

## TRIAL SECTION

Before base construction is started, the Contractor shall spread and compact trial sections as directed by the Engineer. The purpose of the trial sections is to check the suitability of the materials and the efficiency of the equipment and construction method which is proposed to be used by the Contractor. Therefore, the Contractor must use the same material, equipment and procedures that he proposes to use for the main work. One trial section of about 500 m<sup>2</sup> shall be made for every type of material and/or construction equipment/procedure proposed for use.

After final compaction of each trial section, the Contractor shall carry out such field density tests and other tests required as directed by the Engineer.

If a trial section shows that the proposed materials, equipment or procedures in the Engineer's opinion are not suitable for subbase, the material shall be removed at the Contractor's expense, and a new trial section shall be constructed.

If the basic conditions regarding the type of material or procedure change during the execution of the work, new trial sections shall be constructed.

## SURVEYS AND SETTING OUT WORKS

Before the commencement of the pavement works, the Contractor together with the Engineer shall conduct topographic survey which will form the basis of quantity measurement.

The Contractor shall set out the works and shall be solely responsible for the accuracy of such setting-out.

Prior to placement of any material, the Contractor shall establish visible construction markers to clearly define horizontal limits of the Work.

## TOLERANCES

The aggregate base course shall be laid to the designed level and transverse slopes shown on the Plans. The allowable tolerances shall be in accordance with following:

Permitted variation from design THICKNESS OF LAYER	± 10 mm
Permitted variation from design LEVEL OF SURFACE	+ 5 mm -10 mm
Permitted SURFACE IRREGULARITY Measured by 3-m straight-edge	5 mm
Permitted variation from design CROSSFALL OR CAMBER	± 0.2%
Permitted variation from design LONGITUDINAL GRADE over 25 m in length	± 0.1%

**METHOD OF MEASUREMENT**

Aggregate Base Course will be measured by the cubic meter (m<sup>3</sup>). The quantity to be paid for shall be the design volume compacted in-place as shown on the Plans, and accepted in the completed base course. No allowance shall be given for materials placed outside the design limits shown on the cross-sections. Trial sections shall not be measured separately but shall be included in the quantity of aggregate base course.

## ITEM 08 : PORTLAND CEMENT CONCRETE PAVEMENT

### SCOPE OF WORK

The works include the furnishing of all labor, materials and equipment required for the construction of gravel base course and concrete pavement. The works shall be in accordance with the lines and grades shown on the Drawings and in conformity with the Specifications.

### MATERIAL REQUIREMENTS

#### Cement

Portland cement shall conform to the requirements of the Section "Reinforced Concrete".

#### Fine Aggregate

The fine aggregate shall be well-graded from coarse to fine and shall conform to the requirements of the Section "Reinforced Concrete".

#### Coarse Aggregate

Coarse aggregate shall conform to the requirements of the Section "Reinforced Concrete".

#### Water

Clean, fresh, potable water shall be used for the mixing of all concrete and mortar and shall be from a source approved by the Engineer. Sea water or brackish water shall not be used.

#### Admixture

Admixture shall only be used with the written permission of the Engineer. If air-entraining agents, water reducing agents, set retarders or strength accelerators are permitted to be used, they shall not be used in greater dosages than those recommended by the manufacturer, or as permitted by the Engineer. The cost shall be considered as already in the Contractor's unit cost bid for concrete.

### TIE BARS AND SLIP BARS

Tie bars shall be deformed bars conforming to the requirements specified in AASHTO M 31 or M 42, except that rail steel shall not be used for tie bars that are to be bent and re-straightened during construction, sizes as indicated on the Drawings. The deformed bars shall be Grade 40 and shall be shipped in standard bundles, tagged and marked in accordance with the Code of Standard practice of the Concrete Reinforcement Steel Institute.

Slip bars shall be smooth round steel bars conforming to the requirements specified in AASHTO M 31 or plain M 42.

#### Joint Filler

Poured filler for joint shall conform to the requirements of AASHTO M173.

## EXECUTION

### Concrete Class

The concrete for pavement shall satisfy the following requirements:

Minimum 28-day comprehensive strength	:	24 MPa
Minimum Flexural Strength	:	3.8 MPa
Maximum Aggregate size	:	25 mm
Maximum water cement ratio	:	0.52

### Proportioning, Consistency and Mixing of Concrete

The proportioning, consistency and mixing of concrete shall conform to the requirements of the Section "Reinforced Concrete".

### Preparation

The base shall be watered and thoroughly moistened prior to placing of the concrete.

### Formwork Construction

Formwork shall comply with the requirements of the Section "Reinforced Concrete". Forms shall be of steel, of an approved section and shall be straight and of a depth equal to thickness of the pavement at the edge. The base of the forms shall be of sufficient width to provide necessary stability in all directions. The flange braces must extend outward on the base not less than  $\frac{2}{3}$  the height of the form.

All forms shall be rigidly supported on a bed of thoroughly compacted material during the entire operation of placing and finishing the concrete. They shall be set with their faces vertical so as to produce a surface complying with the required tolerance.

Adjacent lanes may be used in lieu of forms for supporting finishing equipment provided that proper protection is afforded to the concrete of the adjacent lanes to prevent damage, and provided further that the surface of the concrete carrying the finishing equipment does not vary by more than 3mm in each meter length. Adjacent lanes in lieu of forms may not be used until the concrete is at least seven (7) days old. Flanged wheels of the finishing equipment shall not be operated on the concrete surface. The inside edge of supporting wheels of the finishing machine shall not operate closer than 100mm from the edge of the concrete lane.

Alternative to placing forms, slip-forming may be used. Slip-form paving equipment shall be equipped with the traveling side forms of sufficient dimensions, shape and strength to support the concrete laterally for a sufficient length of time during placement to produce pavement of the required cross section. No abrupt changes in longitudinal alignment of the pavement will be permitted. The horizontal deviation shall not exceed 20mm from the proper alignment established by the Engineer.

## Joints

All joints, longitudinal, transverse, etc., shall be constructed as shown on the Drawings and shall be clean and free of all foreign material after completion of shoulder work prior to acceptance of the work and in accordance with the following provisions:

### Longitudinal and Transverse Contact Joints:

Longitudinal contact joints are joints formed between lanes that are poured separately. Transverse contact joints are joints formed between segments of a lane that are poured separately. Transverse contact joints shall be formed perpendicular to pavement centerline at the end of each day of concrete placing, or where concreting has been stopped for 30 minutes or longer but not nearer than 1.5 meters from sawed contraction joints. All contact joints shall have faces perpendicular to the surface of the pavement. Tie bars of the size, length and spacing shown on the Drawings shall be placed across longitudinal and transverse contact joints.

## Placing Concrete

The concrete shall be deposited and spread in order that segregation will not occur and place a uniform layer of concrete whose thickness is approximately 20 mm greater than that required for the finished pavement is placed. Rakes shall not be used for handling concrete.

In order to prevent the introduction into the concrete of earth and other foreign materials, the men whose duties require them to work in the concrete, shall in general, confine their movements to the area already covered with fresh concrete. Whenever it becomes necessary for these men to step out of the concrete, their footwear shall be washed or otherwise thoroughly cleaned before returning to the concrete. Repeated carelessness with regard to this detail will be deemed sufficient cause for removing and replacing such worker.

During the operation of striking off the concrete, a uniform ridge of concrete at least 70 mm in height shall be maintained ahead of the strike-off screed for its entire length. Except when making a construction joint, the finishing machine shall at no time be operated beyond that point where this surplus can be maintained in front of the strike-off screed.

After the first operation of the finishing machine, additional concrete shall be added to all low places and honeycombed spots and the concrete rescreeded. In any rescreeding, a uniform head of concrete shall be maintained ahead of the strike-off for its entire length. Honeycombed spots shall not be eliminated by tamping or grouting.

Workers on the job shall have mobile footbridges at their disposal so that they need not walk on the wet concrete.

In conjunction with the placing and spreading, the concrete shall be thoroughly spaded and vibrated along the forms, bulkhead, and joints.

The internal vibrators shall be of pneumatic, gas-driven, or electric type, and shall operate at a frequency of not less than 3,200 pulsations per minute.

Whenever the placing of the concrete is stopped or suspended for any reason, for a period of 30 minutes or longer, a suitable bulkhead shall be placed so as to produce a vertical transverse joint. If an emergency stop occurs within 2.5 meters of the contraction or an expansion joint the concrete shall be removed back to the joint. When the placing of the concrete is resumed, the bulkhead shall be removed and a new concrete placed and

vibrated evenly and solidly against the face of previously deposited concrete. Any concrete in excess of the amount needed to complete a given section or that has been deposited outside the forms shall not be used in the work.

The Contractor shall provide suitable equipment for protecting the fresh concrete in case of rain, such as screens which will cause the rain water to run off beyond the edges of the paving, rain proof tarpaulins or other methods approved by the Engineer. The equipment shall be sufficient to shelter from rain all areas equal to that paved in two hours of work.

### Finishing Concrete

The concrete shall be compacted and finished by a mechanical, self-propelled finishing machine of approved type, having two independently operated screeds. If a machine possessing only one screed is approved, the screed will not be less than 450 mm wide and shall be equipped with compensating springs to minimize the effect of the momentum of the screed on the side forms. The number of driving wheels, the weight of the machine and the power of the motor shall be so coordinated as to prevent slippage. The top of the forms and the surface of the finishing machine wheels shall be kept free from concrete or dirt.

The machine shall at all times be in first-class mechanical condition and shall be capable of compacting and finishing the concrete as herein described. Any machine which causes displacement of the side forms from the line or grade to which they have been properly set, or causes undue delay due to mechanical difficulties, shall be removed from the work and replaced by a machine meeting the Specifications.

The finishing machine shall be operated over each section of pavement two or more times and at such intervals as will produce the desired results. Generally, two passes of the finishing machine are considered the maximum desirable.

The concrete shall be vibrated, compacted, and finished by a vibratory finishing machine. The vibratory machine shall meet the requirements for ordinary finishing, and shall be one of the following type:

1. The machine shall have two independently operated screeds; the front screed shall be equipped with vibratory units with a frequency of not less than 3,500 pulsations per minute. There shall be not less than one vibratory unit for each 2.5 meters length or portion thereof, of vibratory screed surface. The front screed shall not be less than 300mm wide and shall be equipped with a "bull nose" front edge built on a radius of not less than 50mm. This type of vibratory finishing machine shall be operated in such manner that each section of pavement will receive at least one vibratory pass, but not more than two passes, unless otherwise directed, or ;
2. The machine shall be equipped with an independently operated vibratory "pan" (or pans) and two (2) independently operated screeds, the "pan" shall be mounted in a manner that will permit it to come in contact with the forms and will permit vibration of the full width of lane simultaneously.

There shall be not less than one vibratory unit for each 2 m. length or portion thereof, of vibrating pan surface. The vibratory units in any individual pan shall be synchronized and have a frequency of not less than 3,500 pulsations per minute. The front screed shall be capable of operating in a position that will strike off the concrete at a sufficient height above the top of the forms to allow for proper compaction with the vibrating pan. This type of vibratory finishing machine shall be operated in such manner that each section of pavement will receive at least one vibratory pass but not more than two passes, unless otherwise directed.

After the final pass of the finishing machine and when the concrete has started to dry, the surface of the pavement shall be finished with an approved longitudinal float. The float may be operated either manually or by mechanical means. The float may be either of wood or metal shall be straight and smooth and light in weight so as not to displace or sink into the concrete surface.

To be effective, the float shall be at least 300mm wide and 3m long. When manually operated, the float shall be moved from edge to edge with a wiping motion and advance one (1) meter or more.

The succeeding trip shall overlap the previous trip. A light smoothing lute at least 3 meters long may be used provided approved by the Engineer.

The surface of the pavement shall be tested by the Contractor, before the final belting, with an approved standard straightedge 3 meter in length. Irregularities so detected shall be corrected immediately. Special attention shall be given to the concrete adjacent to transverse joints to insure that the edges thereof are not above the grade specified or the adjacent concrete below grade. All depressions or projections shall be corrected before any initial set has developed in the concrete.

After the concrete has been brought to the required grade, contour and smoothness, it shall be finished by passing over the concrete a drag of one or two burlap clothes, which give the surface the required roughness. The vehicles used to carry these cloths may be independent of the concrete-laying machine or may be incorporated with it and may be operated either by hand or mechanically.

Hand finishing will be permitted only on variable width sections of the pavement and other places where the use of the finishing machine would be impractical. Hand finishing shall be accomplished by means of the hand-operated strike-off template of either steel or steel-shod wood construction. The striking template shall be operated forward with a combined longitudinal and transverse motion and shall be so manipulated that neither end will be raised off the side forms. A similar tamper shall be used for tamping the concrete.

As soon as the concrete has attained its initial set, the edges of the pavement, the longitudinal joints, the construction dummy and expansion joints not sawn shall be carefully finished with an edging tool having radius of at least 5mm. The tools, the special accessories for cutting impressed joints and methods of workmanship shall be such as will produce a joint whose edges are of the same quality of concrete as the other portion of the pavement. Methods and workmanship which make use of excess mortar or grout in this area shall be eliminated. Unnecessary tool marks shall be eliminated during work, and the edges left smooth and true to line.

### Striking Forms

Forms shall remain in place at least 12 hours after the concrete has been placed. When working conditions are such that the early strength gain of the concrete is delayed, the forms shall remain in place for a longer period, as directed by the Engineer. Bars or heavy load shall not be used against the concrete when still in the forms. Any damage to concrete resulting from form removal shall be repaired promptly by the Contractor as directed by the Engineer without any additional payment to the Contractor.

## Curing Concrete

Unless otherwise ordered by the Engineer, curing of concrete shall be done by any method specified in the Section "Reinforced Concrete".

## Cleaning and Sealing Joints

After completion of the required curing and before opening of the pavement to traffic, all joints shall be thoroughly cleaned of all concrete aggregate fragments or other materials.

After removal of side forms, the ends at transverse expansion joints at the edges of the pavement shall be carefully cleaned of any concrete within the expansion spaces for the entire depth of slab, care being taken not to injure the ends of the joints. Expansion and contraction joints shall then be poured with a hot joint sealer to the depth as indicated on the Drawings. Joint sealer shall be poured using approved hand pouring pots, with liquid at a temperature not less than that recommended by the approved manufacturer.

