# SITE WORKS

## 1.0 MOBILIZATION & DEMOBILIZATION

### 1.1.1 GENERAL

Work under this Contract shall be in accordance with the terms and conditions stipulated in the Conditions of Contract and Section 1 "General Requirements" of these Specifications and shall apply to this Section whether herein referred to or not.

### 1.1.2 SCOPE OF WORK

This Section includes mobilization, demobilization, assembly and disassembly of equipment/plants including incidentals necessary to complete the work.

### 1.1.3 MOBILIZATION

a) The Contractor shall mobilize and put into operation all equipment and plants required to undertake the Contract.

b) Mobilization shall include the transferring to the job-sites of all equipment, plants, supplies and materials, personnel, and all items necessary for the execution and completion of the work, and shall also include the setting up of all equipment, instruments and all other plants until rendered operable, subject to the confirmation of the Engineer.

c) Sufficient supply of spares for the equipment and plants shall be carried on-site. Equipment/plants encountering breakdowns must be repaired on site by the most expeditious method possible at no cost to the Procuring Entity. In the event that the equipment/plants call for major repair works that cannot be undertaken at the site, the Contractor shall replace such equipment/plants with equal or better performance capacity at no additional mobilization costs to the Procuring Entity and the Contractor shall not be entitled to any time extension.

### 1.1.4 DEMOBILIZATION

Demobilization upon request of the Contractor and approved by the Engineer, shall include the following:

The dismantling, preparation and loading for removal and shipment of all Contractor's plant, equipment and personnel at each site after completion of the works.

## 2.0 CONSTRUCTION PHOTOGRAPHS

a) Provide record progress photographs taken at a fixed point and angle as, when and where directed by the Engineer at intervals of not more than ten (10) days. The photographs shall be sufficient in number and location to record the exact progress of works. The Contractor shall provide the Engineer all the photographs stored in CDs- properly labeled. Billing photographs shall be in 4R size with corresponding billboard indicating the name of the project and location, bill number, item number, name of the person taking the photograph, date taken and the on-going activity.

## 3.0 MONTHLY PROGRESS REPORT

a) The Contractor shall maintain a daily log describing the important events pertaining to the Works, the working hours, the number of laborers employed, effective operation time of equipment, overtime hours, delays due to meteorological and maritime conditions, lack of labor, materials or equipment, progress made including those for dredging and reclamation works, and instructions, notifications and recommendations made by the Engineer.

## 4.0 AS-BUILT DRAWINGS AND FINAL CONSTRUCTION REPORT

Within thirty (30) calendar days after the issuance of the Taking Over Certificate, the Contractor shall prepare and as-built drawings and a final construction report as draft. And within thirty (30) calendar days after the issuance of the Taking Over Certificate, the Contractor shall submit the Final Construction Report and Final As-Built drawings.

## 5.0 DEMOLITION WORK

### 5.1.1 DESCRIPTION

This section shall be applied to the demolition work of existing port structures as indicated on the Drawings.

### 5.1.2 GENERAL PROVISIONS

a) The Contractor shall be deemed to have satisfied himself of the site conditions, and to have included in his unit prices provision for all risks that may arise during or in connection with the work.

b) The demolition work shall be carried out by approved methods and equipment such as concrete breakers, gas-cutters, hydraulic jacks, compressed air disintegrators. Etc., however, no blasting shall be used unless approved in writing by the Engineer and after obtaining the written permission of the concerned Authorities.

c) The Contractor shall provide suitable equipment, skilled labor and appropriate temporary works such as scaffoldings to ensure safety in his demolition works as well as in the adjacent area.

d) The Contractor shall demolish all the structural members above the level on which the subsequent and permanent works under this Contract will begin. To this end, the temporary construction works such as excavation shall be conducted by the Contractor.

e) Materials coming from the demolition works, except general earth, shall remain the property of the Procuring Entity, the designated part of which shall be stored by the Contractor at places specified by the Engineer's authorized Representative

### 5.1.3 PARTICULAR REQUIREMENTS

a) Steel Members

Demolished materials shall be removed from the site and dumped at the disposal areas approved by the Engineer.

Concrete and Other Members

Demolished members, shall be broken to small pieces and debris, and shall be removed from the site as soon as possible and dumped at the disposal areas approved by the Engineer.

