PROJECT SPECIFICATIONS

REHABILITATION of the BELL AMPHITHEATER

1. SCOPE OF WORK FOR BIDDERS

1.1 To provide the infrastructure required for REHABILITATION of the BELL AMPHITHEATER.
1.2 To conduct site visits to familiarize with the on-site conditions and existing facilities.
1.3 To provide as-built plans for the project, one (1) set original CAD drawing printed in A3, three (3) sets photocopy. As-built plans shall indicate the following drawings in any scale not less than 1:100 meter.
   a. Floor layout
   b. Elevations
   c. Sections
   d. Other details that maybe required
1.4 To submit weekly accomplishment reports.
1.5 To properly and safely dispose all wastes generated from the construction.
1.6 To ensure that all workers are equipped with construction safety gear at all times.
1.7 To provide temporary site office/storage and portable toilets/latrines for the workers and do regular maintenance of the same throughout the duration of the project. The portable toilets/latrines shall be dismantled at the end of the project.
1.8 To shoulder all costs for power and water utilities used for the duration of the construction.
1.9 To provide first aid requirements for workers throughout the duration of the project.
1.10 To report immediately to JHMC all unearthed hazardous materials, buried treasures or artifacts. JHMC shall coordinate with concerned agencies to handle the same. Activities in said area shall cease until such time that the hazardous materials, treasures have been properly dealt with.

2. DPWH STANDARDS and SPECIFICATIONS

The scope of work shall be in conformity with of the DPWH standards and specifications.

ITEM 102 - EXCAVATION, BACKFILLING AND DISPOSAL

102.1 Description

The Contractor shall perform all earthworks both for roadway, structures, drainage and borrow excavation and the disposal of material in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

102.2 Construction Requirements

102.2.1 General

When there is evidence of discrepancies on the actual elevations and that shown on the Plans, a pre- construction survey referred to the datum plane used in the approved Plan shall be undertaken by the Contractor under the control of the Engineer to serve as basis for the computation of the actual volume of the excavated materials.

All excavations shall be finished to reasonably smooth and uniform surfaces. No materials shall be wasted without authority of the Engineer. Excavation operation shall be conducted so that material outside of the limits of slopes will not be disturbed. Prior to excavation, all necessary clearing and grubbing in the area shall have been performed in accordance with Item

100, Clearing and Grubbing.

The Contractor shall furnish, place and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching or other approved measures for the removal or exclusion of water, including taking care of storm water and waste water reaching the site of the work from any source so as to prevent damage to the work or adjoining property.

102.2.2 Utilization of Excavated Materials

All suitable material removed from the excavation shall be used in the formation of the embankment, subgrade, shoulders, slopes, bedding and backfill for structures, and for other purposes shown on the Plans or as directed.

The Engineer will designate as unsuitable those soils that cannot be properly compacted in the embankments. All suitable materials shall be disposed-off as shown on the Plans or as directed without delay to the Contractor.

Only approved materials shall be used in the construction of embankments and backfills. All excess material, including rock and boulders that cannot be used in embankments shall be disposed-off as directed. Materials encountered in the excavation and determined by the Engineer as suitable for topping, road finishing, slope protection, or other purposes shall be conserved and utilized as directed by the Engineer.

102.2.3 Removal of Unsuitable Materials

Where the Plans show the bottom portion of the disposal cell bed to be selected, all unsuitable materials shall be excavated to the depth necessary for replacement of the selected clay liner to the required compacted thickness.

Where excavation to the finished graded section results in a subgrade or slopes of unsuitable soil, the Engineer may require the Contractor to remove the unsuitable material and backfill to the finished graded section with approved material. The Contractor shall conduct his operations in such a way that the Engineer can take the necessary cross-sectional measurements before the backfill is placed.

102.3 Method of Measurement

The cost of excavation of material which is incorporated in the works or other areas of fill shall be deemed to be included in the Items of work where the material is used.

For measurement purposes, surplus suitable material shall be calculated as the difference between the net volume of suitable material required to be used in embankment or cover material corrected by applying a shrinkage factor or swell factor in case of rock excavation, determined by laboratory tests to get its original volume measurement, and the net volume of suitable material from excavation in the original position. Separate pay items shall be provided for surplus common, unclassified and rock material.

The Contractor shall be deemed to have included in the contract unit prices all costs of obtaining land for the disposal of unsuitable or surplus material.

102.4 Basis of Payments

The accepted quantities, measured as prescribed in Section 102.3, shall be paid for the contract unit price for each of the particular pay items listed below that are included in the Bill of Quantities which price and payment shall be full compensation for the removal and disposal of excavated materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this item.

Payment shall be made:

Pay Item No.	Description	Unit of Measurement
102 (1)	Unsuitable Excavation	Cubic meter (cu.m.)

102 (2)	Surplus Common Excavation	Cubic meter (cu.m.)
102 (3)	Surplus Rock Excavation	Cubic meter (cu.m.)
102 (4)	Surplus Unclassified Excavation	Cubic meter (cu.m.)

ITEM 403 – METAL STRUCTURES

403.1 Description

This work shall consist of steel structures and the steel structure portions of composite structures, constructed in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

The work will include the furnishing, fabricating, hauling, erecting, welding and painting of structural metals called for in the Special Provision or shown on the Plans.

Structural metals will include structural steel, rivet, welding, special and alloy steels, steel forgings and castings and iron castings. This work will also include any incidental metal construction not otherwise provided for, all in accordance with these Specifications, Plans and Special Provisions.