## Opening to Traffic

The pavement shall be closed to traffic, including the vehicles of the Contractor, for a period of 10 days after the concrete is placed or longer if in the opinion of the Engineer, the weather conditions make it necessary to extend this time. The Contractor shall furnish, place and maintain satisfactory barricades and lights as directed, to exclude all traffic from the pavement.

Any damage to the pavement due to traffic shall be repaired or replaced at the expense of the Contractor. Paving mixers, mechanical concrete spreaders and finishers and other heavy paving equipment shall not be operated on completed concrete lanes in order to construct alternate lanes until after the regular curing period is completed. Even then, planks shall be laid on the finished pavement or other precautions taken to prevent damage to the concrete pavement.

## Pavement Smoothness, Thickness and Tolerance

Portland cement concrete pavement shall be constructed to the designed level and transverse slope shown on the Drawing. The allowable tolerance shall be as listed hereunder:

- |    |  |         |
|----|--|---------|
| 1. | Permitted variation from design thickness of layer | + - 5mm |
| 2. | Permitted variation from design level of surface   | + - 5mm |

The thickness of the pavement will be determined by measurement of cores from the completed pavement in accordance with AASHTO T 148.

The completed pavement shall be accepted on a lot basis. A lot shall be considered as 2,500 sq.m of pavement. The last unit in each slab constitutes a lot in itself when its length is at least  $\frac{1}{2}$  of the normal lot length. If the length of the last unit is shorter than  $\frac{1}{2}$  of the normal lot length, it shall be included in the previous lot.

Other areas such as intersections, entrances, crossovers, ramp, etc., will be grouped together to form a lot. Small irregular areas may be included with other unit areas to form a lot.



## **ITEM 9: STEEL AND METAL WORKS**

### **GENERAL**

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

### **SCOPE OF WORK**

The work includes the furnishing of all labor, materials, equipment and other incidentals necessary for the fabrication and installation of structural steel and miscellaneous metal works as specified in relevant items of these specifications and as indicated on the drawings.

### **SUBMITTAL**

1. Before placing orders for materials for the steel and metal works, the Contractor shall submit to the Engineer for approval shop drawings for all steelwork. All project shop drawings shall show the dimension of all parts, method of construction, bolts, welding sectional areas and other details.
2. The detail of connections shown on the shop drawings shall be such as to minimize formation of pockets to hold condensation, water or dirt. A minimum gap between abutting angles and the like shall be provided wherever possible to eliminate any traps and facilitate maintenance painting.
3. No materials shall be ordered nor fabrication commenced until the shop drawings are approved by the Engineer.

### **STORAGE OF MATERIALS**

Structural materials, 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.

### **MATERIAL REQUIREMENTS**

1. Unless specified herein all steel structures and metals shall conform with the requirements of "Steel and Metal Works." Connections where details are not specified or indicated herein, shall be designed in accordance with the American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition.
2. Structural steel works consisting of channels, gusset plates and other structural steel shape shall be as indicated on the drawings and shall be structural carbon steel conforming to ASTM A 36. Shapes shall be as given in AISC, Manual of Steel Construction.
3. High strength structural bolts, shall conform to ASTM A 325, Types 1 or 2. Nuts shall conform to ASTM A 560, Grade A, heavy hex style, except nuts 38 mm (1-1/2 inch) may be provided in hex style. Washers shall conform to ANSI B 18.22.1, Type B.
4. Electrodes for arc welding shall be E70 series conforming to American Welding Society Specifications A5.1.

5. Tests are required under the ASTM Standards for steel to be used in the Works and shall be carried out in the presence of the Engineer and at least four (4) days notice must be given to him of the dates proposed for such tests. Four (4) calendar days notice on which fabricated steelwork will be ready for inspection in the Contractor's yard.
6. Standard bolt shall conform to ASTM A 307 Carbon Steel Externally Threaded Standard Fasteners.

## **EXECUTION**

### **QUALIFICATION**

Qualification of steel fabricators, erectors and welders shall comply with the requirements.

### **FABRICATION REQUIREMENTS**

#### **1. Workmanship**

Fabrication shall be performed within the permissible tolerance by the approved fabricator. All workmanship shall be of the best quality with respect to internationally recognized standards of practice.

#### **2. Cutting**

Low-carbon structural steel may be cut by machine-guided torch instead of by shears or saw. Harmful notches, burrs, irregularities, etc., shall not be developed at the cut surface.

#### **3. Contact Faces**

Contact surfaces between bases or other elements bearing directly upon bearing plates shall be ground or milled as necessary for full effective bearing. Edges for welding shall likewise be properly prepared.

#### **4. Bolt Holes**

Bolt holes shall be according to engineering practice and as specified in these specifications. Gas burning of holes will not be permitted.

#### **5. High Strength Bolt Assembly Preparation**

Surfaces of high strength bolted parts in contact with bolt heads and nuts shall not have a slope of more than 1:20 with respect to a plane normal to the bolt axis.

Where the surface of a high strength bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for lack of parallelism.

High strength bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials.

When assembled, all joint surfaces including those adjacent to washers shall be free of scale except tight mill scale, and shall be free from dirt, loose scale, burrs, and other defects that would prevent solid seating of parts.

Contact surfaces of friction-type joints shall be free from oil, paint, lacquer or galvanizing.

## 6. Welding

All welding shall be done only by welders certified as to their ability to perform in accordance with accepted testing requirement.

Welding of parts shall be in accordance with structural standards and the Standard Code for Arc and Gas Welding in Building Construction of AWS, and shall only be done where shown, specified, or permitted by the Engineer.

Damage to galvanized areas by welding shall be thoroughly cleaned with wire brushing and all traces of welding flux and loose or cracked zinc coating shall be removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight. As an alternative to the above, the Contractor may submit for approval the use of a galvanizing rod or galvanizing solder to repair damaged areas.

The welding machine shall be a stable welder, and have suitable functions for the dimension of materials to be welded. The auxiliary tools used for welding shall perform sufficiently and adequately.

The welding machine used for field welding shall be of readily adjustable for electric current.

## 7. Shop Assembly

Structural units furnished shall be assembled in the shop. An inspection shall be made to determine that the fabrication and the matching of the component parts are correct.

Jigs shall be used for the assembly of units as much as possible to maintain appropriate position of mutual materials.

Approval of the Engineer shall be required when drilling temporary bolt holes or welding temporary support to the assembled structure.

The tolerances shall not exceed those allowed by codes and each unit assembled shall be closely checked to insure that all necessary clearances have been provided and that binding does not occur in any moving part.

In order to maintain accurate finished dimensions and shape, appropriate reverse strain or restraint shall be provided as required. Assembly and disassembly work shall be performed in the presence of the Engineer, unless waived in writing by the Engineer any errors or defects disclosed shall be immediately remedied by the Contractor.

Before disassembly for shipment, component parts of the structures shall be match marked to facilitate erection in the field.

## FABRICATION TOLERANCES

### 1. Dimensional Tolerances for Structural Work

Dimensions shall be measured by means of an approved calibrated steel tape at the time of inspection. Unevenness of plate work shall not exceed the limitation of the standard mill practice as specified in the American Institute of Steel Construction, "Manual of Steel Construction".

### 2. Camber

Reverse camber in any structural steel members in excess of 1/1,000 of the span length shall cause rejection. The minimum dead load camber for any structural steel member shall be as allowed by Code, or otherwise specified.

## INSPECTION AND TEST OF WELDING

### 1. Inspection of Welding

Inspection of welding shall be executed for the following work phases.

#### a. Before Welding

Scum, angle of bevel, root clearance, cleaning of surface to be welded, quality of end tab, drying of welding rod.

#### b. During Welding

Welding procedure, diameter of coil and wire, type of flux, welding current and voltage, welding speed, welding rod position, length of arc, melting, cleaning of slag of each level under surface chapping, supervision of welding rod.

#### c. After Execution of Welding

Assurance of bead surface, existence of harmful defects, treatment of crater, quality of slag removal, size of fillet, dimension of extra fill of butt welding, treatment of end tab.

### 2. Testing of Welding

Twenty percent (20%) of welds contributing in the overall strength of the structure and which will be inaccessible for the inspection in service shall be tested.

Welding shall be tested by ultrasonic test to the extent specified herein or as directed by the Engineer.

Where partial inspection is required, the ultrasonic test shall be located at random on the welds so as to indicate typical welding quality.

If ten percent (10%) of the random ultrasonic tested indicate unacceptable defect, the remaining eighty percent (80%) of the welding shall be tested. Repair welding required shall be ultrasonic tested after the repairs are made.

## CORRECTIONS

In lieu of the rejection of an entire piece or member containing welding which is unsatisfactory or which indicates inferior workmanship, corrective measures may be permitted by the Engineer whose specific approval shall be obtained for making each correction. Defective or unsound welds or base steel shall be corrected either by removing and replacing the entire weld, or as follows.

1. Excessive convexity or overlap shall be reduced by grinding.
2. Undercuts, lack of weld shall be repaired with necessary reinforcement of weld after removal of any foreign materials such as slag, dust, oil, etc.
3. Any defects such as slag inclusions, incomplete fusion, or inadequate joint penetration, shall be completely removed, cleaned and re-welded.
4. Cracks in welds or base steel, shall be removed to sound steel throughout their length and 5cm beyond each end of the crack, followed by welding. The extent of the crack, depth and length, shall be ascertained by the use of acid etching, magnetic particle inspection or other equally positive means.

The removal of welded steel shall be done by chipping, grinding, oxygen cutting, oxygen gouging, or air carbon arc gouging and in such a manner that the remaining welded steel or base steel is not nicked or undercut. Defective portions of the welding shall be removed without substantial removal of the base steel.

## INSTALLATION

### 1. Installation Program

#### a. Prerequisite Condition

Prior to executing steel fabrication and field installation, the Contractor shall prepare a comprehensive installation program including engineering supervision organization, fabrication procedures, field installation procedures, material application, machinery applications, inspection procedure, scope and standard of quality judgment, and submit to the Engineer for approval.

#### b. Special Technical Engineering

Special technical engineering different from contract specifications can be applied upon receiving approval of the Engineer.

### 2. Installation Requirement

#### a. Setting of Anchor Bolt and Others

- a. 1. Anchor bolts shall be set in accurate position by using templates.
- a. 2. The setting method shall be proposed to the Engineer for his approval before setting starts.
- a. 3. The threads of bolt shall be cured with an appropriate method against rust and/or any damage before tightening.

- a. 4. Non-shrink mortar shall be placed under base plates, well cured to obtain the sufficient strength before bearing loads are applied to base plates.
- b. Temporary Bracing
  - b. 1. Temporary bracing shall be installed as necessary to stay assemblies and assume loads against forces due to transport, erection operations or other work.
  - b. 2. Temporary bracing shall be maintained in place until permanent work is properly connected and other construction installed as necessary for support, bracing or staying of permanent work.
  - b. 3. Extent and quality of temporary bracing shall be as necessary against wind and other loads, including seismic loads not less than those for which the permanent structure is designed to resist.
- c. Adequacy of Temporary Connections

During erection, temporary connection work shall be securely made by bolting and/or welding for all dead load, wind and erection stresses.
- d. Alignment

No permanent bolting or welding shall be done until the alignment of all parts with respect to each other shall be true within the respective tolerances required.
- e. Field Welding
  - e. 1. Any shop paint or surfaces adjacent to joints where field welding is to be executed shall be wire brushed to remove paint/primer.
  - e. 2. Field welding shall conform to the requirements specified herein, except as approved by the Engineer.
- f. High Strength Bolts

Final tightening of high strength bolts shall be done by using manufacturer's power operated equipment without any overstress to the threads.
- g. Correction of Errors
  - g. 1. Corrections of minor misfits by use of drift pins, and reaming, chipping or cutting will be permitted and shall be provided as part of erection work.
  - g. 2. Any errors to be corrected or adjusted, preventing proper assembly, shall be immediately reported to the Engineer, and such corrections or adjustments shall be made as necessary and approved by the Engineer.
  - g. 3. Cutting or alterations other than as approved will not be permitted.

#### **h. Erection**

- h. 1. Erection and installation shall be as per approved shop drawings.**
- h. 2. Each structural unit shall be accurately aligned by the use of steel shims, or other approved methods so that no binding in any moving parts or distortion of any members occurs before it is finally fastened in place.**
- h. 3. Operations, procedures of erection and bracing shall not cause any damage to works previously placed nor make overstress to any of the building parts or components. Damage caused by such operations shall be repaired as directed by the Engineer at no extra cost to the Employer.**

### **GALVANIZING**

#### **PREPARATION**

All mild steel parts exposed to weather shall be hot-dipped galvanized after fabrication in accordance with the requirements of ASTM A 123 or ASTM A 153. Prior to galvanizing, the surfaces shall be cleaned of dirt, weld splatter, grease, slag, oil, paint or other deleterious matters. The steel surfaces shall be chemically de-scaled and cleaned with the same abrasive blast or other suitable method as approved by the Engineer.

#### **COATING**

The zinc coating shall consist of uniform layers of commercially pure zinc free from abrasions, cracks blisters, chemical spots or other imperfections, and shall adhere firmly to the surface of the steel. The weight of zinc coating per square meter of actual surface shall not be less than 550 grams. Any surface damaged subsequent to galvanizing shall be given two coats of approved zinc rich paints.

#### **PAINTING**

This work shall consist of the preparation of the metal surfaces, the application, protection and drying of the painted surfaces, and supplying of all tools, tackle, scaffolding, labor and materials necessary for the entire work. Painting shall be applied in the field or shop as approved by the Engineer.

Unless otherwise specified or approved, all painting work for structural steel shall comply with the requirements of this Section.

#### **SHOP PAINTING**

All structural steel shall be given a shop primer after fabrication and cleaning before delivery to the site.

All steel work shall be thoroughly dried and cleaned of all loose mill scale, rust and foreign matters by means of sand blasting or other suitable methods approved by the Engineer before shop painting shall be applied. Each individual piece shall be painted prior to assembly. Portions where field welding or field contact with concrete is required shall not be painted.

Except for galvanized surfaces and items to be encased in concrete, clean ferrous metal surfaces shall be given one coat of Amerlock 400 Epoxy Primer at 100 Microns or approved equal. Additional coat shall be applied to surfaces that will be concealed or inaccessible for finish painting by Amerlock 400, Top Coat at 150 Microns with color or equivalent.