5.1.4 CONSTRUCTION METHODS

Prior to the commencement of any works herein, the Contractor shall submit his proposed works, and methods, including temporary works such as formwork, supports, scaffolding etc., for the Engineer's approval.

5.1.5 STORAGE AND DUMPING

Prior to the commencement of the demolition work, the Engineer shall submit to the Contractor a list in which all the materials to be salvaged and overhauled, as property of the Procuring Entity and the location of their storage shall be described. Materials embedded in concrete units shall not be salvaged.

The Contractor shall separate materials to be salvaged from debris. Salvaged materials shall be loaded, transported and unloaded by the Contractor at the specified locations.

Debris, if it does not contain any pollutant in the opinion of the Contractor may be dumped at the offshore area.

The Contractor may dump debris on land areas but out of the site, which areas shall be procured and prepared at his own expense. In this case, safety measures shall be undertaken in the transporting, unloading, covering and others as requested by the Engineer.

5.1.6 SAFETY

At the end of each day's work, the site shall be left in safe condition, so that no part is in danger of toppling, or falling or creating hazards to personnel or equipment.

The construction site shall be properly lighted at night. Warning signs shall be properly located for the safety of the port users.

# SPECIFICATIONS

## 6.0 SPECIFICATIONS

6.1.1 GENERAL

All works falling under this category shall include reinforced concrete for all kinds and parts of any reinforced concrete structure.

6.1.2 MATERIALS

a. *Cement*

Cement used shall be Type I Portland conforming to the requirements of the latest revision of ASTM C 150 "Standard Specifications for Portland Cement.".

b. *Coarse Aggregates* .

Coarse Aggregates shall be washed, well graded, hard pieces of

gravel, crushed gravel or rock conforming to the requirements of ASTM C 33 "Standard Specification for Concrete Aggregates".

c. Fine Aggregates

Fine Aggregates shall be washed sand, 'stone screenings or other inert materials of same characteristics, or any combination thereof composed clean, hard, strong, uncoated grains and free from injurious amount of dust, lumps of clay, shale, alkali, and organic matter. It shall conform to the requirements of ASTM C33 "Standard Specifications for Concrete Aggregates". Beach sand shall not be used unless approved by the Engineer.

d. Admixtures

Unless otherwise required by field conditions admixtures may be used subject to the expressed approval of the Engineer. The cost thereof shall be considered as already included in the unit cost bid of the Contractor for the concrete.

6.1.3 STORAGE OF MATERIALS

a. Cement shall, be stockpiled as closely as possible, in weatherproof storage sheds, stacks suitably elevated above ground to prevent cement absorption of moisture.

b. Aggregates shall be placed in stockpile in a manner preventing segregation thereof and contamination with foreign materials.

Reinforcing steel bars shall be stored properly, covered and protected from humidity to prevent rusting and contamination with oil, dirt or other objectionable matters

6.1.4 DESIGNED STRENGTH OF CONCRETE

Concrete for deck or floor slabs, beams and girders of the structure shall develop a minimum 28-day compressive cylinder strength of 3,500 psi., unless otherwise indicated in the drawings.

6.1.5 TRIAL BATCH FOR CONCRETE

Thirty (30) calendar days before the start of (concrete transit mix) concreting works, the Contractor shall submit design mixes and the corresponding test result made on sample thereof. Sampling and testing shall be in accordance with the ASTM Standard procedures for sampling and testing, for the particular design strength(s) required.

The particulars of the mix such as the slump and the proportionate weights of cement, saturated surface dry aggregates and water used shall be stated. Test results shall show 28-day strength(s) fifteen (15%) percent higher than the ultimate strength(s) required.

The design mix for concrete to be used shall be submitted together with at least three (3) standard cylinder samples for approval at least one (1) month prior to the start of each concreting schedule. Such samples shall be prepared in the presence of the Engineer.

Standard laboratory strength test for the 7, 14 and 28 days periods shall be taken to all concrete samples in addition to routine field tests, at cost to the Contractor. Only design mixes represented by test proving the required strength for 7, 14 and 28 days tests shall be allowed.

The cost of sampling, handling and transporting samples from jobsite to the laboratory and the cost of subsequent tests made until the desired mix is attained shall be for the account of the Contractor.

