic daywork rates or prices are to be inserted by the Bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a daywork basis.
- b. Nominal quantities for each item of Daywork, to be priced by each Bidder at Daywork rates as Bid. The rate to be entered by the Bidder against each basic Daywork item should include the Contractor's profit, overheads, supervision, and other charges.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the SCC should state the manner in which they will be used, and under whose authority (usually the Procuring Entity's Representative's).

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by other contractors should be indicated in the relevant part of the Bill of Quantities as a particular provisional sum with an appropriate brief description. A separate procurement procedure is normally carried out by the Procuring Entity to select such specialized contractors. To provide an element of competition among the Bidders in respect of any facilities, amenities, attendance, etc., to be provided by the successful Bidder as prime Contractor for the use and convenience of the specialist contractors, each related provisional sum should be followed by an item in the Bill of Quantities inviting the Bidder to quote a sum for such amenities, facilities, attendance, etc.

Signature Box

A signature box shall be added at the bottom of each page of the Bill of Quantities where the authorized representative of the Bidder shall affix his signature. Failure of the authorized representative to sign each and every page of the Bill of Quantities shall be a cause for rejection of his bid.

These Notes for Preparing a Bill of Quantities are intended only as information for the Procuring Entity or the person drafting the Bidding Documents. They should not be included in the final documents.

Bill of Quantities

REPAIR OF DAMAGED PORT FACILITIES CAUSED BY TYPHOON ODETTE, PORT OF MAASIN SO., LEYTE

Item No.	Description	Quantity	Unit	Unit Price (Pesos)	Amount (Pesos)
I.	GENERAL EXPENSES				
I.1	<u>Mobilization, Demobilization and Clean-up of Site</u> (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	1.00	lot		
II.	<u>SAFETY, HEALTH AND ENVIRONMENTAL PROGRAM</u>				
II.1	Provide Environmental Safety and Health Program (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	1.00	lot		
III	RETAINING WALL WITH ANCHOR TIE RODS				
III.1	Demolition and Disposal of Damaged Existing Structures Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	386.25	Cu.m		
III.2	Supply and Installation of Steel Reinforcements (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	23,895.97	Kgs		

Submitted by:

Name of the Representative of the bidder Date:

Position

Name of the Bidder

III.3	Supply, Installation and Removal of Formworks (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	1,017.27	Sq.m		
III.4	Supply, Place and Compaction of 4000 psi Concrete (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	281.39	Cu.m		
III.5	Supply and Installation of Geotextile Filter Fabric (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	2,060.00	Sq.m		
III.6	Removal and Replacement of Anchor Tie Rods (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	40.00	Unit		
III.7	Supply and Installation of Rubble Stone (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	257.50	Cu.m		
IV	CONCRETE APRON				
IV.1	Demolition and Disposal of Damaged Existing Structures (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	386.25	Cu.m		

IV.2	Supply, Excavation, Backfilling, Spreading and Compaction of Granular Fill, Sub Base and Base Course (Pesos _____ _____ <i>Amount in Words</i> _____ and _____ centavos)	5,098.50	Cu.m		
IV.3	Supply, Place and Compaction of 4000 psi Concrete (Pesos _____ _____ <i>Amount in Words</i> _____ and _____ centavos)	1,545.00	Sq.m		
V	<u>CONCRETE FENCE WITH PLANT BOX</u>				
V.1	<u>Demolition and Disposal of Damaged Existing Structures</u> (Pesos _____ _____ <i>Amount in Words</i> _____ and _____ centavos)	4.76	Cu.m		
V.2	<u>Excavation and Backfilling Works</u> (Pesos _____ _____ <i>Amount in Words</i> _____ and _____ centavos)	6.65	Cu.m		
V.3	<u>Supply and Installation of Steel Reinforcements</u> (Pesos _____ _____ <i>Amount in Words</i> _____ and _____ centavos)	1,644.22	Kgs		
V.4	<u>Supply, Installation and Removal of Formworks</u> (Pesos _____ _____ <i>Amount in Words</i> _____ and _____ centavos)	155.72	Sq.m		

V.5	Supply, Place and Compaction of 4000 psi Concrete (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	20.89	Cu.m		
V.6	Supply and Installation of CHB (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	44.90	Sq.m		
V.7	Supply and Application of Paints for Fences and Plant Box (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	203.01	Sq.m		
VI.	SECURITY BARRICADE FENCE				
VI.1	Excavation Works (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	39.60	Cu.m		
VI.2	Breaking and Disposal of Pavement for Security Fence Foundation (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	9.90	Cu.m		
VI.3	Supply, Installation and Painting of Security Barricade Fence including Concrete Gutters (Pesos _____ _____ <i>Amount in Words</i> and _____ centavos)	110.00	Ln.m		