## FIELD PAINTING

After erection, the Contractor shall thoroughly prepare and clean the entire surface of all structural steel from all dirt, grease, rust or other foreign matters. The entire surface of all members shall then be field painted.

## MATERIALS

### 1. Structural Steel Work

- a. After surface preparation, steelwork shall be given one coat of approved prefabricating primer.
- b. Before final assembly of steelwork at the fabricator's shop, two shop coats of special red lead primer shall be applied to the surface of sections to be in permanent contact, meeting faces and all other concealed surfaces. After final assembly, but before delivery to the project site, the steelwork shall likewise be given two shop coats of special red lead primer.

### 2. Galvanized Steelwork

All galvanized steelwork shall be treated with zinc chromate two-pack etch primer followed by one coat of non-etch zinc chromate primer.

### 3. Miscellaneous Metal Work

Unless otherwise specified in other Sections of the Specifications or shown on the drawing, miscellaneous metal works such as ladders, structural steel ladder rungs, etc. shall be given two shop coats of epoxy primer and two coats of epoxy enamel.

## CONSTRUCTION METHODS

### 1. Cleaning of Surfaces

Surfaces of metal to be painted shall be thoroughly cleaned; removing rust, loose mill scale, dirt, oil or grease, and other foreign substances. Unless cleaning is to be done by sand blasting, all weld areas, before cleaning is started, shall be neutralized with a proper chemical, after which they shall be thoroughly rinsed with water.

Three methods of cleaning are provided herein. The particular method to be used shall be as directed by the Engineer.

### 2. Hand Cleaning

The removal of rust, scale, and dirt shall be done by the use of metal brushes, scrapers, chisels, hammers or other effective means. Oil and grease shall be removed by the use of gasoline or benzene.

Bristle or wood fiber brushes shall be used for removing loose dirt.

### 3. Sandblasting

All steel shall be cleaned by sandblasting. The sandblasting shall remove all loose mill scale and other substances. Special attention shall be given to cleaning of corners and re-entrant angles. Before painting, sand adhering to the steel in corners and elsewhere shall



be removed. The cleaning shall be approved by the Engineer prior to any painting which shall be done as soon as possible before rust forms.

#### 4. Flame Cleaning

All metal, except surface inside boxed members and other surfaces which shall be inaccessible to the flame cleaning operation after the member is assembled, shall be flame cleaned in accordance with the following operations.

- a. Oil, grease, and similar adherent matter shall be removed by washing with a suitable solvent. Excess solvent shall be wiped from the work before processing with subsequent operations.
- b. The surface to be painted shall be cleaned and dehydrated (free from occluded moisture) by the passage of oxyacetylene flames which have an oxygen to acetylene ratio of at least 1.0. The oxyacetylene flames shall be applied to the surfaces of the steel in such a manner and at such speed that the surfaces are dehydrated; dirt, rust loose scale in the form of blisters or scabs, and similar foreign matters are freed by the rapid, intense heating by the flames. The number arrangement and manipulation of the flames shall be such that all parts of the surfaces to be painted are adequately cleaned and dehydrated.
- c. Promptly after the application of the flames, the surfaces of the steel shall be wire brushed, hand scraped wherever necessary, and then swept and dusted to remove all free materials and foreign particles.
- d. Paint shall be applied promptly after the steel has been cleaned and while the temperature of the steel is still above that of the surrounding atmosphere.

#### 5. Weather Conditions

##### a. Exterior Coatings

Coatings to surface shall not be applied during foggy or rainy weather, or under the following surface temperature conditions: below 4°C, or over 35°C, unless approved by the Engineer.

##### b. Interior Coatings

Coatings shall be applied when surfaces to be painted are dry and the following surface temperatures can be maintained: between 18 to 35°C during the application.

#### 6. Application

- a. Paint shall be factory tinted and mixed. All paint shall be field mixed before applying in order to keep the pigments in uniform suspension.

##### b. Field Painting

When the erection work is complete, including all bolting and straightening of bent metal, all adhering rust, scale, dirt, grease or other foreign materials shall be removed as specified above.

As soon as the Engineer has examined and approved each steel and metal works structures, all field bolts, all welds, and any surfaces from which the top or first coat of paint has become worn off, or has otherwise come defective shall be cleaned and thoroughly covered with one coat of paint.

Surfaces to be bolted and surfaces which shall be in contact with concrete, shall not be painted. Surfaces which shall be inaccessible after erection shall be painted with such field coats as are required. When the paint applied for retouching the shop coat has thoroughly dried, and the field cleaning has been satisfactorily completed, such field coats as are required shall be applied. In no case shall a succeeding coat be applied until the previous coat is dry throughout the full thickness of the paint film. All small cracks and cavities which were not sealed in a watertight manner by the first field coat shall be filled with a pasty mixture of red lead and linseed oil before the second coat is applied.

The following provision shall apply to the application of both coats. To secure a maximum coating on edges of plates or shapes, bolt heads and other parts subjected to special wear and attack, the edges shall first be striped with a longitudinal motion and the bolt heads with a rotary motion of the brush, followed immediately by the general painting of the whole surface, including the edges and bolt heads.

The application of the second field coat shall be deferred until adjoining concrete work has been placed and finished. If concreting operations have damaged the paint, the surface shall be re-cleaned and repainted.

c. General Manners

Painting shall be done in a neat and workmanlike manner. Paint may be applied with hand brushes or be spraying, except aluminum paint which preferably shall be applied by spraying. By either method the coating of paint applied shall be smoothly and uniformly spread so that no excess paint shall collect at any point. If the work done by spraying is not satisfactory to the Engineer hand brushing shall be required.

d. Brushing

When brushes are used, the paint shall be so manipulated under the brush as to produce a smooth, uniform, even coating in close contact with the metal or with previously applied paint, and shall be worked into all corners and crevices.

e. Spraying

Power spraying equipment shall be used to apply the paint in a fine spray. Without the addition of any paint, the sprayed area shall be immediately followed by brushing, when necessary, to secure uniform coverage and to eliminate wrinkling, blistering and air holes.

f. Removal of Paint

If the painting is unsatisfactory to the Engineer the paint shall be removed and the metal thoroughly cleaned and repainted.

**ITEM 10 : SECURITY FENCE**

**DESCRIPTION**

This item shall consist of furnishing, construction and installation of security fence components in any combinations in accordance with this specification, lines, grades and cross-sections shown on the Plans, or as directed by the Engineer.

**MATERIALS REQUIREMENT**

Materials shall conform to the respective specifications and other requirements specified below

**CONCRETE HOLLOW BLOCKS (CHB)**

CHB shall be of standard manufacture, machine vibrated with fine and even texture and well-defined edges and conforming to the requirements of ASTM C 129. Unless otherwise specified on the Drawings, It shall have a minimum compressive strength of 4.14 MPa (600 psi). CHB shall be non-load bearing uniform and essentially smooth as normally achieves by standard molding methods and shall be free from any cracks, flaws or other defects.

**BEDDING MORTAR**

Mortar shall be composed of 1 part of Portland cement, 3 parts of sand and ½ part of lime. It shall have a compressive strength of [14 MPa (2,000 psi)] at 28 days and shall comply with property specifications for type N mortar set forth in ASTM Specification C 270 and as modified herein, proportioned and tested in an approved laboratory at the expense of the Contractor. When tested for water retention, the mortar shall have a flow after suction, of 75 percent or more when mixed to an initial flow of 125 to 140 percent. When tested for compressive strength, mortar shall be mixed to a flow of 100 to 115 percent. Aggregate for mortar shall conform to ASTM C 144.

**PLASTER**

Plaster shall comply with the same specification as those for bedding mortar and will include the use of synthetic fibrous reinforcement of type and dosage recommended by the manufacturer.

**REINFORCING STEEL BARS AND RODS**

Minimum yield strength of reinforcement shall conform to the specifications in Section of Reinforced Concrete.

**CONCRETE**

Minimum compressive strength of concrete shall conform to the specifications in Section of Reinforced Concrete.

**BARBED WIRE AND STEEL/GI PIPE POST**

The materials to be used shall conform to the specifications indicated on the drawings and shall be approved by the Engineer prior to installation.

**CYCLONE WIRE MESH**

Cyclone Wire Mesh shall conform to the requirements of ASTM A 121, Class I.

## CONSTRUCTION REQUIREMENT

The Contractor shall perform such clearing and grubbing as may be necessary to construct the fence to required grade and alignment. Fence shall generally follow the contour of the ground. Grading shall be performed where necessary to provide a neat appearance.

The post shall be erected vertically in position inside the formwork of the foundation block prior to the placing of concrete shall be adequately supported by bracing to prevent movement of the post during the placing and setting of the concrete. The post shall be erected to the height and location shown on the Plans, or as ordered by the Engineer.

Masonry shall be laid plumb, true to line, with level courses accurately spaced. Bond pattern shall be kept plumb throughout. Corners and reveals shall be plumb and true. Vertical joints shall be shoved tight. Each unit shall be adjusted to final position while mortar is still soft and plastic. Any unit that is disturbed after mortar has stiffened shall be removed and relaid with fresh mortar. Courses shall be so spaced that backing masonry will level off, flush with the face work at all joints where ties occur. Chases and rake-out joints shall be kept free from mortar or other debris.

Anchorage to concrete. Anchorage to abutting columns shall be provided only where indicated. Details shall be as indicated including anchorage to underside of beams and slabs

Cutting and fitting, including that required to accommodate the work of others shall be done by masonry mechanics. Wherever possible, full units of the proper size shall be used in lieu of cut units. Cut edges shall be clean, true and sharp. Openings shall be carefully cut, formed or otherwise neatly made for recessed items and for electrical, plumbing, or other mechanical installations so that wall plates, cover plates, or escutcheons required by the installation will completely conceal the openings and will have bottoms in alignment with lower edge of masonry joints. Webs of hollow masonry units shall be cut to the minimum required for the installation. Reinforced masonry lintels shall be provided as indicated above openings over 300mm wide, for pipes, ducts and cable trays, unless steel sleeves are used.

Spaces around built-in items shall be filled with mortar. Openings around flush-mounted electrical outlet boxes in wet locations shall be pointed flush with mortar including flush joints above the boxes. Anchors, ties, accessories, flashing, pipe sleeves and other items required to be built-in shall be built-in as the masonry work progresses. Anchors, ties, and joint reinforcement shall be fully embedded in mortar.

Unfinished work shall be stepped back for jointing with new work. Toothing may be resorted to only when specifically approved. Before laying new work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned.

Mortar shall be accurately measured in laboratory-established proportions and mixed with as much water as may be necessary to produce the wettest workable consistency possible. Mortar shall be placed in final position within one hour after mixing. Mortar not used or that has started to set within this time interval shall be discarded.

Joints in exposed-to-view except control joints, joints to be pointed or caulked or sealed, and openings around flush-mounted electrical outlet boxes in wet locations shall be tooled slightly concave with the mortar thoroughly compacted and pressed against the edges of the units. Tooling shall be done when the mortar has been thumbprint hard. The tooled joint shall be finished to uniformly straight and true lines and surfaces, smooth and free of tool marks.

Details of reinforcement shall be as indicated in the drawings. Reinforcing shall not be bent or straightened in a manner injurious to the steel. Bars with kinks or bends not shown on the drawings shall not be used. Placement of reinforcement shall be inspected and approved prior to placing

grout. One piece vertical bars extending from floor to floor or roof above shall be provided. Vertical bars shall be spliced only where indicated.

**a. Positioning Bars**

Vertical bars shall be positioned accurately at the centerline of the wall. A minimum clearance between the bars and masonry units of 12mm and between parallel bars of one diameter of the reinforcement shall be maintained. Vertical reinforcing shall be held in place using metal supports, centering clips, spacers, ties or caging devices located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement.

**b. Splices**

Splices shall be located only as indicated. Splices shall be staggered in adjacent bars at least 600mm. Bars shall be lapped a minimum of 40 diameters of the reinforcement.

Welding shall be done in accordance with Standard Code and under supervision of Engineer.

**PAINTING AND CLEANING**

If required in the contract, paint shall be in accordance to the specification indicated in the plans and coordinated with the end user.

Mortar daubs or splashing, before setting or hardening, shall be completely removed from masonry unit surfaces that will be exposed or painted. Before completion of the work, all defects in joints or masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Masonry surfaces shall not be cleaned, other than removing excess surface mortar until mortar in joints has hardened. Masonry hardened surfaces shall be left clean, free of mortar daubs, dirt, stain and discoloration, including scum from cleaning operations and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

**ITEM 11 : DRAINAGE WORKS**

**SCOPE OF WORK**

The works shall consist of excavation, backfilling and construction of lateral drains, construction of manholes, reconnection to existing lateral and other related works in accordance with the dimensions, size, elevation and grade as shown on the drawing and shall conform with the Specification.

At least thirty (30) days before the start of any construction related to drainage works, the Contractor shall submit to the Engineer for his approval, shop drawings of the drainage work he intends to construct. The shop drawings shall include the materials and the general method of installation he intends to employ.

**MATERIAL REQUIREMENTS**

**BACK FILL**

Fill shall be in accordance with Item "Reclamation and Fill".

**GRAVEL BEDDING**

Gravel Bedding/gravel base shall be in accordance with the specifications of Crushed Course Aggregates in "Reinforced Concrete".

**SAND BEDDING**

Sand bedding shall be in accordance with Item "Reinforced Concrete (Fine Aggregates)".

**CONCRETE**

Mixing/Casting and steel reinforcements shall be in accordance with Item "Reinforced Concrete" while the dimensions shall be as shown on the Drawings.

**CEMENT MORTAR**

Cement mortar shall consist of one part Portland cement to two parts of fine aggregate with water added as necessary to obtain the required consistency.

**REINFORCED CONCRETE PIPE**

The fabrication of reinforced concrete pipes shall conform to the Specifications of ASTM C 76 while the testing requirements shall conform to ASTM C 497. The Engineer reserves the right to inspect and test the pipe delivered for intended purpose. Defects that are discovered after acceptance of delivery of the pipe but before installation shall be a cause for rejection.

Standard reinforcement details and concrete strength shall be in accordance with DPWH "Standard Two Meter Concrete Pipe Culvert".