6.1.6 CONCRETE PROPORTION AND CONSISTENCY

Concrete proportion should produce mix consistencies that will work readily into angles and comers of the forms and around reinforcements irrespective of the method of placing employed, without permitting -the - materials to segregate or excess water to collect on the surface of the concrete and with separated individual particles of aggregates showing coating of mortar with proportionate amount of sand. The total aggregate in the proportion used shall be such that when sieved, the weight passing the No. 4 standard sieve shall be thirty percent (30%) of the total.

The methods used for measuring materials going into the concrete mix shall permit easy checking and control of proportions at any time during the work.

6.1.7. MIXING CONCRETE AT SITE

a. Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. The pick-up and throw-over blades of mixers shall be restored or replaced when any part or section is worn 20 mm or more below the original height of the manufacturer's design. Mixers and agitators which have an accumulation of hard concrete or mortar shall not be used.

b. When bulk cement is used and the volume of the batch is 0.5 $m^3$ or more, the scale and weigh hopper for Portland cement shall be separate and distinct from the aggregate hopper or hoppers.

   The discharge mechanism of the bulk cement weigh hopper shall be interlocked against opening before the full amount of cement is in the hopper. The discharging mechanism shall be interlocked against opening when the amount of cement in the hopper is underweight by more than one percent or overweight by more than 3 percent of the amount specified.

c. When the aggregates contain more water than the quantity necessary to produce a saturated surface dry condition, representative samples shall be taken and the moisture content determined for each kind of aggregate.

d. The batch shall be so charged into the mixer that some water enter in advance of cement and aggregates. All water shall be in the drum by the end of the first quarter of the specified mixing time.

e. Cement shall be batched and charged into the mixer by such means that it will not result in loss of cement due to the effect of wind, or in accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cement in the concrete mixture.

f. Where required, synthetic fibrous reinforcement shall be added directly to the concrete mixer after placing the sufficient amount of mixing water, cement and aggregates.

g. The entire contents of a batch mixer shall be removed from the drum before materials for a succeeding batch are place therein. The materials composing a batch except water shall be deposited simultaneously into the mixer.

h. All concrete shall be mixed for a period of not less that 3 minutes after all materials, including water, are in the mixer. During the period of mixing, the mixer shall operate at the speed for which it has been designed.

i. Mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanism shall be so interlocked that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

j. The first batch of concrete materials placed in the mixer shall contain a sufficient excess of cement, sand, and water to coat the inside of the drum without reducing the required mortar content of the mix. When mixing is to cease for a period of one hour or more, the mixer shall be thoroughly cleaned.

6.1.8 PLACING OF CONCRETE

1. Concrete shall be placed in the presence of the Engineer only after the forms, reinforcing bars and other spaces to receive the concrete have been inspected and approved by him.

2. Concrete shall be placed only when wind and weather conditions will allow proper placement and curing of the concrete. Notice of any concreting operations shall be served to the Engineer at least three (3) days ahead of each schedule.

3. Mixed concrete shall be deposited in its final position within a practicable time. Each succeeding fresh deposit for particular structural member shall be placed at a practicable rate to prevent cold joints. Each successive fresh deposit of concrete shall be vibrated vertically at uniformly spaced points and levels, of such duration and intensity to compact the concrete thoroughly but shall be discontinued the moment segregation of materials is noticed.

4. Where concreting operations involve a fall more than I .50meters (4.92 feet), the fresh concrete shall be poured through approved sheet metal conduit or pipes. The pipes shall be kept full of concrete and its lower end kept below the surface of concrete throughout, the, pouring operations.

5. Deposition of concrete shall be in such a way as to prevent segregation of the materials and the displacement of the reinforcement. Placing shall be done preferably with the use of buggies, buckets or wheel-borrows. Troughs, conveyors and pipes and the manner of use of each one shall be with the expressed permission of the Engineer

6. Each layer of concrete shall be placed approximately normal as possible in uniform layers not exceeding 0.30 meter, unless otherwise ordered. The rate of placing concrete in the forms shall preferably be 0.025 meter (0.082 feet) vertical rise per minute.