403.2 Material Requirements

Materials shall meet the requirements of Item 712, Structural Metal; Item 409, Welded Structural Steel, and Item 409, Welded Structural Steel; and Item 709, Paints.

403.3 Construction Requirements

403.3.1 Inspection

The Contractor shall give the Engineer at least fifteen (15) days notice prior to the beginning of work at the mill or shop, so that the required inspection may be made.

The term “mill” means any rolling mill, shop or foundry where material for the work is to be manufactured or fabricated. No material shall be rolled or fabricated until said inspection has been provided.

The Contractor shall furnish the Engineer with copies of the certified mill reports of the structural steel, preferably before but not later than the delivery of the steel to the job site.

The Contractor shall furnish all facilities for inspection and the Engineer shall be allowed free access to the mill or shop and premises at all times.The Contractor shall furnish, without charge, all labor, machinery, material and tools necessary to prepare test specimens.

Inspection at the mill or shop is intended as a means of facilitating the work and avoiding errors and it is expressly understood that it will not relieve the Contractor from any responsibility for imperfect material or workmanship and the necessity for replacing same. The acceptance of any material or finished member at the mill or shop by the Engineer shall not preclude their subsequent rejection if found defective before final acceptance of the work.Inspection of welding will be in accordance with the provision of Section 5 of the “Standard Code for Arc and Gas Welding in Building Construction” of the American Welding Society.

403.3.2 Stock Material Control

When so specified in the Contract, stock material shall be segregated into classes designated as “identified” or “unidentified”.Identified material is material which can be positively identified as having been rolled from a given heat for which certified mill test can be produced.Unidentified material shall include all other general stock materials. When it is proposed to use unidentified material, the Engineer shall be notified of such intention at least fifteen (15) days in advance of commencing fabrication to permit sampling and testing.

When so indicated or directed, the Contractor shall select such material as he wishes to use from stock, and place it in such position that it will be accessible for inspection and sampling. The Contractor shall select identified material from as few heat numbers as possible, and furnish the certified mill test reports on each of such heat numbers. Two samples shall be taken from each heat number as directed, one for a tension test and one for a bend test.

In the case of unidentified stock, the Engineer may, at his discretion, select any number of random test specimens.

Each bin from which rivets or bolts are taken shall subject to random test. Five rivets or bolts may be selected by the Engineer from each bin for test purposes.

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

403.3.3 Fabrication

These Specifications apply to riveted, bolted and welded construction. The Contractor may, however, with approval of the Engineer, substitute high tensile strength steel bolts equivalent to the rivets in any connection.

Workmanship and finish shall be in accordance with the best general practice in modern bridge shops.Portions of the work exposed to view shall be finished neatly.Shearing, flame cutting, and chipping shall be done carefully and accurately.

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

Rolled material before being laid off or worked must be straight.If straightening is necessary, it shall be done by methods that will not injure the metal. Sharp kinks and bends will be cause for rejection of the material.

Preparation of material shall be in accordance with AWS (American Welding Society) D 1.1, paragraph 3.2 as modified by AASHTO Standard Specification for Welding of Structural Steel Highway Bridges.

403.3.4 Finishing and Shaping

Finished members shall be true to line and free from twists, bends and open joints.

Fabricated members shall be true to line and free from twists, bends and open joints.

403.3.5 Welding

Welding shall be done in accordance with the best modern practice and the applicable requirements at AWS D1.1 except as modified by AASHTO “Standard Specifications for Welding of Structural Steel Highway Bridges”.

403.3.6 Erection

1. General

   The Contractor shall provide the falsework and all tools, machinery and appliances, including drift pins and fitting-up bolts, necessary for the expeditious handling of the work and shall erect the metal work, remove the temporary construction, and do all work necessary to complete the structure as required by the Contract and in accordance with the Plans and these Specifications.

If shown on the Plans or in the Special Provisions, the Contractor shall dismantle the old structure on the bridge site in accordance with Item 101, Removal of Structures and Obstructions.

403.3.7 Handling and Storing Materials

Materials to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained.Girders and beams shall be placed upright and shored.Long members, such as columns and chords, shall be supported on skids placed near enough together to prevent injury from deflection.If the Contract is for erection only, the Contractor shall check the material turned over to him against the shipping lists and report promptly in writing any shortage or damage discovered.He shall be responsible for the loss of any material while in his care, or for any damage caused to it after being received by him.

403.3.8 Method and Equipment

Before starting the work of erection, the Contractor shall inform the Engineer fully as to the method of erection he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the Engineer.The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the Plans and Specifications. No work shall be done until such approval by the Engineer has been obtained.

403.3.9 Straightening Bent Materials

The strengthening of plates, angles, other shapes and built-up members, when permitted by the Engineer, shall be done by methods that will not produce fracture or other injury. Distorted members shall be straightened by mechanical means or, if approved by the Engineer, by the carefully planned and supervised application of a limited amount of localized heat, except that heat straightening of AASHTO M 244 (ASTM A 514) or ASTM A 517 steel members shall be done only under rigidly controlled procedures, each application subject to the approval of the Engineer. In no case shall the maximum temperature of the AASHTO M 244 (ASTM A 514) or ASTM A 517 steels exceed 607.2ºC, nor shall the temperature exceed 510ºC at the weld metal or within 152.4 mm of weld metal. Heat shall not be applied directly on weld metal. In all other steels, the temperature of the heated area shall not exceed 648.9ºC (a dull red) as controlled by temperature indicating crayons, liquids or bimetal thermometers.

Parts to be heat-straightened shall be substantially free of stress and from external forces, except stresses resulting from mechanical means used in conjunction with the application of heat.