**STEEL GRATING**

The fabrication of grating shall conform to requirements of Steel and Metal Works" and "Zinc Coatings on Iron and Steel"

All steel grades and dimensions shall conform with the approved plans.

## **EXECUTION**

### **EARTHWORKS**

All earthworks for concrete pipe culvert shall conform to the lines, grades and elevations shown on the drawings or as directed by the Engineer.

The lateral drain shall be excavated to the depth, grade and width established by the Engineer. The bedding surface shall provide a firm foundation of uniform density throughout the entire length. Soft, spongy, or otherwise unstable material encountered that will not provide a firm foundation for the concrete drainage shall be removed to the full width of the trenches and replaced by suitable material to a depth of not less than 30 cm. 100mm thick gravel bedding shall be used as foundation or otherwise as specified.

### **PIPE LAYING**

The pipe shall be tested for water-tightness of joints before backfilling the trench. Unsatisfactory work shall be corrected without additional cost to the PPA. The collar shall have set sufficiently prior to backfilling.

Methods of installation and typical bedding for pipe conduits if not included in the plans, shall conformed to DPWH "Standard Two Meter Reinforced Concrete Culvert".

### **LATERAL DRAIN**

Concrete cover and the existing steel gratings shall be set to the required elevations as shown on the drawings to fit the adjoining surfaces and shall be installed after the adjoining concrete is struck off and finished, and the fit on the frames shall be such that there is no rocking.

All completed structures shall be thoroughly cleaned of any accumulations of silts, debris or foreign matter of any kind, until finally accepted and put into service.

### **CATCH BASIN INLETS, MANHOLES AND OUTLETS**

Lid frames shall be set to the required elevations as shown on the drawings to fit the adjoining surfaces. Lids shall be installed after the adjoining concrete is struck off and finished, and the fit on the frames shall be such that there is no rocking.

Where reconstruction of existing catch basin inlets, manholes, outlets, or similar structures are indicated, the work shall be in accordance to the details and elevations as shown on the drawings, including re-installation of existing metal frames, grates and lids, or replacing of concrete covers instead of grates that may have been lost or found lacking. All completed structures shall be thoroughly cleaned of any accumulations of silts, debris or foreign matter of any kind, until finally accepted and put into service.

### **FIELD DENSITY TEST**

Field Density tests to determine the percent of compaction of the fill material shall be conducted until a field density of at least 95 percent of the maximum dry density in accordance with AASHTO T180, Method D has been achieved. In place density determination shall be made in accordance with AASHTO T191.

## CLEARING AND DISPOSAL

Dumping or disposal of un-used excavated materials shall be coordinated to PMO. If the excavated materials are determined for disposal, the contractor will provide all necessary works and expenses for its completion in concurrence by the Engineer.



## **ITEM 12 : CONSTRUCTION JOINTS**

### **SCOPE OF WORK**

This item shall consist of the manufacturing and installation of construction joints / expansion joints in accordance with the details, and at the locations, lines, grades and dimensions shown in the drawings.

### **MATERIAL REQUIREMENTS**

1. All construction joints / expansion joints shall be hot-dipped galvanized inside and out in accordance with international standards for galvanizing BS EN1460.
2. Painted finish shall be rejected.
3. All steel gratings and angle bars for construction joints / expansion joints shall be hot-dipped galvanized except for the nuts, washers and bolts which shall be stainless steel.
4. Welding shall be in accordance with the AWS Code and as herein specified or any other welding standard, approved by the Engineer.

The Contractor shall be required to submit test certificates for steel materials for the construction / expansion joints used in its manufacture; and for hot-dip galvanizing which shall meet or exceed the specifications under "Zinc Coating".

### **EXECUTION**

#### **DELIVERY, STORAGE AND INSTALLATION**

1. Upon delivery at site, the hot-dipped galvanized construction joints / expansion joints shall not be subjected to the following activities:
  - a. Re-fabrication
  - b. Cutting
  - c. Grinding
  - d. Welding
  - e. Sawing
  - f. Any hot works or similar activities
2. Stainless steel nuts and bolts may be tack welded using stainless steel welding rods.
3. The construction joints / expansion joints shall not be exposed to sea water and other corrosive chemicals or substances prior to installation.

## **ITEM 13 : ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL**

### **SCOPE OF WORK**

This specification covers the requirements for zinc coating (galvanizing) by the hot-dip process on iron and steel products made from rolled pressed and forged shapes, casting, plates, bars and strips.

This specification covers both fabricated and un-fabricated products, for example, assembled steel products, structural steel fabrications, large tubes already bent or welded before galvanizing, and wire work fabricated from uncoated steel wire. It also covers steel forgings and iron castings incorporated into pieces fabricated before galvanizing or which are too large to be centrifuged (or otherwise handled to remove excess galvanizing bath metal).

### **MATERIAL REQUIREMENTS**

#### **STEEL OR IRON**

The specification, grade or designation, and type and degree of surface contamination of the iron or steel in articles to be galvanized shall be supplied by the purchaser to the hot-dip galvanizer prior to galvanizing.

The presence in steels and weld metal, in certain percentages, of some elements such as silicon, carbon and phosphorus tends to accelerate the growth of the zinc-iron alloy layer so that the coating may have a matte finish with a little or no outer zinc layer.

### **EXECUTION**

#### **FABRICATION**

The design and fabrication of the product to be galvanized shall be in accordance to the plans and specifications. ASTM Practices A 143, A 384 and A 385 provide guidance for steel fabrication for optimum hot-dip galvanizing and shall be complied with in both design and fabrication.

#### **CASTINGS**

The composition of heat treatment of iron and steel castings shall conform to specifications designated by the purchaser. Some types of castings have been known to show potential problems being embrittled during normal thermal cycle of hot-dip galvanizing. The requirements for malleable iron castings to be galvanized are stipulated in ASTM specification A 47.

#### **ZINC**

The zinc used in the galvanizing bath shall conform to ASTM Specification B 6. If a zinc alloy is used as the primary feed to the galvanizing bath, then the base material used to make that alloy shall conform to ASTM Specification B 6.

#### **BATH COMPOSITION**

The molten metal in the working volume of the galvanizing bath shall contain not less than an average value of 98.0% zinc by weight.

## COATING PROPERTIES

**Table 1 – Minimum Average Coating Thickness Grade by Material Category**

Material Category	All Specimens Tested Steel Thickness Range (Measured), mm (in.)				
	< 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 and Bar	45	65	75	85	100
Pipe and Tubing	45	45	75	75	75
Wire	35	50	60	65	80

## COATING THICKNESS

The average thickness of coating for all specimens tested shall conform to the requirements of Table 1 for the categories and thickness of the material being galvanized. Minimum average thickness of coating for any individual specimen is one coating grade less than that required in Table 1. Where products consisting of various material thicknesses or categories are galvanized, the coating thickness grades of each thickness range and material category of material shall be shown in Table 1. The specification of coating thickness heavier than those required by Table 1 shall be subject to mutual agreement between the galvanizer and Engineer.

For articles whose surface area is greater than 100,000 mm<sup>2</sup> (160 in.<sup>2</sup>) (multi-specimen articles), each test article in the sample must meet the appropriate minimum average coating thickness grade requirements of Table 1. Each specimen coating thickness grade comprising that overall average for each test article shall average not less than one coating grade below that required in Table 1.

For articles whose surface area is equal to or less than 100,000 mm<sup>2</sup> (160 in.<sup>2</sup>) (single-specimen articles), the average of all test articles in the sample must meet the appropriate minimum average coating thickness grade requirements of Table 1. For each test article, its specimen coating thickness shall not be less than one coating grade below that required in Table 1.

No individual measurement or cluster of measurements at the same general location on a test specimen shall be cause for rejection under this specification provided that when those measurements are averaged with the other dispersed measurements to determine the specimen coating thickness grade for that specimen, the requirements of the above specifications as appropriate are met.

The coating thickness grades in Table 1 represent the minimum value obtainable with a high level of confidence for the ranges typically found in each material category. While most coating thicknesses will be in excess of those values, some materials in each category may be less reactive (for example, because of chemistry or surface condition) than other materials of the steel category spectrum. Therefore, some articles may have a coating grade at or close to the minimum requirements shown in Table 1. In such cases, the precision and accuracy of the coating thickness measuring technique should be taken into consideration when rejecting such articles for coating thickness below that is required by this specification.

## FINISH

The coating shall be continuous (except as provided below), and as reasonably smooth and uniform in thickness as the weight size and shape of the item. Except for local excess coating thickness which would interfere with the use of the product or make it dangerous to handle (edge tears or spikes), rejection for non-uniform coating shall be made only for plainly visible excess coating not related to design factors such as holes, joints, or special drainage problems. Since surface smoothness is a relative term, minor roughness that does not interfere with the intended use of the product, or roughness that is related to the as-received (un-galvanized) surface condition, steel chemistry to zinc shall not be grounds for rejection.

Surfaces that remain uncoated after galvanizing may be renovated in accordance with the methods in ASTM Practice A 780 provided that the following conditions are met:

1. Each area subject to renovation shall be 25mm (1 in.) or less in its narrowest dimension.
2. The total area subject to renovation on each article shall be no more than  $\frac{1}{2}$  of 1% of the accessible surface area to be coated on that article, or 22,500mm<sup>2</sup> (36 in.<sup>2</sup>) per ton of piece weight, whichever is less. Inaccessible surface areas are those which cannot be reached for appropriate surface preparation and application of repair materials as described in ASTM Practice A 780.
3. The thickness of renovation shall be that is required by the thickness grade for the appropriate material category and thickness range in Table 1 in accordance with the coating thickness requirements, except that for renovation using zinc paints, the thickness of renovation shall be 50% higher than that required by table 1, but not greater than 0.0254mm (4.0 mils).
4. When areas requiring renovation exceed the criteria previously provide, or are inaccessible for repair, the coating shall be rejected.

## THREADED COMPONENTS IN ASSEMBLIES

The zinc coating on external threads shall not be subjected to a cutting, rolling or finishing tool operation, unless specifically authorized by the purchaser. Internal threads may be tapped or retapped after galvanizing. Coatings shall conform to the requirements of ASTM Specification A 153/A 153 M.

## APPEARANCE

Upon shipment from the galvanizing facility, galvanized articles shall be free from uncoated areas, blisters, flux deposits and gross dross inclusions. Lumps, projections, globules or heavy deposits of zinc which will interfere with the intended use of the material will not be permitted. Plain holes of 12.5mm (1/2 in.) diameter or more shall be clean and reasonably free from excess zinc. Marks in the zinc coating caused by tongs or other items used in handling the article during the galvanizing operation shall not be cause for rejection unless such marks have exposed the base metal, and the bare metal areas exceed the criteria provided in number 1 and 2 of Subsection "Finish".

Whenever dross is present in a form other than finely dispersed pimples in the coating and is present in such amount as to be susceptible to mechanical damage, it will be considered as "gross".

## ADHERENCE

The zinc coating shall withstand handling consistent with the nature and thickness of the coating and the normal use of the article, without peeling or flanking. Although some material may be formed after galvanizing, in general the zinc coating on the articles covered by this specification is too heavy to permit severe bonding without damaging the coating.

## SAMPLING

A lot is a unit of production or shipment from which a sample may be taken for testing. Unless otherwise agreed upon between the galvanizer and the purchaser, or established within this specification, the lot shall be as follows:

1. For testing at a galvanizer's facility, a lot is one or more articles of the same type and size comprising a single order or a single delivery load, whichever is smaller, or any number of articles identified as a lot by the galvanizer, when these have been galvanized within a single production shift and in the same bath.
2. For test by the purchaser after delivery, the lot consists of the single order or the single delivery load, whichever is smaller, unless the lot identify, established in accordance with the above, is maintained and clearly indicated in the shipment by the galvanizer.

The method of selection and number of test specimens shall be agreed upon between the galvanizer and the purchaser. Otherwise, the test specimens shall be selected random from each lot. In this case, the minimum number of specimens from each lot shall be as follows:

Number of Pieces in Lot	Number of Specimens
3 or less	All
4 to 500	3
501 to 1,200	5
1,201 to 3,200	8
3,201 to 10,000	13
10,001 and over	20

A test specimen which fails to conform to any requirement of this specifications shall not be used to determine the conformance to other requirements.

## TEST REQUIREMENTS

### Magnetic Thickness Measurements:

The thickness of the coating shall be determined by magnetic thickness gauge measurements in accordance with ASTM Practice E 376. For each specimen, five or more measurements shall be made at points widely dispersed throughout the volume occupied by the specimen so as to represent as much as practical, the entire surface area of the test specimen. The average of the five or more measurements thus made for each specimen is the specimen coating thickness.

For articles whose surface area is greater than 100,000 mm<sup>2</sup> (160 in<sup>2</sup>), in the average of the three specimen coating thickness grades comprising each test article is the average coating thickness for that test article. A specimen must be evaluated for each steel category and material thickness within the requirements for each specimen of the test article.

For articles whose surface area is equal to or less than 100,000 mm<sup>2</sup> (160 in<sup>2</sup>), the average of all specimen coating thickness grades is the average coating thickness for the sample.

The use of magnetic measurement method is appropriate for larger articles, and may be appropriate for smaller articles when such is practical using ASTM Practice E 376.

### Stripping Method

The average weight of coating may be determined by stripping a test article, a specimen removed from a test article, or group of test articles in the case of very small items such as nails, etc., in accordance with Test method ASTM A 90/A 90m. The weight of coating per unit area thus determined is converted to equivalent coating thickness values in accordance with Table 2, Coating Thickness Grade (rounding up or down as appropriate). The thickness of coating thus obtained is the test article coating thickness, or in the case of a specimen removed from a test article, is the specimen average coating thickness.

Table 2 – Coating Thickness Grade <sup>A</sup>

Coating Grade	mils	oz/ft <sup>2</sup>	μm	g/m <sup>2</sup>
35	1.4	0.8	35	245
40	1.4	1.0	45	320
50	2.0	1.2	50	355
55	2.2	1.3	55	390
60	2.4	1.4	60	425
65	2.6	1.5	65	460
75	3.0	1.7	75	530
80	3.1	1.9	80	565
85	3.3	2.0	85	600
100	3.9	2.3	100	705

<sup>A</sup> Conversions in Table 2 are based on the metric thickness value equivalents from the next earlier version, using conversion factors consistent with Table X 2.1 in Specification A 653/A 653M, rounded to the nearest 5 μm (0.0002 in.). The conversion factors used are: mils = μm x 0.03937; oz/ft<sup>2</sup> = μm x 0.002316; g/m<sup>2</sup> = μm x 7.067.