7. Concrete spacer of 3” thickness shall be provided to maintain the concrete covering of steel reinforcements.

8. Concrete epoxy shall be provided to have a complete bond between the old concrete and the new one.

6.1.9 FORMS AND FALSEWORK

All forms and false work to be used in the work must be designed, and constructed by the Contractor for rigidity and adequacy for carrying the loads of the fresh concrete and/or additional superimposed construction loads. The Authority may from time to time verify the adequacy and safety of such temporary works and may require the Contractor to submit detailed designed drawings of forms and falseworks proposed to be used. Approval of such drawings or design of forms, however, shall not relieve the Contractor of his liability on resulting imperfections or damages to the finished concrete, or other damages which may directly result therefrom.

Forms may be re-used but shall be scrapped by a wire brush of all clinging mortar. Bulges should be planed and realigned prior to its use.

Prior to placing concrete form surfaces should be oiled for easy form removal. However, the oil coating should not be so thick as to stain and soften the concrete surface. Oil coatings should be applied before rebars are placed.

6.1.10 CURING AND WATER PROOFING

All concrete shall be cured for at least 7 days (*with Hi-Early Concrete Plasticizer*) after the date of placing in accordance with the approved and accepted methods.

6.1.11 FINISHING OF CONCRETE SURFACES

Concrete surfaces shall conform accurately to the form, alignment, grades and sections shown in the drawings or as prescribed by the Engineer. It shall be free from bulges, ridges, honeycombing or roughness of any kind and shall be of a reasonably smooth wood float finish.

6.1.12 ARCHITECTURAL FINISH

All exposed concrete exterior surfaces shall be given an architectural finish as directed by the Engineer.

6.1.13 PLACING OF REINFORCEMENT

Metal reinforcement shall be placed as accurately detailed on drawings and properly secured by approved means.

All reinforcing steel shall be cleaned of all rust or scale and deleterious materials which tend to destroy the bond between the concrete and the steel. Concrete covering must be strictly observed.

6.1.14 REINFORCING BAR SPLICES

Generally, splice/s of reinforcement at points of maximum stress especially in slabs, beams and girders shall be avoided. Such splice/s may however be approved by the Engineer in writing provided the lap if bonded or butt welded is sufficient to transfer tensile stress between bars by at least 125 % of the specified yield strength of the reinforcing bar. For adjacent bars splices shall staggered.

6.1.15 TEST ON CONCRETE

Test on concrete shall be in accordance with the following:
Concrete samples for tests shall be secured and molded in accordance With ASTM C172 – " Method of sampling Concrete", and ASTM C31 – "Method of making Curing, Concrete Compression and Flexure Test specimens in the fields".

Strength tests on samples shall be made in accordance with ASTM C39 "Standard Method of Test for Compressive Strength of Molded Concrete Cylinder".

Not less than four (4) cylindrical specimens shall be made for each test for which at least two (2) shall be reserved for 28 –day test. Not less than one (1) test shall be made for every fifty (50) cubic meters of concrete but in no case less than on (1) test for each day's concreting.

Samples shall be taken by the Contractor under dose supervision of the Engineer; and shall be delivered as soon as practicable for testing, at his expense, to the designated laboratories.

The average strength of test samples representing any definite class of concrete used as well as the average of any five (5) consecutive strength test representing the class of concrete shall be equal to or greater than the specified strength and not more than one (1) strength test in ten (10) shall have an average value less than 90% of the remaining work, or in the procedure of curing the concrete.

6.1.17 FIELD TESTS

Field Tests as may deem necessary to check on the quantity of the materials and mixtures and the manner of construction employed shall be conducted by the Project Engineer assigned to the project. And when such tests result to values less than that tolerated by standards set in applicable provisions of the ASTM Specifications referred herein, or contrary to accepted good Engineering practice, the Contractor shall comply to any instructions given by the Project Engineer to upgrade the materials used and method of construction employed.

## 7.0 MOORING AND FENDER SYSTEMS

7.1.1 GENERAL

7.1.2 SCOPE OF WORK

1. The work includes furnishing of all labor, materials and equipment to complete the installation of mooring bollards.

2. Work shall include the supply, transport, handling, storage and installation of fender systems in the newly constructed piers.

3. 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.

7.1.3 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 be form a part of these Specifications to the extent by the reference thereto.

   Publication

   G 5101 SC 46, Carbon Steel

   G 3101 SS41, Rolled Steel for General Structures

   JIS B0205 Standard M Screw

   JIS B1181 Hexagon Nut

3. ***Mooring Bollards shall be 35T T-head with complete accessories***.