Following the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of fracture.

403.3.10 Assembling Steel

The parts shall be accurately assembled as shown on the working drawings and any match marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged.Hammering which will injure or distort the members shall not be done.Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.Unless erected by the cantilevermethods, truss spans shall be erected on blocking so placed as to give the trusses proper camber.The blocking shall be left in place until the tension chord splices are fully connected with permanent fasteners and all other truss connections pinned and erection bolted. Splices of butt joints of compression members, that are milled to bear and of railing shall not be permanently fastened until the spans have been swung, except that such permanent fastening may be accomplished for the truss members at any time that joint holes are fair. Splices and field connections shall have one-half of the holes filled with erection bolts and cylindrical erection pins (half bolts and half pins) before placing permanent fasteners.Splices and connections carrying traffic during erection shall have three-fourths of the holes so filled, unless otherwise permitted by

the Engineer.

Fitting-up bolts shall be of the same nominal diameter as the permanent fasteners and cylindrical erection pins will be 1.6 mm larger.

403.3.11 Preparing Metal Surfaces for Painting

All surfaces of new structural steel which are to be painted shall be blast cleaned unless otherwise specified in the Special Provisions or approved in writing by the Engineer.

In repainting existing structures where partial cleaning is required, the method of cleaning will be specified in the Special Provision.

The steel surfaces to be painted shall be prepared as outlined in the "Steel Structures Painting Council Specifications" (SSPC) meeting one of the following classes of surface preparation.

a. SSPC – SP – 5	White Metal Blast Cleaning
b. SSPC – SP – 6	Commercial Blast Cleaning
c. SSPC – SP – 8	Pickling
d. SSPC – SP – 10	Near White Blast Cleaning

Blast cleaning shall leave all surfaces with a dense and uniform anchor pattern of not less than one and one-half mills as measured with an approved surface profile comparator.

Blast cleaned surfaces shall be primed or treated the same day blast cleaning is done. If cleaned surface rust or are contaminated with foreign material before painting is accomplished, they shall be re-cleaned by the Contractor at his expense.

When paint systems No. 1 or 3 are specified, the steel surfaces shall be blast cleaned in accordance with SSPC – SP – 10.When paint systems No. 2, 4 or 5 are specified, the steel surface shall be blast cleaned in accordance with SSPC – SP – 6.

403.3.12 System of Paint

The paint system to be applied shall consist of one as set forth in Table 403.4 and as modified in the Special Provisions.

403.3.13 Painting Metal Surfaces

1. Time of Application

   The prime coat of paint or pretreatment when specified, shall be applied as soon as possible after the surface has been cleaned and before deterioration of the surface occurs.Any oil, grease, soil, dust or foreign matter deposited on the surface after the surface preparation is completed shall be removed prior to painting. In the event the rusting occurs after completion of the surface preparation, the surfaces shall be again cleaned.

   Particular care shall be taken to prevent the contamination of cleaned surfaces with salts, acids, alkali, or other corrosive chemicals before the prime coat is applied and between applications of the remaining coats of paint. Such contaminants shall be removed from the surface.Under these circumstances, the pretreatments or, in the absence of a pretreatment, the prime coat of paint shall be applied immediately after the surface has been cleaned.

2. Storage of Paint and Thinner

   All paint and thinner should preferably be stored in a separate building or room that is well ventilated and free from excessive heat, sparks, flame or the direct ray of the sun.

   All containers of paint should remain unopened until required for use.

Containers which have been opened shall be used first.

Paint which has livered, gelled, or otherwise deteriorated during storage shall not be used.Thixotropic materials which may be stirred to attain normal consistency are satisfactory.

3. Mixing and Thinning

All ingredients in any container of paint shall be thoroughly mixed before use and shall be agitated often enough during application to keep the pigment in suspension.

Paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the vehicle.This does not imply that part of the vehicle cannot be poured off temporarily to simplify the mixing.

Mixing shall be by mechanical methods, except that hard mixing will be permitted for container up to 19 liters in size.

Mixing in open containers shall be done in a well-ventilated area away from sparks or flames.

Paint shall not be mixed or kept in suspension by means of an air stream bubbling under the paint surface.

When a skin has formed in the container, the skin shall be cut loose from the sides of the container, removed, and discarded.If such skins are thick enough to have a practical effect on the composition and quality of the paint, the paint shall not be used.

The paint shall be mixed in manner which will insure breaking up of all lumps, complete dispersion of settled pigment, and a uniform composition. If mixing is done by hand, most of the vehicle shall be poured off into a clean container. The pigment in the paint shall be lifted from the bottom of the container with a broad, flat paddle, lumps shall be broken up, and the pigment thoroughly mixed with the vehicle.The poured off vehicle shall be returned to the paint with simultaneous stirring, or pouring repeatedly from one container to another until the composition is uniform. The bottom of the container shall be inspected for unmixed pigment. Tinting pastes or colors shall be wetted with a small amount of thinner, vehicle, or paint and thoroughly mixed.The thinned mixture shall be added to the large container of paint and mixed until the color is uniform.

Paint which does not have a limited pot life, or does not deteriorate on standing, may be mixed at any time before using, but if settling has occurred, it must be remixed immediately before using. Paint shall not remain in spray pots, painter's buckets, etc., overnight, but shall be gathered into a container and remixed before use.

No thinner shall be added to the paint unless necessary for proper application.In no case shall more than 0.5 liters of thinner be added per 3.8 liters unless the paint is intentionally formulated for greater thinning.