### Weighing Before or After Galvanizing

The average of coating may be determined by weighing articles before and after galvanizing, subtracting the first weigh from the second and dividing the result by the surface area. The first weigh shall be determined after pickling and drying, and the second after cooling to ambient temperature. The weight of coating per unit area thus determined is converted to equivalent coating thickness values according to Table 2 (rounding up or down as appropriate). The thickness of coating thus obtained is the test article coating thickness.

## Microscopy

The thickness of coating may be determined by cross-sectional and optical measurement in accordance with ASTM Test Method B 487. The thickness thus determined is a point value. No less than five such measurements shall be made at locations on the test article which are as widely dispersed as practical, so as to be representative of the whole surface of the test article. The average of no less than five such measurement is the specimen coating thickness.

## Adhesion

Determine adhesion of the zinc coating to the surface of the base metal by cutting or prying with the point of a stout knife, applied with considerable pressure in a manner tending to remove a portion of the coating. The adhesion shall be considered inadequate if the coating flakes off in the form of a layer of the coating so as to expose the base metal in advance of the knife point. Do not use testing carried out at edges or corners (points of lowest coating adhesion) to determine adhesion of the coating. Likewise, do not use removal of small particles of the coating by paring or whittling to determine failure.

## Embrittlement

Test for embrittlement may be made in accordance with ASTM Practice A 143

The galvanized article should withstand a degree of bending substantially the same as the ungalvanized article. Flaking or spalling of the galvanized coating is not be constructed as an embrittlement failure.

## Inspection, Rejection and Retest

The material shall be inspected at the galvanizer's plant prior to shipment. However, by agreement the purchaser may make the tests which govern the acceptance or rejection of the materials in his own laboratory or elsewhere.

When inspection of materials to determine conformity with the visual requirements of Subsection "Finish" warrants rejection of a lot, the galvanizer may sort the lot and submit it once again for acceptance after he has removed any nonconforming articles and replace them with conforming articles.

Materials have been rejected for reasons other than embrittlement may be stripped and regalvanized, and again submitted for inspection and test at which time they shall conform to the requirements of this inspection.

## Transport and Storage

Galvanized components shall, wherever possible, be transported and stored under dry, well-ventilated conditions to prevent the formation of wet storage staining.

Either zinc phosphate or chromate passivation treatment after galvanizing may be used to minimize the wet storage staining which may occur on articles unable to be stored in dry, well-ventilated conditions.

Provided the coating thickness complies with the requirements of Subsection "Coating Thickness", no further remedial action is required to the stained areas.

## ITEM 14 : EXCAVATION WORKS

### SCOPE OF WORK

#### General Provisions

1. The area shall be excavated at the *required depth* as indicated on the Drawing/s.
2. The work includes furnishing of all labor, materials, plants and equipment required to complete/finish the excavation works.

#### Work Schedules

1. After examinations of all relevant data, coordination needs, work constrains, equipment to be used and other matters, a PERT/CPM diagram showing the detailed schedule/duration and sequences for the execution of excavation work shall be submitted to the Engineer for approval within 15 days before the proposed commencement of the Works.
2. Before the commencement of excavation works, the Contractor together with the Authority's Representatives and Surveyors shall conduct a pre-joint hydrographic and topographic survey which will form basis of actual quantity of excavated materials to be removed/excavated.
3. Prior to excavation works, the Contractor shall establish visible markers to clearly define the limits of the excavation.

### EQUIPMENT/LAYOUT OF WORK

#### Plant

1. The Contractor shall keep on the job sufficient equipment/plant to meet the requirement of the project.
2. The equipment/plant shall be in satisfactorily operating conditions and capable of efficiently performing the excavation works with safety as set forth herein and shall be subject to inspection by the Engineer at all times.

#### Physical Data/Layout of Work

1. The Authority does not guarantee to keep the project excavation area free from obstructions.
2. The Contractor shall conduct the work in such manner not to disrupt the port operational activities at all times.
3. The Contractor shall layout his work from the government established ranges and gauges which shall be pointed out to him prior to commencement of the excavation work but shall be responsible for all measurements in connection therewith.
4. The Contractor shall furnish, at his own expense, survey equipment, range markers, poles, buoys, etc., and labor as may be required in laying out any part of the excavation work.
5. The Contractor shall be responsible for the installation, maintenance and preservation of all gauges, ranges, platforms, excavation limit markers. Upon completion of the work, the Contractor shall promptly remove all ranges, markers, and other marker placed by him that may be detrimental to port operation.



## **EXECUTION**

### **EXCAVATION WORKS**

#### **Description**

1. This item shall consist for the removal of existing seabed/fill in conformity with the dimensions shown in hydrographic and topographic survey plan or as established by the Engineer.
2. The excavated suitable materials shall be used if proven to pass the requirements as backfilling materials.
3. The excavated good materials shall be stockpiled within the project site to be designated by the Engineer. The good materials shall be used for backfilling as directed by the Engineer.

#### **Progress of Work**

1. Upon mobilizing sufficient labors, materials, plants and equipment, the Contractor shall works at such hours as may be necessary, subject to existing laws, to ensure the prosecution of work in accordance with the approved schedule (PERT/CPM). If the Contractor falls behind the approved excavation schedule, the Engineer may require the Contractor to increase the number of shifts and/or equipment without extra cost to the Authority.
2. Failure of the Contractor to comply with the requirements shall be reasonable grounds to assume that the Contractor is not performing the excavation work with such diligence as will insure completion within the specified time, in which case, the Engineer may be compelled to take steps to protect the interest of the PPA.
3. When the Contractor elects to work overtime and on Sundays and legal holidays, appropriate authority from those concern must be secured and notice of his intention to do so shall be submitted to the Engineer within the reasonable time in advance thereof.
4. The Contractor shall *submit daily excavation reports in duplicate* within two (2) days after the end of the day covered by the report duly signed by the Contractor or his duly authorized representative and the Engineer. The report shall be made in forms and to be provided by the Authority.
5. The Contractor shall take necessary measures to protect the life and health of his men in accordance with the existing laws and regulations of the Government. The Contractor shall provide safety devices to Engineer and personnel while on board the equipment/plant in performance of their official duties.
6. The Contractor shall put up and maintain such markers and buoys as will prevent any accident in consequence of his excavation work. No liability whatsoever attaches to the Authority, if as a result of the operations or installation, an accident happens in the project area. The Contractor shall hold the Authority free and harmless against any or all claims of persons involve in such accidents.

## **EXCAVATED MATERIALS**

1. Disposal of excavated unsuitable materials from seabed shall be transported and deposited at 10.00 kms. (minimum) away from the area to be excavated.
2. Stockpiling and usage of excavated materials from existing backfill shall be approved by the Engineer in coordination with the Agency.

### **Displace Materials**

1. Should the Contractor, during the progress of the excavation works, lose, dump, throw overboard, sink, misplace any materials, plant, machinery or appliance which may be dangerous to or obstruct navigation and/or port operations activities, the Contractor shall immediately give notice with description and location of such obstruction to the Authority and when required, shall mark the obstruction until such time the same is removed.
2. Should the Contractor refuse, neglect or delay compliance with the above requirements, such obstructions shall be removed by the Authority and the cost of its removal shall be deducted from any money due or to become due to the Contractor or proceeded against his performance bond.
3. Any excavated materials that is deposited other than the designated area will not be paid and the Contractor shall be required to remove such misplaced materials and deposit it to where directed at his expense.

## **INSPECTION**

1. No PPA Project Engineer or Authority's Representative is authorized to change any provisions of the excavation specifications without written authorization of the Authority.
2. Nor shall the presence or absence of a PPA project Engineer or Authority's Representative relieve the Contractor from any of his responsibility under the Contract.

## **PAY LIMITS**

It is to be clearly understood that no payments will be made for excavation beyond the excavation limits. The Contractor shall bear all the cost of over excavation beyond the project depth and in addition, of any remedial measures ordered by the Authority or its representative to be taken in areas over excavation is not permitted.

## **SOUNDINGS**

1. The Contractor, in the presence or joint with the Authority's Representative and during the progress of the excavation works, shall perform continuous checking of the depth thru soundings.
2. For the purpose of work progress payments; the Contractor, jointly with the Authority's Representative and/or Surveyors, shall conduct soundings on areas subjected to excavation activities during the month or the preceding period for which payment is being claimed.
3. The Contractor will be responsible for all costs involved in the above mentioned such as costs for the survey equipment, measurement, markings, materials and other cost related thereto.

## ITEM 15 : PILING WORKS (SPP)

### SCOPE OF WORK

This section covers the minimum requirements for the fabrication, hauling, spotting, driving and finishing of all foundation piles to be used as containment for the proposed pier.

The Contractor may however, adopt, in addition to this minimum requirements additional provisions as may be necessary to insure the successful prosecution of the work related to the said undertaking.

### METHOD STATEMENT

Before the commencement of any piling works, the Contractor shall submit (allowing sufficient time for consideration) to the Engineer for approval a Safety Policy and a Method Statement which shall include the following information:

1. Program of Works detailing sequence and timing of individual portions of works.
2. Maximum proposed lead at any stage of driving between a pile and its neighbor and the limitations of same if hard driving is encountered.
3. Contingency plan in the event of encountering obstructions or reaching driving refusal to minimize disruption/delay especially when using pitch and drive methods.

### MATERIAL REQUIREMENTS

#### STEEL PIPE PILES

Steel tubular piles required under this heading may either be fluted or plain, tapered or cylindrical, seamless or welded type or as indicated in the drawing conforming to the requirements of ASTM A 252, equal or better. Minimum shell thickness shall be as indicated in the drawings.

Manufacturing processes, grades and test requirements shall conform to the requirements of ASTM A 252. Other materials, equal or better, than this standard may be allowed upon approval of the implementing agency.

Type of Test	-	Requirements
Chemical Composition	-	ASTM A252, ASTM A751
Mechanical/ Tensile Test	-	ASTM A252, ASTM A370
Physical /Test	-	ASTM A252

#### REINFORCING BAND AND BACKING CYLINDER PLATE

Manufacturing processes, grades and test requirements shall conform to the requirements of ASTM A 252. Other materials, equal or better, than this standard may be allowed upon approval of the implementing agency.

#### CONCRETE AND REINFORCEMENT WORKS

Concrete and reinforcement works for filler of steel pipe piles, concrete jacket and pile cap shall be in accordance with the Section "Reinforced Concrete" where the compressive strength of concrete at 28 days and yield strength of reinforcement shall be 24MPa (3,500 psi) and 276MPa (40 000psi) respectively.

## PROTECTIVE COATING

### *Coating System*

The corrosion protective coating shall be polyurethane-base.

The protective coating supplier is required to certify that the materials delivered to the fabrication site will be proven to meet or exceed the following properties:

TECHNICAL PROPERTIES	UNIT	MINIMUM	TEST STANDARD
<b>A. Physical Characteristics:</b>			
Thickness	microns	1500	ASTM D1186
<b>B. Mechanical Properties:</b>			
Tensile Strength	N/mm <sup>2</sup>	18	DIN 53504
Elongation	%	19	ASTM D2370
Impact	J/mm	8	ASTM 2794-69/14
Bond Strength	kg/cm <sup>2</sup>	234	DIN 53232

Application of the protective coating shall be one meter (1) below the design depth up to the pile butt of the steel pipe piles, as illustrated in Figure 1.

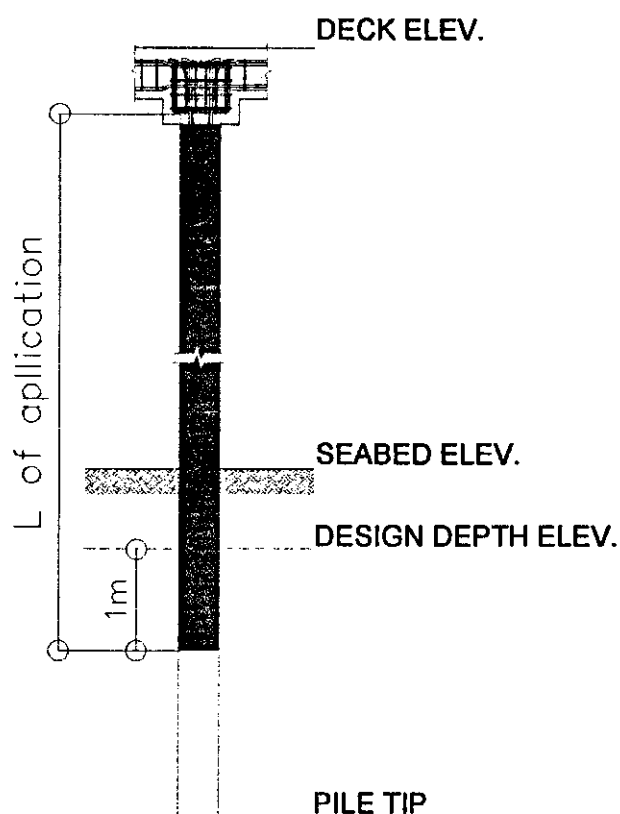


Figure 1: Illustration showing the application of Protective Coating System

### ***Surface Preparation***

The surface areas of the sections of piles that are intended to be coated are cleaned in accordance with standard ISO 8501-1 "Pictorial Standard of Cleanliness". These standards for surface cleaning outline the visual characteristics of the substrate as viewed by the naked eye. Once the substrate is cleaned, it is compared to reference pictures contained within the standards. The Sa 2½ is to be used for this undertaking, which is defined in ISO 8501-1 as having the following characteristics:

"Very thorough blast cleaning: Near white metal, 85% clean. The surface shall be free from visible oil, dirt and grease, from poorly adhering mill scale, rust, paint coatings and foreign matter. The metal has a greyish color. Any traces of contamination shall be visible only as slight stains in the form of spots or stripes."

### ***Spraying Method***

Airless spraying techniques involve paint being "forced out of an orifice at high pressure, 5 to 35 MPa". The paint appears to form a coating "sheet" to ensure a uniform and continuous coating layer. This uniformity is important as even the smallest discrepancy in the coating can lead to accelerated corrosion. Once any small-sized area of the substrate becomes exposed it will begin to corrode. This corrosion continues under the protective layer in the adjoining coated areas in all directions, even if the coating has not been damaged.