7.1.5 MATERIAL REQUIREMENTS

7.1.5.1 MOORING SYSTEM

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

   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 the holding down bolt with 12.5 mm weld, as show 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 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.

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 6, "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.

7.1.5.2 RUBBER DOCK FENDER SYSTEM

7.1.4 RUBBER FENDER SYSTEMS

1. Material for fender systems such as rubber fenders, anchor bolts and templates shall be supplied by the Contractor. ***Rubber Dock Fenders shall be V-Type 400H x 1000L.***

2. The Contractor shall install the fender system properly according to the drawing 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.

| Type of Fender | Min. Energy Absorption (Ton-M) | Max. Reaction Force (Ton) |
|---|---|---|
| (1) | 1.0 | 15 |
| (2) | 1.8 | 20 |
| (3) | 2.8 | 32 |

4. For V-type 400H x 1000H Fenders, it shall have a Reaction Force (R/F) of 294 KN and Energy Absorption (E/A) of 39.2 Kn-m.

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

6. 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.

7. Anchor

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

8. 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.

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.

9. Sampling of Specimen

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

10. 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. Material for bolts and fittings to be covered by certified organization.

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.

11. 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 dimension (length, height)
e. Bill number in accordance with the project code specified in the Bill off Quantities.

12. 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.

## 8.0 AGGREGATE BASE COURSE

### 8.1 GENERAL

#### 8.1.1.DESCRIPTION

This Section shall consist of furnishing, placing and compacting aggregate base course on a prepared subgrade in accordance with this Specification and the lines, grades, thickness and typical cross sections shown on the Plans, or as established by the Engineer.

#### **8.1.2** PRODUCTS

##### 8.1.2.1 MATERIAL REQUIREMENTS

Aggregate for base course shall consist of hard, durable particles or fragments of crushed slag or crushed or natural gravel and filler of natural or crushed sand or other finely divided mineral matter. The composite material shall be free from vegetable matter and lumps or balls of clay, and shall be of such nature that it can be compacted readily to form a firm, stable base.

The base course material shall conform to **Table 1**

Table 1
Grading Requirements

| **Sieve Designation** | | **Mass Percent Passing** | |
|---|---|---|---|
| **Standard mm** | **Alternate US Standard** | **Grading A** | **Grading B** |

| | | | |
|---|---|---|---|
| 50.0 | 2" | 100 | |
| 37.5 | 1 1/2" | - | 100 |
| 25.0 | 1" | 60-85 | |
| 19.0 | ' | - | 60-85 |
| 12.5 | 1/2" | 36-65 | - |
| 4.75 | No. 4 | 20-50 | 30-55 |
| 0.425 | No. 40 | 5-20 | 8-25 |
| 0.075 | No. 200 | 0-12 | 2-14 |

The fraction passing the 0.075 mm (No.200) sieve shall not be greater than 0.66 (two thirds) of the fraction passing the 0.425 mm (No. 40) sieve.

The fraction passing the 0.425 mm (No.40) sieve shall have a liquid limit not greater than 25 and plasticity index not greater than 6 as determined by AASHTO T 89 and T 90, respectively.

**8.1.2** EXECUTION

8.1.2.1 PREPARATION OF EXISTING SURFACE

The existing surface shall be graded and finished as provided under Section 5.6, "Subgrade Preparation", before placing the base material.

8.1.2.2 PLACING

The aggregate base material shall be placed as a uniform mixture on a prepared subgrade in a quality which will provide the required compacted thickness. When more than one layer is required, each layer shall be shaped and compacted before the succeeding layer is placed.

The placing of materials shall begin at the point designated by the Engineer. Placing shall be from vehicles especially equipped to distribute the material in a continuous uniform layer or windrow. The layer or windrow shall be of such size that when spread and compacted the finished layer shall be in reasonably close conformity to the nominal thickness shown on the Plans.

When hauling is done over previously placed material, hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer, to minimize rutting or uneven compaction.

8.1.2.3 SPREADING AND COMPACTING

When uniformly mixed, the mixture shall be spread to the plan thickness, for compaction. Where the required thickness is 150 mm or less, the material may be spread and compacted in one layer. Where the required thickness is more than 150 mm, the aggregate base shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 150 mm. All subsequent layers shall be spread and compacted in a similar manner.