The type of thinner shall comply with the paint specification.
When the use of thinner is permissible, thinner shall be added to paint during the mixing process.Painters shall not add thinner to paint after it has been thinned to the correct consistency.

All thinning shall be done under supervision of one acquainted with the correct amount and type of thinner to be added to the paint.

Table 403.4 – Paint System

	Paint System				
	1	2	3	4	5
High Pollution or Coastal	x	x	x		
Mild Climate				x	x

Note:

1. Paint system shown for severe areas are satisfactorily in less severe areas.

2. Coastal - within 304.8 m of ocean or tidal water.

   High pollution-air pollution environment such as industrial areas.

   Mild-other than coastal areas not in air pollution environment.

All structural steel shall be painted by one of the following systems. The required system or choice of systems will be shown in the Contract.

System 4 is intended for use in mild climates or to repaint existing structures where the other systems are not compatible.

Coating Thickness	**Specifications**	**Min. Dry**
System 1 – Vinyl Paint System		
Wash Prime	708.03 (b)	12.7
Intermediate Coat	708.03 (b)	38.10 – 50.80
3rd Coat	708.03 (b)	38.10 – 50.80
4th Coat	708.03 (b)	38.10 – 50.80
Finish Coat	708.03 (b)	38.10 – 50.80
Total thickness		165.10 – 203.20
System 2 – Epoxy-Polymide System		
Prime Coat	708.03 (c)	50.80 – 76.20
Intermediate Coat	708.03 (c)	50.80 – 76.20
3rd Coat	708.03 (c)	50.80 – 76.20
Finish Coat	708.03 (c)	38.10 – 50.80
Total thickness		190.50 – 279.40
* The third coat may be eliminated in mild climates		
Coating Thickness	**Specifications**	**Min. Dry**
System 3 – Inorganic Zinc-Rich Coating System		
Prime Coat	708.03(d)	88.90 – 127
Epoxy Intermediate Coat	708.03 (d)	40.80 – 76.20
Finish Coat	708.03 (d)	38.10 – 50.80
Total thickness		177.80 – 254
Alternate System		
Prime Coat	708.03 (d)	88.90 – 127
Wash Primer Tie Coat	708.03 (d)	12.70
Finish Coat	708.03 (d)	38.10 – 50.80
Total thickness		139.70 – 190.50
System 4 – Alkyd-Oil-Basic Lead-Chromate System		
Prime Coat	708.03 (e)	38.10 – 50.80
Intermediate Coat	708.03 (e)	38.10 – 50.80

Finish Coat	708.03 (e)	38.10 – 50.80
Total thickness		114.30 – 152.40
* The paint system may be specified as four coats for new structure steel in mild climate, with a minimum thickness of 152.40 mm.		
System 5 – Organic Zinc-Rich Paint System		
Prime Coat	708.03 (f)	38.10 – 50.80
Intermediate Coat	708.03 (f)	50.80 – 63.50
Wash Primer Tie Coat	708.03 (f)	12.70
Finish Coat	708.03 (f)	38.10 – 50.80
Total thickness		139.70 – 177.80

4. Application of Paint

a. General

The oldest of each kind of paint shall be used first.Paint shall be applied by brushing or spraying or a combination of these methods.

Daubers or sheepskins may be used when no other method is practicable for proper application in places of difficult access. Dipping, roller coating, or flow coating shall be used only when specifically authorized. All paints shall be applied in accordance with the manufacturer's instructions.

Open seams at contact surfaces of built up members which would retain moisture shall be caulked with red lead paste, or other 0approved material, before the second undercoat of paint is applied.

Paint shall not be applied when the surrounding air temperature is below 4.4°C.Paint shall not be applied when the temperature is expected to drop to 0°C before the paint has dried.Paint shall not be applied to steel at a temperature over 51.7°C unless the paint is specifically formulated for application at the proposed temperature, nor shall paint be applied to steel which is at a temperature that will cause blistering or porosity or otherwise will be detrimental to the life of the paint.

Paint shall not be applied in fog or mist, or when it is raining or when the relative humidity exceeds 85 percent. Paint shall not be applied to wet or damp surfaces.

When paint must be applied in damp or cold weather, the steel shall be painted under cover, or protected, or sheltered or the surrounding air and the steel heated to a satisfactory temperature. In such cases, the above temperature and humidity conditions shall be met. Such steel shall remain under cover or be protected until dry or until weather conditions permit its exposure.

Any applied paint exposed to excess humidity, rain or condensation shall first be permitted to dry. Then damaged areas of paint shall be removed, the surface again prepared and then repainted with the same number of coats of paint of the same kind as the undamaged areas.

If stripe painting is stipulated in the Special Provisions or if the Contractor chooses to do so at his option, all edges, corners, crevices, rivets, bolts, weld and sharp edges shall be painted with the priming paint by brush before the steel receives first full prime coat of paint. Such striping shall extend for at least 25.4 mm from the edge. When practicable, this stripe coat shall be permitted to dry before the prime coat is applied, otherwise the stripe coat shall set to touch before the

full prime coat is applied. However, the stripe coat shall not be permitted to dry for a period of long enough to allow rusting of the unprimed steel. When desired, the stripe coat may be applied after a complete prime coat.