VI.4	Supply of Sprigs and Sods (Plants & Soil) for Landscape along Barricade Fence (Pesos _____ _____ <u>Amount in</u> <u>Words</u> and _____ centavos)	62.70	Sq.m		
VII	MOORING AND FENDERING SYSTEM				
VII.1	Removal and Turn Over of RDF and Bollards at Wharf (Pesos _____ _____ <u>Amount in</u> <u>Words</u> and _____ centavos)	11.00	Units		
VII.2	Supply and Installation of Steel Reinforcements for Mooring Blocks (Pesos _____ _____ <u>Amount in</u> <u>Words</u> and _____ centavos)	500.80	Kgs		
VII.3	Supply, Place and Compaction of 3500 psi Concrete for Mooring Blocks (Pesos _____ _____ <u>Amount in</u> <u>Words</u> and _____ centavos)	15.30	Cu.m		
VII.4	Supply, Delivery and Installation of Cylindrical Rubber Dock Fenders (Pesos _____ _____ <u>Amount in</u> <u>Words</u> and _____ centavos)	10.00	Units		

VII.5	Re-Installation of Mooring Bollard and Rubber Dock Fender (Pesos _____ _____ <i>Amount in</i> <i>Words</i> _____ and _____ centavos)	8.00	Units		
TOTAL:					

Submitted by:

Name of the Representative of the Bidder _____ Date: _____
Position
Name of the Bidder

Section IX. Checklist of Technical and Financial Documents

Notes on the Checklist of Technical and Financial Documents

The prescribed documents in the checklist are mandatory to be submitted in the Bid, but shall be subject to the following:

- a. GPPB Resolution No. 09-2020 on the efficient procurement measures during a State of Calamity or other similar issuances that shall allow the use of alternate documents in lieu of the mandated requirements; or
- b. any subsequent GPPB issuances adjusting the documentary requirements after the effectivity of the adoption of the PBDs.

The BAC shall be checking the submitted documents of each Bidder against this checklist to ascertain if they are all present, using a non-discretionary “pass/fail” criterion pursuant to Section 30 of the 2016 revised IRR of RA No. 9184.

Checklist of Technical and Financial Documents

I. TECHNICAL COMPONENT ENVELOPE

Class “A” Documents

Legal Documents

- ☐ (a) Valid PhilGEPS Registration Certificate (Platinum Membership) (all pages) in accordance with Section 8.5.2 of the IRR;

Technical Documents

- ☐ (b) Statement of the prospective bidder of all its ongoing government and private contracts, including contracts awarded but not yet started, if any, whether similar or not similar in nature and complexity to the contract to be bid; **and**
- ☐ (c) Statement of the bidder’s Single Largest Completed Contract (SLCC) similar to the contract to be bid, except under conditions provided under the rules; **and**
- ☐ (d) Special PCAB License in case of Joint Ventures; **and** registration for the type and cost of the contract to be bid; **and**
- ☐ (e) Original copy of Bid Security. If in the form of a Surety Bond, submit also a certification issued by the Insurance Commission; **or**
Original copy of Notarized Bid Securing Declaration; **and**
- ☐ (f) Project Requirements, which shall include the following:
 - ☐ a. Organizational chart for the contract to be bid;
 - ☐ b. List of contractor’s key personnel (e.g., Project Manager, Project Engineers, Materials Engineers, and Foremen), to be assigned to the contract to be bid, with their complete qualification and experience data;
 - ☐ c. List of contractor’s major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership or certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be; **and**
- ☐ (g) Original duly signed Omnibus Sworn Statement (OSS); **and** if applicable, Original Notarized Secretary’s Certificate in case of a corporation, partnership, or cooperative; or Original Special Power of Attorney of all members of the joint venture giving full power and authority to its officer to sign the OSS and do acts to represent the Bidder.

Financial Documents

- ☐ (h) The prospective bidder’s computation of Net Financial Contracting Capacity (NFCC).

Class “B” Documents

- ☐ (i) If applicable, duly signed joint venture agreement (JVA) in accordance with RA No. 4566 and its IRR in case the joint venture is already in existence; **or**
duly notarized statements from all the potential joint venture partners stating

that they will enter into and abide by the provisions of the JVA in the instance that the bid is successful.

II. FINANCIAL COMPONENT ENVELOPE

- ☐ (j) Original of duly signed and accomplished Financial Bid Form; **and**

Other documentary requirements under RA No. 9184

- ☐ (k) Original of duly signed Bid Prices in the Bill of Quantities; **and**
- ☐ (l) Duly accomplished Detailed Estimates Form, including a summary sheet indicating the unit prices of construction materials, labor rates, and equipment rentals used in coming up with the Bid; **and**
- ☐ (m) Cash Flow by Quarter.