The moisture content of base material shall, if necessary, be adjusted prior to compaction by watering with approved sprinkler mounted on trucks or by drying out, as required in order to obtain the required compaction.

Immediately following final spreading and smoothing, each layer shall be compacted to the full width by means of approved compaction equipment.

Rolling shall progress gradually from the sides to the center, parallel to the centerline of the road, and shall continue until the whole surface has been rolled. Any irregularities or depressions that develop shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform. Along curbs, headers, and walls, and at all places not accessible to the roller, the base material shall be compacted thoroughly with approved tampers or compactors.

If the layer of base materials, or part thereof, does not conform to the required finish, the Contractor shall, at his own expense, make the necessary corrections.

The field density required of each layer is not less than 98 percent of the maximum dry density determined in accordance with AASHTO T 180 (ASTM D1557).

## 9.0 CEMENT TREATED BASE COURSE

### 9.1 GENERAL

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

#### 9.1.1 MATERIAL REQUIREMENTS

a. CEMENT

Portland cement shall conform with the requirements of AASHTO M 85 (ASTM C-150). Only type I cement shall be used.

b. AGGREGATES

Aggregates for cement treated base shall consist of any combination of gravel, sand and stone fragments, and shall be lean, free from organic matter, lumps of clay and other deleterious substance, conforming to the following grading and quality requirements:

1. The aggregates shall have a grading curve within the limits for Class C given in the **Table 2**

Table 2
**Cement Treated Base Aggregate Grading**

| **Sieve Designation** | | **Percent Passing By Weight** |
|---|---|---|
| **Standard MM** | **Alternative US Standard** | **Class C** |
| 19 | 3/4 | 80-100 |
| 4.75 | No.4 | 40-100 |
| 0.425 | No. 40 | 10-100 |
| 0.075 | No. 200 | 3-15 |

The aggregates shall be uniform mixture of coarse and fine aggregates prior to adding cement.

2. the coarse aggregates retained on a 4.75 mm (No.4) sieve shall have a percentage of wear by the Los Angeles Abrasion Test (AASHTO T 96) of not more than 50;

3. the material shall have loss of less than 12% when subject to five cycles of the Sodium Sulfate Soundness test according to AASHTO T 104; and

4. The sand equivalent determined according to AASHTO T 176 shall not be less than 20.

c. WATER

Water shall be free oil, acid, alkali or other deleterious substances, the quality of which shall be subject to the approval of the Engineer. Sufficient supply of water shall be made available throughout the work.

### 9.1.2 EXECUTION

#### 9.1.2.1.1 MIXTURE

Cement treated base shall have a cement content not less than 10% of the weight of the aggregate in the mixture.

b. EQUIPMENT

Before commencing the work, the equipment necessary for the work shall be on the site in good working condition, and shall be subject to the approval of the Engineer both as to the type and condition. The Contractor shall provide sufficient equipment with corresponding experienced operators to ensure efficient progress of the work.

c. PROPORTIONING AND MIXING

Cement treated base shall be mixed in-situ by either batch type mixing using revolving blade or rotary drum mixer, at the option of the Contractor. The aggregate and cement shall be proportioned by weight.

The water shall be proportioned by weight and there shall be means by which the Engineer may readily verify the amount of water per batch. The time of addition of water or the points at which it is introduced into the mixer shall be as approved by the Engineer.

The moisture content of the completed mixture during placing shall not be higher than the optimum moisture content and not lower than 3% below the optimum moisture content.

Cement shall be added in such a manner that is uniformly distributed throughout the aggregate during the mixing operation. Safe, convenient facilities shall be provided for sampling cement in the supply line.

The charge in batch mixer, shall not exceed that which will permit complete mixing of all the material. Dead areas in the mixer, in which the materials does not move or is not sufficiently agitated, shall be corrected.

The cement content of the completed mixture of cement treated base, after it has been spread on the subgrade and prior to initial compaction shall not be lower than the specified cement content shall only be made with the approval of the Engineer.