Good surface preparation is essential and it profoundly effects the performance of the protective coating. Poor surface preparation invariably develops a poor adhesive bond between the coating and the substrate and causes premature coating failure. Hence, the surface preparation and airless spraying shall be done in an "Enclosed Area" wherein humidity and corrosion may be controlled prior to delivery of the Steel Pipe Piles at the project site.

### ***On-site repairs***

A special touch up materials shall be provided by the supplier/contractor and shall be done either by the use of a spray or manual brush with the objective of having a final homogeneous coating. The special touch up materials shall be used in repairing damages caused by handling and transporting of the Steel Pipe Piles.

## **WELDING REQUIREMENTS**

The welding material used for the production of steel piles by circumferential welding of steel pile or in the attachment of accessories shall have a tensile strength not less than the following test standards.

JIS Z 3211	-	Covered Electrodes for Mild Steel
JIS Z 3213	-	Covered Electrodes for High Tensile Strength Steel
JIS Z 3312	-	MAG Welding Solid Wires for Mild
JIS Z 3313	-	Flux Cored Wives for Gas Shielded and self-shielded Metal Arc Welding of Mild Steel, High Strength Steel and Low Temperature Service Steel
JIS Z 3352	-	Submerged Arc Welding Fluxes for Carbon Steel and Low Alloy Steel

## **EXECUTION**

### **MARKING**

The pile shall be marked on with durable paint indicating:

1. Serial Number, marked close to both ends
2. Date of Arrival, marked same as (1)
3. Length of pile, marked same as (1)
4. Meters mark in two faces, throughout the length

### **DOCUMENTS TO BE SUBMITTED**

1. Steel Pipe manufacturing plan (Steel pipe production plan, welding method, welding material, production location, production method, transportation, etc.)
2. Design plan
3. Manufacturing process
4. Shipment method and stacking plan
5. Steel pipe inspection certificate
6. Size inspection record
7. Radiographic Test record

### **STEEL PIPE PILES**

The Contractor shall submit to the Engineer three (3) copies of test reports by the approved steel mill certifying that the steel pipe pile meets the requirements specified in these technical specifications.

### **PILE SPLICING**

#### **General Provision**

1. The alignment of piles shall be plumb and the length of upper and lower segment shall be in accordance in the approved plans.
2. Lower segment of piles should be spliced with the upper segment piles prior to the conduct of actual driving.
3. The splice shall be embedded at least 4m from the design depth elevation.
4. Splice welding shall conform to the welding requirements of this section.
5. The welder shall be accredited by TESDA.

## REINFORCED CONCRETE

The requirements regarding testing of concrete and reinforcement used in the concrete filler and cage bars of steel pipe piles shall be in accordance with Section "Reinforced Concrete".

## STORAGE AND HANDLING

1. Piles may be stored in open air but on wooden sleepers to be placed in a manner so as not to cause excessive bending.
2. Piles shall be stacked on a stable yard and shall not be stacked more than three (3) tiers high.
3. All piles shall be carefully lifted at the location of the lifting points as indicated in the Drawings. Other practical and convenient methods may be used subject to the approval of the Engineer.

## DRIVING OF PILES

A diesel or hydraulic pile hammer shall be used for driving the steel pipe piles.

The required weight of ram for the diesel pile hammer 2.5 tons or at least 25% (1/4) of the weight of longest pile.

Piles driven shall be held firmly in position in axial alignment with the hammer by means of leads of adequate length. Approved cushions shall be provided to the pile butts.

## BEARING POWER OF PILES

Each pile shall be driven to attain not less than the required minimum bearing power shown in the pile schedule, as determined by the Hiley's Formula as follows:

$$\text{For Diesel Pile Hammer :} \quad R = \frac{1}{6} \times \frac{2WH}{S + 2.54}$$

where :      R = allowable bearing capacity of pile (tf)

W = weight of ram (tf)

H = fall of ram (cm)

S = set (cm)

In case of the use of hydraulic pile hammer, the computed minimum bearing power shall be submitted to the Project Development Department (PDD) and shall be evaluated and approved by the Designing Engineer.

## DRIVING RECORDS

The Contractor shall keep complete and accurate piling records. Two (2) signed copies of these records shall be submitted to the Engineer not more than 48 hours from the date of works detailed therein. The pile records shall always be submitted with sufficient time for the Engineer's approval.

The records shall contain the following information:

1. Pile reference number
2. Pile type and Steel Grade
3. Pile Length
4. Commencing surface level and final toe level
5. Depth driven, time, date when piles were driven
6. Where required the number of blows to drive each 250 mm over the last 2.5 meter shall be recorded
7. Comments regarding unusual/unexpected driving conditions

#### **INTERRUPTED DRIVING**

When driving is stopped before final penetration is reached and/or refusal is attained, the record of pile penetration shall be taken only after a minimum of 30 cm. (12 in.) total penetration has been obtained on resumption of driving.

#### **ALIGNMENT TOLERANCE**

Piles driven shall be within the allowable tolerance in alignment of 10 cm. (4 in.) in any direction.

#### **DAMAGED AND MISDRIVEN PILES**

1. Piles shall not be more than 10 cm. (4 in.) out of place at cut-off level. All steel pipe piles shall not be more than 2% out of plumb.
2. Any pile damaged by improper driving or driven out of its proper location, or driven out of elevation fixed on the plans, shall be corrected correspondingly at the Contractor's expense by any of the following methods:
  - a. Withdrawal of the pile and replacement by a new pile.
  - b. Driving a second pile adjacent to the defective one.
  - c. Splicing an additional length.

The method to be adopted in each case shall be at the discretion of the Engineer.



## **ITEM 16 : MOORING AND FENDERING SYSTEM**

### **SCOPE OF WORK**

1. The work includes furnishing of all labor, materials and equipment to complete the installation of mooring bollards and fenders in piers/wharves.
2. The work shall include the supply, transport, handling, storage and installation of fenders systems in the newly constructed piers.
3. The Contractor shall furnish and install the necessary fittings as shown on the drawings and/or 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.

### **MATERIAL REQUIREMENTS**

#### **MOORING SYSTEM**

Designated load capacity of mooring bollards shall be as shown in the drawings, and shall be referred to as the maximum load capacity. The mooring bollards shall be at rupture stage upon reaching the maximum load capacity.

Mooring bollards shall be of the dimensions, weights, capacities and designs as shown in the drawings and shall be fabricated by approved manufacturer with cast steel conforming to the requirements indicated in the plan/drawings, or approved equivalent.

The size of the bolts, nuts and washers shall be in accordance with the specifications provided in the plans/drawings. The anchor plate shall be connected to the holding down bolt as shown in the plans/drawings. All bolts, nuts, washers etc., that are exposed shall be hot-dip galvanized.

Samples of the bolts, nuts, washers and anchor plates shall be submitted to the Engineer for approval before being used in the Works.

The upper part of bollards and base plates which are not embedded in concrete shall be painted. The surface of bollards 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 120m micron thickness in accordance with JIS K5623 or the approved standard.

#### **Base Steel:**

Chemical composition and mechanical properties of base metal to be used for fabrication of mooring bollard and its accessories shall comply with ASTM A36 and other required standard stated therein.

**Concrete Foundation :**

Concrete foundation for mooring bollards shall conform to the requirements of the Section concerning "Reinforced Concrete".

**Visual Inspection :**

All mooring bollards delivered to Site shall be inspected by the Engineer for any signs of flaws or defect inimical to usage.

**Mill Test Certificates:**

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

**Test 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 Specifications and the best of workmanship.

## FENDER SYSTEM

The rubber fenders should comply with the performance requirements specified in the table provided on the plan/drawings of Rubber Dock Fenders (RDF).

### PHYSICAL PROPERTIES OF MATERIALS

The rubber for the fenders shall be of high quality natural rubber, synthetic rubber or mixed rubber blended with carbon black used in the rubber industry and shall have sufficient resilience and anti-ageing, weathering, abrasion, wear and oil resistant properties. The rubber dock fenders shall be free from bubbles, cracks and other harmful defects.

The physical properties of the rubber compound used for the fenders shall comply with the following requirements:

**Physical Properties and Test Method**

Test Item		Properties	Test Method	
Physical Test	Before Aging	Tensile Strength	Test piece: Dumbell No. 3	ASTM D412
		Elongation		ASTM D1456
		Hardness	Spring Type hardness test (Type A)	ASTM D2240
	After Aging	Tensile Strength	Aging by air heating: 70±1°C x 96 hours.	ASTM D412
		Elongation		ASTM D1456
		Hardness		ASTM D2240
	Compression Test		Heat treatment: 70±1°C x 22 hours.	ASTM D395

Note: Equivalent Standards are acceptable.

### FITTINGS AND ANCHORAGE

Anchor bolts and connecting hardware shall be fabricated using type of steel specified and to the required shapes and sizes shown on the approved plan/drawings.

### TESTING, SAMPLING, INSPECTION, ACCEPTANCE, MARKING AND PACKAGING

#### Testing

All rubber dock fenders shall be tested for performance. It shall pass the required energy absorption and reaction force at a certain deflection as indicated in the plan.

The Contractor shall be required to submit test certificates showing compliance to the above requirements. The test certificates shall be certified by an independent testing institute / organization recognized by the Authority.

The standard performance testing methodology shall be Method B, to wit:

1. Fender temperature shall be stabilized at 23 degrees plus or minus 5 degrees centigrade for at least 24 hours before compression testing.
2. Break-in of fender by deflecting 3 times to rated deflection.
3. Removed load from the RDF and allow recovering for a minimum of 1 hour.
4. Deflect RDF at speed of 2-8 cm/min once to rated deflection.

The testing apparatus shall be calibrated and certified within plus or minus 1% in accordance with ISO or equivalent JIS or ASTM requirements. Calibration shall be traceable to a national/international standard and shall be performed annually by an accredited third party organization. The RDF performance testing center shall be subjected to accreditation by PPA and notation and /or certification by DPWH-BRS prior to acceptance.

### Inspection

All fenders of each type shall be inspected for compliance to specified dimensions and all fenders shall be inspected by the Engineer for any sign of flaw or defect inimical to its use.

All anchor bolts and fittings shall be inspected. The material used for the fabrication of bolts and fittings shall be covered by the manufacturer's certified mill certificate and shall be verified by the Authority.

All RDF items/units shall be clearly numbered and marked indicated the following:

### Acceptance Tolerance

The acceptance tolerance shall be based on the following:

1. Fender Dimension
 

Length	:	-2% to +4%
Width	:	-2% to +4%
Height	:	-2% to +4%
Thickness	:	-2% to +8%
2. Anchor Bolt Holes in Fender
 

Diameter of the Hole	:	+2.0mm
Pitch of the Hole	:	+4.0mm
3. Acceptance tolerance for all fenders supplied shall be as follows:
 

E = Energy absorption,	E ≥ Specified E but not less than 10% of the specified E
R = Reaction force,	R ≤ Specified R but not more than 10% of the specified R

## Marking

All fender units shall be clearly numbered and marked. Each fender shall have the following markings.

1. Fender type and manufacturer's name or trade mark
2. Production serial number
3. Date of manufacture or its abbreviation
4. Main dimensions
5. Project identification as follows:

Name of Port/Project: \_\_\_\_\_

Year supplied \_\_\_\_\_

## Packaging

The fenders shall be packaged on wooden crate or wrapped individually with Polypropylene sheets except when shipped containerized. The bolts and fittings should be placed in crates and suitably treated for protection when transported by sea and stored in port areas.

## EXECUTION

### MOORING / FENDERING SYSTEM

All units shall be installed at the locations shown on the drawings and as directed by the Engineer.

## ITEM 17 : ELECTRICAL WORKS

### SCOPE OF WORK

The work to be done shall consist of furnishing, delivering and installing Integrated Solar Street Light completed in accordance with all the details of the electrical works as shown on the drawings including materials, labor, tools and equipment and all incidental works as found necessary.

Refer to electrical plans/drawings for location and extent of work involved.

### GENERAL REQUIREMENTS

- a) All works shall be done in accordance with the requirements of the publications and agencies having jurisdiction, as well as the requirements of the approved standards.
  1. National Fire Protection Association - (NFPA)
  2. National Electrical Manufacturer Association - (NEMA)
  3. Underwriter Laboratories, Inc. - (UL)
  4. Philippine Electrical Code - (PEC)  
Philippine National Standard - (PNS)
  5. Federation Specification:  
Circuit Breaker, Molded Case, Branch  
Circuit and Service
  6. American National Standard Institute - (ANSI)
  7. American Society for Testing and Materials - (ASTM)
  8. Illuminating Engineering Society - (IES)
  9. Light Emitting Diode - (LED)
- b) The Contractor shall employ a licensed Registered Electrical Engineer or Master electrician to perform or to supervise and to conduct the continuous inspection of all electrical work.
- c) The Contractor shall first obtain approval from the Authority before procurement, furnishing or delivery of Integrated Solar Street Light to the project site. Partial submittals will not be acceptable and will be returned without review. Submittals shall include the Manufacturer's Name, Trade Name, Place of Manufacture, Catalog Model or Number, Nameplate Data, Size, Layout Dimensions, Capacity, Project Specification and Paragraph Reference, Technical Society Publication References and other information necessary to establish contract compliance of each item to be furnished.
- d) All excavations fill and backfill and concrete works involved herein, shall be carried to the required elevations and shall conform to the provisions of specification under Earthwork and Concrete Construction of this document.
- e) The materials and equipment to be furnished shall be standard products of reputable manufacturer engaged in the reproduction of such materials and equipment.

- f) All permits and electrical fees required for this work shall be obtained at the expense of the Contractor. The Contractor shall furnish the Engineer-in-Charge, the final Certificates of Inspections and approval from the proper government authorities after the completion of work. The Contractor shall prepare all as-built plans and all other paper works as required by the enforcing authorities.
- g) The Contractor shall furnish and install Integrated Solar Street Light as shown in the drawings. A licensed Electrical Engineer or Master Electrician is required to implement the installation of the electrical works.
- h) Electrical installation shall conform to the requirements of Philippine Electrical Code (PEC) and the other approved standards.
- i) The contractor shall install all electrical works with the supervision of the qualified Registered Electrical Engineer (REE) or Master Electrician. All electrical installation regardless of capacity and voltage whether new, addition or revision shall be accompanied by electrical plans signed and sealed by a duly licensed Professional Electrical Engineer (PEE).