To the maximum extent practicable, each coat of paint shall be applied as continuous film of uniform thickness free of pores. Any thin spots or areas missed in the application shall be repainted and permitted to dry before the next coat of paint is applied. Film thickness is included in the description of paint systems. Each coat of paint shall be in a proper state of cure or dryness before application of the succeeding coat.

b. Brush Application

Paint shall be worked into all crevices and corners where possible and surfaces not accessible to brushes shall be painted by spray, doubers, or sheepskins. All runs or rags shall be brushed out. There shall be a minimum of brush marks left in the paint.

c. Spray Application of Paint

The equipment used for spray application of paint shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied and shall be equipped with suitable pressure regulators and gages. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed.The equipment shall be kept in satisfactory condition to permit proper paint application.In closed or recirculating paint spray system, where gas under pressure is used over the liquid, the gas shall be an inert, one such as nitrogen. Traps or separators shall be provided to remove oil and water from the compressed air.These traps or separators shall be adequate size and shall be drained periodically during operations.The air from the spray gun impinging against the surface shall show no water or oil.

Paint ingredients shall be kept properly mixed in the spray pots or containers during paint applications either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

The pressure on the material in the pot and of the air at the guns shall be adjusted for optimum spraying effectiveness. The pressure on the material in the pot shall be adjusted when necessary for changes in elevation of the gun above the pot.The atomizing air pressure at the gun shall be high enough to atomize the paint properly but not so high as to cause excessive fogging of paint, excessive evaporation of solvent or loss by overspray.

Spray equipment shall be kept sufficiently clean so that dirt, dried paint and other foreign material are not deposited in the paint film. Any solvents left in the equipment shall be completely removed before applying paint to the surface being painted.

Paint shall be applied in uniform layer, with overlapping at the edge of the spray pattern.The spray shall be adjusted so that the paint is deposited uniformly. During application, the gun shall be held perpendicular to the surface and at a distance which will insure that a wet layer of paint is deposited on the surface. The trigger of the gun should be released at the end of each stroke.

All rums and sags shall be brushed out immediately or the paint shall be removed and the surface repainted. Spray application of prime coats shall in all cases be immediately followed by brushing

Areas inaccessible to the spray gun shall be painted by brush, if not accessible by brush, daubers or sheepskins shall be used. Brushes shall be used to work paint into cracks, crevices and blind spots where are not adequately painted by spray.

d. Shop Painting

Shop painting shall be done after fabrication and before any damage to the surface occurs from weather or other exposure. Shop contact surfaces shall not be painted unless specified.

Surfaces not to be in contact but which will be inaccessible after assembly shall receive the full paint system specified or three shop coats of the specified before assembly.

The areas of steel surfaces to be in contact with concrete shall not be painted, unless otherwise shown on the Plans, the areas of steel surfaces to be in contact with wood shall receive either the full paint coats specified or three shop coats of the specified primer.

If paint would be harmful to a welding operator or would be detrimental to the welding operation or the finished welds, the steel shall not be painted within a suitable distance from the edges to be welded. Welding through inorganic zinc paint systems will not be permitted unless approved by the Engineer.

Anti-weld spatter coatings shall be removed before painting. Weld slag and flux shall be removed by methods at least as effective as those specified for the cleaning.

Machine-finished or similar surfaces that are not to be painted, but do not require protections, shall be protected with a coating of rust inhibitive petroleum, other coating which may be more suitable, for special conditions.

Erection marks and weight marks shall be copied on area that have been previously painted with the shop coat.

e. Field Painting

Steel structures shall be painted as soon as practicable after erection.

Metal which has been shop coated shall be touched up with the same type of paints as the shop coat.This touch-up shall include cleaning and painting of field connections, welds, rivets and all damaged or defective paint and rusted areas. The Contractor may, at his option, apply an overall coat of primer in place of touch-up spot painting.

Surfaces (other than contact surfaces) which are accessible before erection but which will not be accessible after erection shall receive all field coats of paint before erection. If possible the final coat of paint shall not be applied until all concrete work is finished.If concreting or other operations damage any paint, the surfaces shall be cleaned and repainted.All cement or concrete spatter and dripping shall be removed before any paint is applied.

Wet paint shall be protected against damage from dust or other detrimental foreign matter to the extent practicable.

f. Drying of Painted Metal

The maximum practicable time shall be allowed for paint to dry before recoating or exposure. No drier shall be added to paint on the job unless specifically called for in the Specifications for the paint. No painted metal shall be subjected to immersion before the paint is dried through. Paint shall be protected from rain, condensation, contamination, and freezing until dry, to the fullest extent practicable.

g. Handling of Painted Steel

Painted steel shall not be handled until the paint has dried, except for necessary handling in turning for painting or stacking for drying.

Paint which is damaged in handling shall be scraped off and touched-up with the same number of the coats and kinds of paint as were previously applied to the steel.

Painted steel shall not be loaded for shipment or shipped until it is dry.

Precautions shall be taken to minimize damage to paint films resulting from stocking members.

403.3.14 Clean-up

Upon completion and before final acceptance, the Contractor shall remove all falsework, falsework piling down to at least 609.6 mm below the finished ground line, excavated or unused materials, rubbish and temporary buildings. He shall replace or renew any fences damaged and restored in an acceptable manner all property, both public and private, which may have been damaged during the prosecution of the work and shall leave the work site and adjacent highway in a neat and presentable condition, satisfactory to the Engineer.All excavated material or falsework placed in the stream channel during construction shall be removed by the Contractor before final acceptance.

403.4 Method of Measurement

403.4.1 Unit Basis

The quantity of structural steel to be paid for shall be the number of kilos complete in place and accepted.For the purpose of measurement for payment components fabricated from metals listed in (1) below, such as casting, alloy steels, steel plates, anchor bolts and nuts, shoes, rockers, rollers, pins and nuts, expansion dams, roadway drains and souppers, welds metal, bolts embedded in concrete, cradles and brackets, posts, conduits and ducts, and structural shapes for expansion joints and pier protection will be considered as structural steel.