The aggregate and cement for cement treated base shall be brought to the site of the work before the addition of water. The equipment used and the method adopted shall be such that the material is crushed uniformly to the full depth of the layer to produce a homogenous material. Details of the equipment and method which the Contractor proposes to use for the work shall be subject to the approval of the Engineer.

d. SPREADING

Immediately prior to depositing cement treated base, the area to be covered shall be moistened and kept moist, but not excessively wet. Segregation shall be prevented and the mixtures shall be free from pockets of coarse or fine material.

The mixed material shall be spread in widths acceptable to the Engineer. Except when placed as a leveling course, the maximum compacted thickness of any layer shall not exceed 250 mm and the minimum thickness shall not be less than 80 mm. When cement treated base is placed in more than one layer, the surface of the lower layer of compacted material shall be kept moist until covered with the next layer of cement treated base on surface is placed.

The treated mixture may be spread by such equipment which will consistently finish the base within the tolerance specified and which does not result in segregation. Cement treated base placed on areas inaccessible to mechanical spreading equipment may be spread in one layer by methods approved by the Engineer.

The use of motor graders may be permitted during spreading and compacting operations and to trim the edges and surfaces of the cement treated base after compaction in order to finish the base within the tolerances specified.

e. COMPACTING

After spreading, the materials shall be thoroughly compacted to the required lines, grades, and cross section by means of pneumatic tampers, or with other compacting equipment which consistently obtains the degree of compaction required.

Excess material may be placed as aggregate for shoulder construction subject to the following conditions:

1. Hardened lumps of trimmed materials shall be removed or reduced to the maximum size specified for shoulder aggregate prior to spreading additional shoulder aggregates.
2. The amount of trimmed material incorporated in the shoulder shall not exceed 25% of the designed volume of shoulder aggregate. When trimmings exceed this limit, the excess shall be removed.
3. The excess material shall be uniformly distributed in the shoulder area prior to spreading additional shoulder aggregate.
4. Following such trimming, the finished surface shall be thoroughly compacted so that the entire layer of cement treated base conforms to the compaction requirements hereinafter specified. Final compaction shall be accomplished in such a manner that no loose material remain on the surface and all tire marks are eliminated.

f. COMPACTION REQUIREMENTS

The relative compaction of cement treated base shall not be less than 100% of the maximum dry density determined according to AASHTO T134, Method B.

## 10.0 INTERLOCKING CONCRETE BLOCK PAVEMENT

### 10.1 DESCRIPTION

The Work include the furnishing of labor, materials and equipment required for cement treated base course for port roads, storage and parking areas

in accordance with the lines and grades shown on the Drawings and in conformity with these specifications.

10.1.1 SCOPE OF WORK

This specification covers the construction of interlocking concrete block pavement on a prepared base courses and the laying of leveling course sand bedding all in accordance with the Specifications and Drawings.

10.1.2 SUBMITTALS

Before materials for the fabrication of the interlocking concrete blocks are ordered, the Contractor shall submit to the Engineer for his approval certified test report of the equipment and materials to be used for the fabrication of the interlocking concrete blocks.

Twenty eight (28) days before the shipment and installation of the fabrication, the Contractor shall submit his method of fabrication of the interlocking locks and a lists of equipment to be used in the fabrication.

No materials for the fabrication of the concrete blocks shall be delivered at the site unless fabrication equipment of adequate capacity and in good working order is ready at the site and approved by the Engineer.

10.1.3.MATERIAL REQUIREMENTS

10.1.3.1 INTERLOCKING CONCRETE BLOCKS

i. Class of Concrete

Concrete for the interlocking concrete block shall be 41.4 Mpa. (6,000 psi.), Mixing and casting shall be in accordance with Section 3.2 “Reinforced Concrete” and the form and dimension shall be as shown on the Drawings.

Additional requirements shall be as follows:

| | | |
|---|---|---|
| Minimum 28 day compressive strength | - | 41.4 |
| Mpa Minimum aggregate | - | 19 mm |
| Minimum water-cement ratio | - | 0.47 |
| Minimum cement content | - | 470 kg/m$^3$ |

ii. SAND LEVELLING COURSE (SAND CUSHION)

Materials for sand cushion shall consist of sand with uncoated grains, free from injurious amount of dust, lumps of clay, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances. Beach shall not be allowed for use.

## 11.0 CLEARING WORKS

The Contractor shall remove all temporary structures erected, excess materials and construction debris within the construction/port area upon completion of the project.