## **MATERIAL REQUIREMENTS**

All materials shall be brand new and shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the Philippine Standard Agency (PSA) mark.

### **PRODUCTS (DESCRIPTION):**

Integrated Solar Street Lights are a type of street lighting that uses solar power to provide energy to the light. They consist of a solar panel, a battery, and a light all integrated into one unit. These lights are designed to be energy-efficient and environmentally friendly, as they use the power of the sun to provide light, rather than traditional electricity.

The solar panel on an integrated solar street light converts sunlight into electricity, which is stored in the battery. The battery then powers the light at night. These lights are designed to turn on automatically at night and turn off during the day, ensuring that the light is only used when it is needed.

Integrated Solar Street Lights have many advantages over traditional street lights, such as:

They are cost-effective which do not require any electricity or wiring, which means that installation costs are much lower than traditional street lights.

They are environmentally friendly which do not produce any emissions and do not rely on fossil fuels, making them an environmentally friendly option.

They are easy to install which do not require any wiring or complicated installation processes, making them easy to install in any location.

They are low maintenance which does not rely on electricity; they do not require regular maintenance, such as replacing light bulbs or adjusting timers.

Overall, integrated solar street lights are a cost-effective and environmentally friendly option for street lighting. They are easy to install and require minimal maintenance, making them an excellent choice for a wide range of applications.

## **PRODUCTS (SPECIFICATION):**

<b>Solar Module Type</b>	<b>:</b>	<b>120 watt Monocrystalline or equivalent</b>
<b>Service Life</b>	<b>:</b>	<b>25 years</b>
<b>Battery Type Life PO4</b>	<b>:</b>	<b>Lithium Phosphate</b>
<b>Service Life</b>	<b>:</b>	<b>5 years</b>
<b>Charge Time</b>	<b>:</b>	<b>6-7 hrs. (By Sun)</b>
<b>Discharge Time</b>	<b>:</b>	<b>12 hrs. with 5-7 back up rainy days</b>
<b>LED Lamp</b>	<b>:</b>	<b>120 watt</b>
<b>Lumens</b>	<b>:</b>	<b>19200 – 21600 lm</b>
<b>Materials</b>	<b>:</b>	<b>Aluminum Alloy</b>
<b>Working Temperature</b>	<b>:</b>	<b>- 30 C / 70 C</b>
<b>Color</b>	<b>:</b>	<b>6500K -7000K</b>
<b>Mounting Height</b>	<b>:</b>	<b>7 -10 meter</b>
<b>Distance Range</b>	<b>:</b>	<b>25 -35 meter</b>
<b>Warranty</b>	<b>:</b>	<b>3 years</b>
<b>Certificates</b>	<b>:</b>	<b>CE / ROHS / IP65</b>
<b>Product Weight</b>	<b>:</b>	<b>27 kg</b>

## **PRODUCTS (APPLICATION):**

**Integrated Solar Street Lights** are widely used in various applications such as:

Remote and rural areas are particularly useful where traditional electrical infrastructure is not available. They are easy to install and maintain, making them an ideal solution for lighting in these areas.

Parks and recreational areas can be used to illuminate parks, hiking trails, and other recreational areas, providing a safe and well-lit environment for people to enjoy.

Roadways and streets can be used to illuminate roads, streets, and highways, providing a safe and well-lit environment for drivers and pedestrians.

Parking lots and garages can be used to illuminate parking lots and garages, providing a safe and well-lit environment for drivers and pedestrians.

Public spaces can be used to illuminate public spaces such as plazas, squares and sidewalks, providing a safe and well-lit environment for people to enjoy.

Industrial areas can be used to illuminate industrial areas such as warehouses and factories, providing efficient and durable lighting.

**Integrated Solar Street Lights** are versatile and can be used in a variety of outdoor lighting applications. Their energy-efficient and low-maintenance features make them a cost-effective solution for street lighting.

## **EXECUTION**

### **INSTALLATION**

Lamp Post shall be installed as shown on the approved plans.

Pole Setting:      Depth as shown on the approved plans.



Construction of lamp post foundation shall be in accordance with the shape and dimensions as shown on the approved plans.

Excavations / backfilling required before /after installation of lamp post with the trench shall conform to the provisions of Earthwork and Concrete construction.

#### WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of and at the satisfaction of the Registered Electrical Engineer or Master Electrician, who will interpret the intent meaning of the drawings and specification and shall have the power to reject any work and materials which in his judgment, are not in full accordance therewith.

#### TESTING OPERATIONS

When the electrical installation is completed, the Contractor shall test the installed Integrated Solar Street Lights in the presence of Registered Electrical Engineer or Master Electrician. The system shall be free from any defects, shorts or grounds. The Contractor at no extra cost shall furnish all necessary instruments and personnel required for the testing.

#### GUARANTEE

Upon completion and before final acceptance of the work, the Contractor shall furnish the Engineer a written guarantee stating that all works executed are free from defects on materials and workmanship. The guarantee shall be for a period of one year from the date of the final acceptance. Any work that becomes defective during the said period shall be corrected / replaced by the Contractor at his own expense in a manner satisfactory to the Authority.

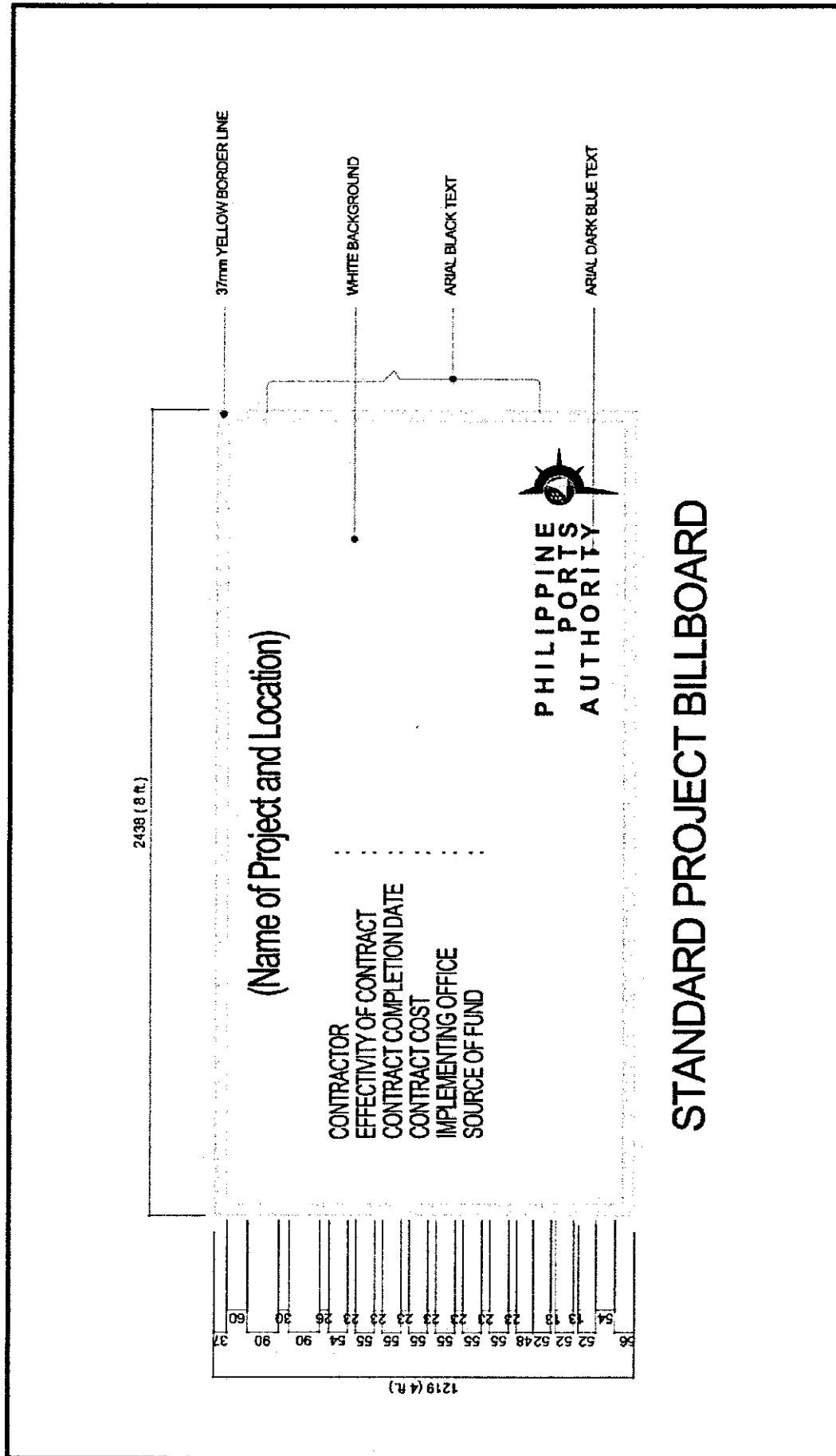
**ITEM 18 : PROJECT BILLBOARD****SPECIFICATION**

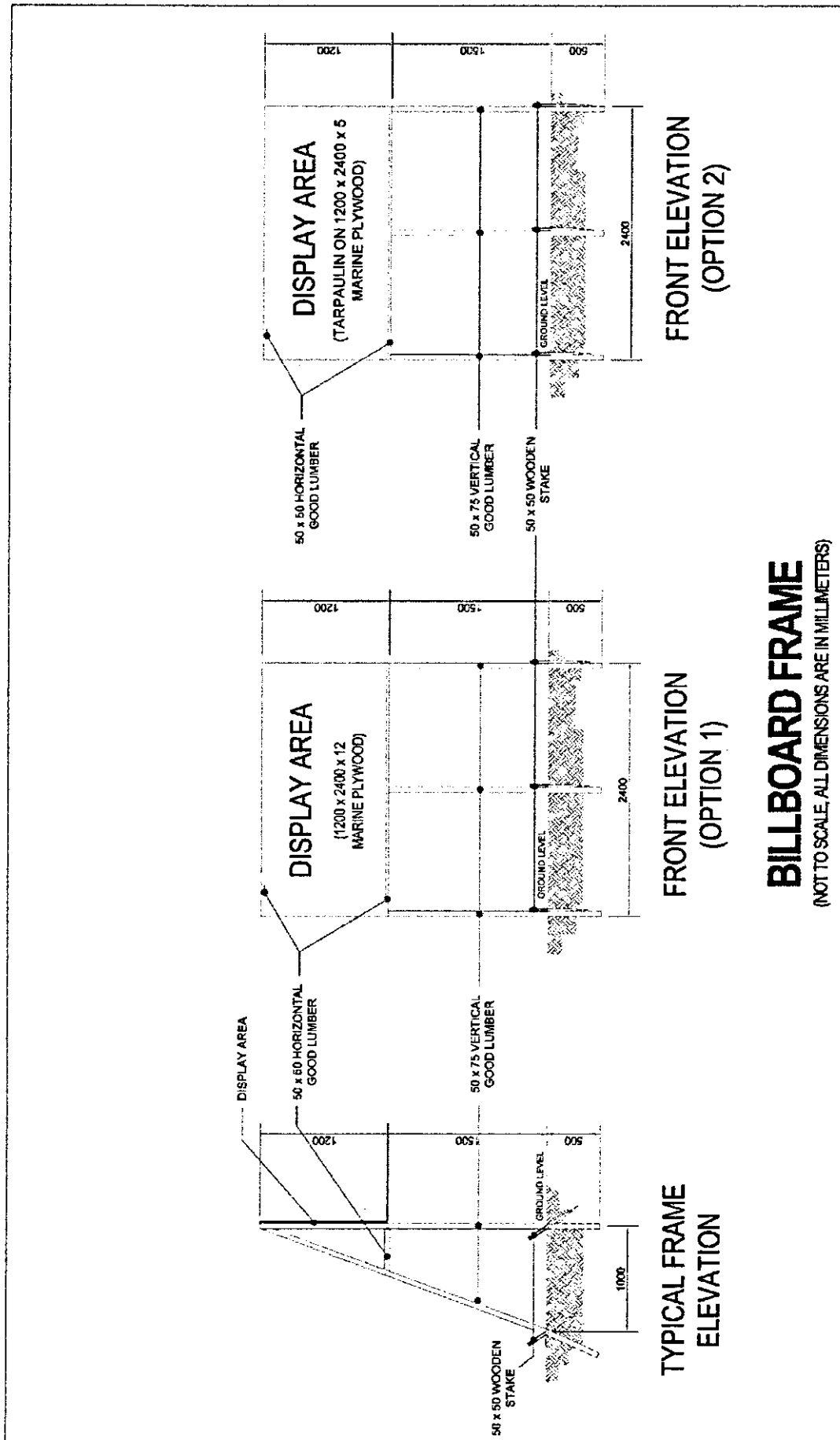
The Project Billboard shall be installed at location(s) designated by the Engineer.

The size and specifications of materials for the standard billboard shall be 4ft. x 8ft. (1,200mm x 2,400mm) using ½ inch (12mm) marine plywood or tarpaulin poster on 3/16 inch (5mm) marine plywood.

Project billboards shall not contain Name(s) and/or picture(s) of any personages.

See attached drawings for further details of the standard billboard.





“To all our contractors, suppliers, and service providers, all we ask is for you to

**SPEED UP**

your contracts and **FINISH**

**AHEAD** of schedule,

**WITHOUT SACRIFICING**

**QUALITY**

of work, and **REASONABLENESS OF COST** agreed upon. Gawin niyo ‘yan at hindi tayo maghihiwalay ng landas (Do that and we will not part ways).”

A Message from  
DOTr Secretary Arthur Tugade



@DOTrPH



@DOTrPH

[www.dotr.gov.ph](http://www.dotr.gov.ph)

## ITEM 19 : SAFETY SIGNAGES AND BARRICADES

### DESCRIPTION

This work includes the furnishing and installing of safety signages and barricades in accordance with the specifications and to the details shown below in the drawings, or as directed by the Engineer.