Unless otherwise provided, the mass of metal paid for shall be computed and based upon the following mass:

1. Unit Density kg/m^3

Aluminum, cast or rolled	2771.2
Bronze or copper alloy	8585.9
Copper sheet	8938.3
Iron, cast	7128.2
Iron, malleable	7528.7
Lead, sheet	11229
Steel, cast or rolled, including alloy copper bearing and stainless	7849
Zinc	7208.3

2. Miscellaneous

The mass of erection bolts, shop and field paint, galvanizing the boxes, crates and other containers used for shipping, together with sills, struts, and rods used for supporting members during the transportation, bridge hardware as defined in Subsection 402.2.2 excluding steel plates and bearings, connectors used for joining timber members, nails, spikes and bolts, except anchor bolts will be excluded.

3. Welds

The mass of shop and field fillet welds shall be assumed as follows:

Size of Weld (mm)	kg per linear metre
6.3	0.984
7.9	1.213
9.5	1.771
12.7	2.690
5.9	3.936
19.0	5.379
22.2	7.314
25.4	9.774

The mass of other welds will be computed on the basis of the theoretical volume from dimensions of the welds, with an addition of 50 mass percent as an allowance for overrun.

4. Other Items

The quantities of other Contract Items which enter into the completed and accepted structure shall be measured for payment in the manner prescribed for the Items involved.

403.4.2 Lump Sum Basis

Lump sum will be the basis of payment unless noted otherwise in the bidding documents. No measurements of quantities will be made except as provided in Subsection 403.5.1 (4).

403.5 Basis of Payment

403.5.1 Structural Steel

1. Furnished, Fabricated and Erected

The quantity, determined as provided above, shall be paid for at the contract unit price per kilogram for "Structural Steel, furnished, fabricated and erected", which price and payment shall constitute full compensation for furnishing, galvanizing, fabricating, radiographing, magnetic particle inspection, delivering, erecting ready for use, and painting all steel and other metal including all labor, equipment, tools and incidentals necessary to complete the work, except as provided in Subsections 403.5.2, 403.5.3 and 403.5.4.

2. Furnished and Fabricated

When a quantity and unit price for "Structural Steel, furnished and fabricated" are shown in the Bill of Quantities, the quantity, determined as provided above, will be paid for at the contract unit price per kilogram which price and payment shall be full compensation for furnishing, galvanizing, fabricating, radiographing, magnet particle

inspection, shop painting and delivering the structural steel and other metal free of charges at the place designated in the Special Provisions and for all labor, equipment, tools and incidentals necessary to complete the work, save erection and except as provided in Subsection 403.5.2, 403.5.3 and 403.5.4.

3. Erected

When a quantity and unit price for "Structural Steel Erected" are shown in the Bill of Quantities, the quantity, determined as provided above, will be paid for at the said contract unit price per kilogram which price and payment shall be full compensation for unloading all the structural steel and other metal, payment of any demurrage charges, transporting to the bridge site, erecting, magnetic particle inspection and radiographing, complete ready for use including furnishing and applying the field paint including all labor, equipment, tools and incidentals necessary to complete the work, save furnishing and fabrication, and except as provided in Subsections 403.5.2, 403.5.3 and 403.5.4.

4. Lump Sum

When the Bill of Quantities calls for lump sum price for "Structural Steel, furnished, fabricated and erected", the Item will be paid for at the contract lump sum price and payment shall be full compensation for furnishing, fabricating and erecting material and for all work herein before prescribed in connection therewith, including all labor, equipment, tools and incidentals necessary to complete the work, except as provided in Subsections 403.5.2, 403.5.3 and 403.5.4.

The estimate of the mass of structural steel shown on the Plans is approximate only and no guarantee is made that it is the correct mass to be furnished. No adjustment in the contract price will be made if the mass furnished is more or less than estimated mass.

If changes in the work are ordered by the Engineer, which vary the mass of steel to be furnished, the lump sum payment shall be adjusted as follows:

a. The value per kilogram of the increase or decrease in mass of structural steel involved in the change shall be determined by dividing the contract lump sum amount by the estimate of mass shown on the Plans.The adjusted contract lump sum payment shall be the contract lump sum plus or minus the value of the steel involved in the change, and no additional compensation shall be made on account of said change.

b. Full-size members which are tested in accordance with the Specifications when such tests are required by the Contract, shall be paid for at the same rate as for comparable members in the structure. Members which fail to meet the Contract requirements, and members rejected as a result of test shall not be paid for.

403.5.2 Material Considered as Structural Steel

For the purpose of Subsection 403.5.1 and unless otherwise shown on the Plans, castings, forgings, special alloy steels and steel plates, wrought iron, and structural shapes of expansion joints and pier protection shall be considered as structural steel except that when quantities and unit price for certain alloy steels, forgings, castings or other specific categories of metal are called for in the Bill of Quantities, the mass of such selected material, determined as provided above, shall be paid for at the respective contract unit price per kilogram for "Structural Steel (Alloy steel, forgings, castings, and/or other category), furnished and fabricated, and erected" or "Structural Steel (Subsection 403.4.1), furnished and fabricated" as named in the Bill of Quantities.

403.5.3 Other Items

The quantities of all other Contract Items which enter into the completed and accepted structure shall be paid for at the contract unit prices for the several Pay Items as prescribed for the Items involved.