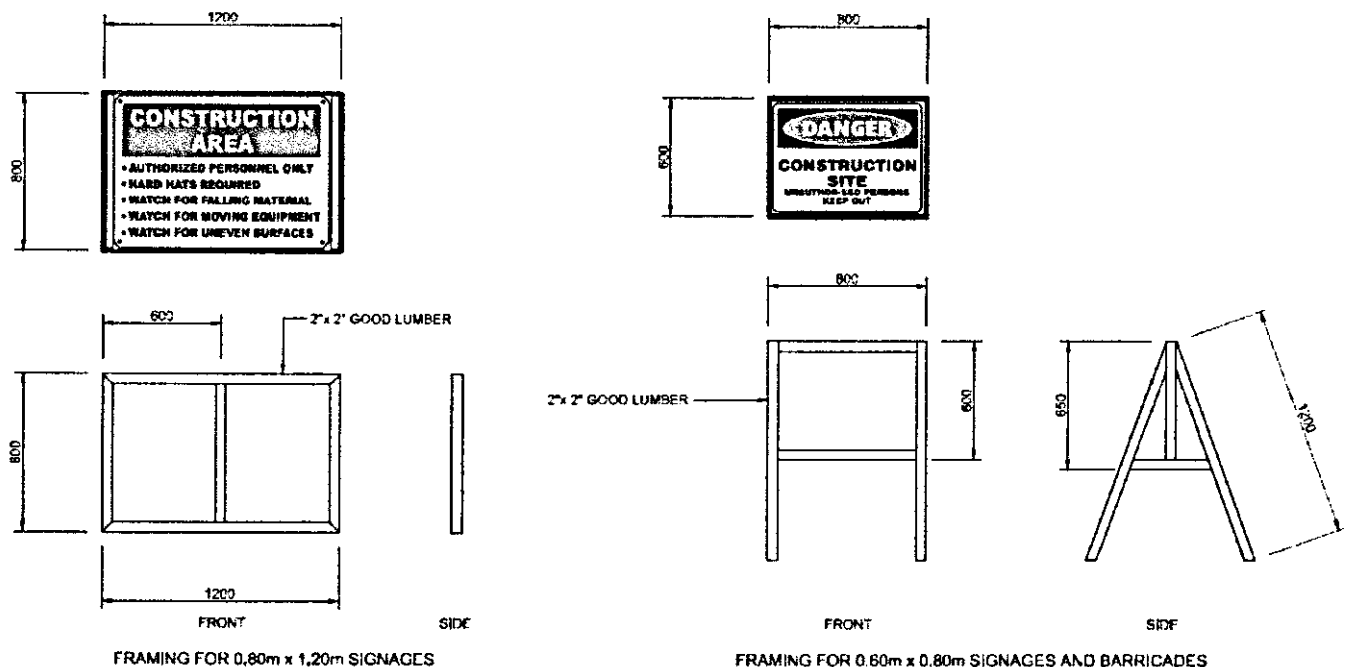
### SPECIFICATION

The Signage's and Barricades shall be installed at location(s) designated by the Engineer.

The sizes of the standard signages shall be 2-2/3ft x 4ft (800mm X 1,200mm) for fixed type and 2ft x 2-2/3ft (600mm x 800mm) for mobile type. For barricade standard 2ft x 2-2/3ft (600mm x 800mm) shall be provided.

The materials to be used for signages and barricades are ½ inch (12mm) marine plywood or tarpaulin poster on 2" x 2" (50mm x 50mm) good lumber frame (see drawing below).

The printing or painting shall be the discretion of the Engineer.



## STANDARD PLAN FOR SIGNAGES AND BARRICADES

**SECTION VII**

**DRAWINGS**  
**(APPROVED PLANS)**

# SECTION VII

## DRAWINGS AND APPROVED PLANS

(SEE ISSUED APPROVED PLANS)

### LIST OF DRAWINGS:

- 01 of 30 - Vicinity Map, Development Plan, General Notes, List of Drawings
- 02 of 30 - General Plan
- 03 of 30 - Part Plan (Operational Area & Access Road), Typical Pavement Joint
- 04 of 30 - Drainage Layout Plan, Detail of Catch Drain Manhole Cover, Detail of Catch Drain Manhole
- 05 of 30 - Sheet Piling Plan, Key Sheet Piling Plan, Detail of Wale Splice, Channel/Wale Section
- 06 of 30 - Section X-X, Section Y-Y, Section Z-Z, Section A-A
- 07 of 30 - Section B-B, Section C-C, Section D-D
- 08 of 30 - Section E-E, Section F-F
- 09 of 30 - Section G-G, Section H-H
- 10 of 30 - Detail of Tie Rod, Detail of Retaining Walls, Detail of Slotted R.C. Curb, Detail of Concrete Block, Detail of Anchor Wall
- 11 of 30 - Part Plan (Proposed Access Trestle)
- 12 of 30 - Piling Plan (Proposed Access Trestle, Pile Schedule (Proposed Access Trestle)
- 13 of 30 - Section Detail (Proposed Access Trestle)
- 14 of 30 - Typical Detail of Fender Block, Typical Detail of Pile Caps (Proposed Access Trestle)
- 15 of 30 - Part Plan (Proposed Wharf "Block-1")
- 16 of 30 - Part Plan (Proposed Wharf "Block-2")
- 17 of 30 - Piling Plan, Pile Schedule (Proposed Wharf "Block-1")
- 18 of 30 - Piling Plan, Pile Schedule (Proposed Wharf "Block-2")
- 19 of 30 - Section Detail (Proposed Wharf)
- 20 of 30 - Typical Detail of Mooring & Fender Block - 1 & 2
- 21 of 30 - Typical Detail of Pile Caps (Proposed Wharf)
- 22 of 30 - Typical Section of 500mm Ø X 13mm Thk. Tubular Steel Piles
- 23 of 30 - Typical Section of 700mm Ø X 13mm Thk. Tubular Steel Piles
- 24 of 30 - Detail of V-Type Rubber Dock Fender (400hx2000l), 50 Ton Mooring Tee Head
- 25 of 30 - Detail of 100 Tons Mooring Bollard (Tee Head)
- 26 of 30 - Detail of Cone Type Rubber Fender (1000h)
- 27 of 30 - Detail of Steel Main Gate
- 28 of 30 - Detail of Fence
- 29 of 30 - Port Lighting Layout, General Notes, Legend
- 30 of 30 - Detail of Lamp Post Foundation, Integrated Solar Street Light, Specification



**SECTION VIII**

**BILL OF QUANTITIES**  
**and**  
**ATTACHMENTS**

**BID SUMMARY**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur

NO.	DESCRIPTION OF WORK	AMOUNT (Pesos)
BILL NO. 1	GENERAL EXPENSES	
BILL NO. 2	CONSTRUCTION OF PORT OPERATIONAL AREA AND ACCESS ROAD	
BILL NO. 3	CONSTRUCTION OF ACCESS TRESTLE ON PILES	
BILL NO. 4	CONSTRUCTION OF RC WHARF	
<b>TOTAL BID PRICE</b>		

\_\_\_\_\_  
 Name of Firm

\_\_\_\_\_  
 Name of Bidder/Authorized Representative  
 (Signatory's Legal Capacity)

\_\_\_\_\_  
 Date

**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
<b>BILL NO. 1</b>	<b>GENERAL EXPENSES</b>				
1.01	Mobilization, demobilization and cleaning	lot	1		-
1.02	Rental of temporary site office and residence for the Engineer and staff	mo.	22		-
1.03	Maintain temporary site office and residence for the Engineer and staff	mo.	22		-
1.04	Provide Construction Safety and Health Program in the execution of the project	mo.	22		-
<b>TOTAL FOR BILL NO. 1</b>					-

\_\_\_\_\_  
 Name of Bidder/Authorized Representative  
 (Signatory's Legal Capacity)

**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
2.11	Supply and place sand and gravel fill	cu.m.	9,621		-
2.12	Supply, place and compact aggregate sub-base course	cu.m.	10,045		-
2.13	Supply, spread and compact aggregate base course	cu.m.	1,030		-
2.14	Supply and place portland cement concrete pavement (PCCP, 300mm thk.)	sq.m.	5,150		-
2.15	Construct CHB wall (150mm thk.) for perimeter fence including reinforcement	sq.m.	313		-
2.16	Supply and place plain cement plaster finish for CHB wall and column	sq.m.	731		-
2.17	Supply, fabricate and install various materials for cyclone wire mesh fence including barbed wire	sq.m.	392		-
2.18	Supply and apply paint for concrete surfaces (2-coats)	sq.m.	731		-
2.19	Supply, fabricate and install steel gate including accessories	set	1		-
2.20	Supply and install 610mm diameter RCP for drainage	l.m.	136		-
2.21	Construct catch drain manhole including cover	no.	10		-
2.22	Excavate, backfill and compaction of existing fill materials prior to installation of drainage system	cu.m.	256		-

\_\_\_\_\_  
Name of Bidder/Authorized Representative  
(Signatory's Legal Capacity)

**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
<b>BILL NO.</b>	<b>2 CONSTRUCTION OF PORT OPERATIONAL AREA AND ACCESS ROAD</b>				
2.01	Supply and deliver to site steel sheet piles (Z-type, hot rolled, Sx≥1807 cm3/m, steel grade = S355) including accessories	m.t.	102		-
2.02	Handle, pitch and drive steel sheet piles (Z-type, hot rolled, Sx≥1807 cm3/m, steel grade = S355)	l.m.	1,320		-
2.03	Cutting of driven steel sheet piles up to cut-off elevation including turn-over to authority of excess piles	no.	132		-
2.04	Supply, fabricate and install steel channel wale including splice plates, bolts, washers and other accessories	kg.	8,232		-
2.05	Supply and install 60mmØ x 12m tie-rod including accessories	set	33		-
2.06	Supply & place 3,500 psi. concrete for retaining walls, anchor block , rc curb chb column, box culvert, lamp post foundation and steel gate column	cu.m.	777		-
2.07	Supply & install steel reinforcement for retaining walls, anchor block, rc curb, chb column, box culvert, lamp post foundation and steel gate column	kg.	61,917		-
2.08	Supply and place 1,000 kg. Armour rocks	cu.m.	1,235		-
2.09	Supply and place 50-100 kg. Core rocks	cu.m.	3,329		-
2.10	Supply and install Geotextile Fabric	sq.m.	3,467		-

\_\_\_\_\_  
 Name of Bidder/Authorized Representative  
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**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
2.23	Supply and place gravel bedding	cu.m.	155		-
2.24	Supply and install hot-dipped galvanized 100mm x 100mm x 10mm angle bar for construction joint including dowel bars	l.m.	9		-
2.25	Excavate existing seabed up to required elevation prior to laying of rocks	cu.m.	1,389		-
2.26	Supply and install electrical works for port lighting	lot	1		-
<b>TOTAL FOR BILL NO. 2</b>					-

Name of Bidder/Authorized Representative  
 (Signatory's Legal Capacity)

**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
<b>BILL NO. 3</b>	<b>CONSTRUCTION OF ACCESS TRESTLE ON PILES</b>				
3.01	Supply and deliver to site steel pipe piles (A252 Grade 2, 500mm Ø x 13mm thk.)	m.t.	426		-
3.02	Application of polyurethane external coating and mastic filler for steel pipe piles (Polyurethane : 32-10 @ 1,500 microns dry film thickness or equivalent)	sq.m.	1,637		-
3.03	Supply and install 9mm thk. reinforcing band tip for steel pipe piles	no.	106		-
3.04	Handle, pitch and drive steel pipe vertical piles (500mm x 13mm thk)	l.m.	1,306		-
3.05	Handle, pitch and drive steel pipe batter piles (500mm x 13mm thk)	l.m.	1,418		-
3.06	Extract clogged materials from steel pipe piles	cu.m.	97		-
3.07	Supply and place 3,500 psi concrete filler for steel pipe piles	cu.m.	221		-
3.08	Supply and install reinforcing steel cage for steel pipe piles	kg	55,109		-
3.09	Cutting of driven steel pipe piles up to cut-off elevation including turn-over to authority of excess piles	no.	106		-
3.10	Supply and place 3,500 psi concrete for superstructure	cu.m	714		-
3.11	Supply and install steel reinforcements for superstructure	kg	119,797		-

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 Name of Bidder/Authorized Representative  
 (Signatory's Legal Capacity)

**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
3.12	Supply and install hot-dipped galvanized 100mm x 100mm x 10mm angle bar for construction joint including dowel bars	l.m.	36		-
3.13	Supply and deliver to site rubber dock fender (V-400H x 2000L) including accessories	set	4		-
3.14	Install rubber dock fender including accessories	set	4		-
<b>TOTAL FOR BILL NO. 3</b>					-

Name of Bidder/Authorized Representative  
 (Signatory's Legal Capacity)



**BILL OF QUANTITIES**  
**BALOGO PORT DEVELOPMENT PROJECT**  
 Port of Balogo, Pasacao, Camarines Sur



NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
<b>BILL NO. 4</b>	<b>CONSTRUCTION OF RC WHARF</b>				
4.01	Supply and deliver to site steel pipe piles (A252 Grade 2, 700mm Ø x 13mm thk.)	m.t.	1,728		-
4.02	Application of polyurethane external coating and mastic filler for steel pipe piles (Polyurethane : 32-10 @ 1,500 microns dry film thickness or equivalent)	sq.m.	8,858		-
4.03	Splice steel pipe piles as directed by the engineer	no.	212		-
4.04	Supply and install 9mm thk. reinforcing band tip for steel pipe piles	no.	212		-
4.05	Handle, pitch and drive steel pipe vertical piles (700mm x 13mm thk)	l.m.	3,816		-
4.06	Handle, pitch and drive steel pipe batter piles (700mm x 13mm thk)	l.m.	4,028		-
4.07	Extract clogged materials from steel pipe piles	cu.m.	651		-
4.08	Supply and place 3,500 psi concrete filler for steel pipe piles	cu.m.	1,588		-
4.09	Supply and install reinforcing steel cage for steel pipe piles	kg	352,437		-
4.10	Cutting of driven steel pipe piles up to cut-off elevation including turn-over to authority of excess piles	no.	212		-
4.11	Supply and place 3,500 psi concrete for superstructure	cu.m	1,585		-
4.12	Supply and install steel reinforcements for superstructure	kg	240,511		-

Name of Bidder/Authorized Representative  
 (Signatory's Legal Capacity)