403.5.4 Payment as Reinforcing Steel

When the Bill of Quantities does not contain a pay item for structural steel, the quantities of metal drains, scuppers, conduits, ducts and structural shapes for expansion joints and pier protection, measured as provided above will be paid for as Reinforcing Steel under Item 404.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
403 (1)	Structural Steel, furnished, fabricated and erected	kilogram

Where separate payment is to be made for certain metals or for certain particular components, other than under the general provision for structural steel, designation of those particular cases shall be inserted in the spaces provided in the pay names for Item 403 (2), 403 (4) or 403 (6), as the case may be.

ITEM 414 FORMS AND FALSEWORKS

414.1 Description

This Item shall consist of designing, constructing and removing forms and falsework to temporarily support concrete, girders and other structural elements until the structure is completed to the point it can support itself.

414.2 Material Requirements

414.2.1 Formwork

The materials used for smooth form finish shall be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other acceptable materials capable of producing the desired finish for form-facing materials. Form-facing materials shall produce a smooth, uniform texture on the concrete. Form-facing materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of concrete surfaces shall not be permitted. No form-facing material shall be specified for rough form finish.

414.2.1.1 Formwork accessories

Formwork accessories that are partially or wholly embedded In concrete, including ties and hangers shall be commercially manufactured. The use of non-fabricated wire form ties shall not be permitted. Where indicated in the Contract, use form ties with integral water barrier plates in walls.

414.2.1.2 Formwork release agents

Commercially manufactured formwork release agents shall be used to prevent formwork absorption of moisture, prevent bond with concrete, and hot stain the concrete surfaces.

414.2.2 Falsework

The materials to be used in the falsework construction shall be of the quantity and quality necessary to withstand the stresses imposed; it may be timber or steel or a combination of both. The workmanship shall be of such quality that the falsework will support the loads imposed on it without excessive settlement or take up beyond as shown on the falsework drawings.

414.3 Construction Requirements

414.3.1 Design

Falsework and Formworks design and drawings shall be in accordance, with Item 407 Concrete Structure subsection 407.3.9 and 407.3.12 respectively.

414.3.1.1 Formwork and Falsework Drawings

When complete details for forms and falseworks are not shown, prepare and submit drawings to the Engineer, showing the following:

1. Details for constructing safe and adequate forms and falsework that provide the necessary rigidity, support the loads imposed, and produce in the finished structure the required lines and grades. See subsection 414.3.1.2 for design loads. See Subsection 414.3.1.3 for design stresses, loadings and deflections. See subsection 414.3.2 for manufactured assemblies.

2. The maximum applied structural load on the foundation material. Include a drainage plan or description of how foundations will be protected from saturation, erosion, and/or scour see subsection 414.3.3.1.

3. The description of all proposed material. Describe the material that is not describable by standard nomenclature (such as AASHTO or ASTM specified) based on manufacturer's test and recommended working loads. Provide evaluation data for falsework material showing that the physical properties and conditions of the material can support the loads assumed in the design.

4. The design calculations and material specifications showing that the proposed system will support the imposed concrete pressures and other loads. Provide an outline of the proposed concrete placement operation listing the equipment, labor, and procedures to be used for duration of each operation. A superstructure placing diagram showing the concrete placing sequence and construction joint locations shall be included.

5. Design calculations for proposed bridge falsework. A registered professional engineer proficient in structural design shall design, sign, and seal the drawings. The falsework design calculations shall show the stresses and deflections in load supporting members.

6. Anticipated total settlements of falsework and forms shall be shown. Include falsework footing settlement and joint take-up. Design for anticipated settlements not to exceed 20 millimeters. Design and detail on falsework supporting deck slabs and overhangs on girder bridges so there is no differential settlement between the girders and the deck forms during placement of deck concrete. Design and construct the falsework to elevations that include anticipated settlement during concrete placement and required camber to compensate for member deflections during construction.

7. Support system for form panels supporting concrete deck slabs and overhangs on girder bridges.

8. Details for strengthening and protecting falsework over or adjacent to roadways and railroads during each phase of erection and removal. See subsection 414.3.3.2.

9. Intended steel erection procedures with calculations in sufficient detail to substantiate that the girder geometry will be correct. See subsection 414.3.3.3.

   Details of proposed anchorage and ties for void forms shall be submitted. See subsection 414.3.4 for void form requirements.

Separate Falsework drawings for each structure shall be submitted to the Engineer for approval, except for identical structures with identical falsework design and details.

414.3.3 Acceptance

Forms and falsework (including design, construction, and removal) shall be evaluated and approved by the Engineer.

When the falsework installation is complete and before concrete placement or removal begins, the falsework shall be inspected by the Engineer. The Engineer shall certify in writing that the installation conforms to the contract, the approved falsework drawings (including approved changes) and acceptable engineering practices.

414.3 Method of Measurement

When the Contract stipulates that payment will be made for forms and falsework on lump-sum basis, the pay item will include all materials and accessories needed in the work.

Whenever the Bill of Quantities does not contain an item for form and falsework, the work will not be paid directly but will be considered as a subsidiary obligation of the contractor under other Contract Items.

414. 4 Basis of Payment

The accepted quantities measured as prescribed in subsection 414.4, shall be paid for at the Contract lump-slim price for Forms and Falsework which price and payment shall be full compensation for designing, constructing and removing forms and falsework, all materials and accessories needed and for furnishing all labor equipment tools and incidentals necessary to complete the item.

Payment will be made under:

Pay Item Number	Description	Unit Measurement
414	Forms and Falsework	Lump Sum

ITEM 900 - REINFORCED CONCRETE

900.1 Description

This item shall consist of furnishing, placing and finishing concrete in buildings and related structures, flood control and ports, and water supply structures in accordance with this specification and conforming to the lines, grades and dimension shown in the plans.

900.2 Materials Requirements

900.2.1 Portland Cement

This item shall conform to the requirement of ITEM 700, Hydraulic Cement, Vol. I.

Concrete Aggregates

The concrete aggregates shall conform to the requirement of Subsection 311.2.2 and 311.2.3 under ITEM 311 of Volume I and ASTM C 33 for lightweight aggregates, except that aggregates failing to meet these specifications but which have been shown by special that or actual service to produce concrete of adequate strength and durability maybe used under method (2) of determining the proportion of concrete, where authorized by the Engineer.

Except as permitted elsewhere in this section, the maximum size of the aggregate shall be not larger than one-fifth (1/5) of the narrowest dimensions between size of forms of the member

for which the concrete is to be used nor later than three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars or pre-tensioning strands.

Aggregate Test

Samples of the fine and coarse aggregates to be used shall be selected by the Engineer for tests at least 30 days before the actual concreting operations are to begin. It shall be the responsibility of the contractor to designate the source or sources of aggregate to give the Engineer sufficient time to obtain the necessary samples and submit them for testing.

No aggregates shall be used until official advice has been received that it has satisfactory passed all test, at which time written authority shall be given for its use.

900.2.3 Water

Water used in mixing concrete shall conform to the requirement of Subsection 311.2.4 under ITEM 311, Part D of Volume 1.

900.2.4 Metal Reinforcement

Reinforcing Steel bars shall conform to the requirements of the following Specifications:

Deformed & Plain Billet Steel	ASTM A 6151
Bars for concrete reinforcement	AASHTO M31
Deformed Rail – Steel and Plain Bars for concrete reinforcement	ASTM A616
Deformed A x b – Steel and Plain Bars for concrete reinforcement	ASTM A617

If reinforcing bars are to be welded, these ASTM specifications shall be supplemented by requirements assuring satisfactory weldability.

Bars and rod for concrete Reinforcement	ASTM A187
Cold-Drawn Steel Wire for	ASTM A187
Concrete reinforcement	AASHTO M32
Welded Steel wire fabric	ASTM A185
For concrete reinforcement	AASHTO M55

Except that the welded shear strength requirement of those specification shall be extended to Include a wire size differential up to and including six gages.

Wire and Strands for prestressed	ASTM A416
Concrete	ASTM A421

Used in making strands for post-tensioning shall be cold-drawn and either stress-relieved in the Case of uncoated strands or hot-dip galvanized in the case of galvanized strands.

High strength alloy steel bar for post-tensioning shall be proof stressed to 90% of the granted tensile strength. After proof stressing, the bars shall conform to the following minimum properties:

Tensile strength fs’	1000 Mpa
Yield strength (0.2 offset)	0.90 fs’

Elongation at rupture in 20 diameter	4 percent
Reduction of area at rupture	25 percent
Structural steel	ASTM A36
Steel Pipe for concrete-filled Pipe columns	ASTM A 53
Cast-iron Pipe for concrete Columns	ASTM A 377

900.2.5 Admixtures

Air-entraining admixtures, if used shall conform to ASTM C 260. Water-reducing admixtures, retarding admixtures, water-reducing and retarding admixtures and water reducing and accelerating admixtures, if used, shall conform to the requirements of ASTM C 494.

900.2.6 Storage of Materials

Cement and aggregates shall be stored in such a manner as to prevent their deterioration or intrusion of foreign matter. Cement shall be stored immediately upon arrival on the site of the work, in substantial waterproof bodegas, with a floor raised from the ground sufficiently high to be free from dampness. Aggregates shall be stored in such a manner as to avoid the inclusion of foreign materials.

900.3 Construction Requirements

Notations: The notations used in these regulations are defined as follows:

f'c = compressive strength of concrete

Fsp = ratio of splitting tensile strength to square root compressive strength

900.3.1 Concrete Quality

All plans submitted for approval or used for any project shall clearly show the specified strength, fc', of concrete of the specified age for which each part of the structure was designed.

Concrete that will be exposed to sulfate containing or other chemically aggressive solutions shall be proportioned in accordance with "Recommended Practice for Selecting proportions for Concrete (ACI 613)" and with "Recommended Practice for Selecting proportions for Structural Lightweight Concrete (ACI 613A)."

900.3.2 Methods of Determining the Proportions of Concrete

The determination of the proportions of cement, aggregate, and water to attain the required strengths shall be made by one of the following methods, but lower water-cement ratios may be required for conformance with the quality of concrete.

Method 1. Without preliminary test

Where preliminary test data on the materials to be used in the concrete have not been obtained the water- cement ratio for a given strength of concrete shall not exceed the values shown in Table 900.1. When strengths in excess of 281 kilograms per square centimeter (4000 pounds per square inch) are require or when light weight aggregates or admixtures (other than those exclusively for the purpose of entraining air) are used, the require water-cement ratio shall be determined in accordance with Method 2.

Method 2. For combination of materials previous evaluated or to be established by trial mixtures. Water-cement ratios for strengths greater than that shown in Table 900.1 may be used provided that the relationship between strength and water-cement ratio for the materials to be used has been previously established by reliable test data and the resulting concrete satisfies the requirements of concrete quality.

Where previous data are not available, concrete trial mixtures having proportions and consistency suitable for the work shall be made using at least three different water-cement ratios (or cement content in the case of lightweight aggregates) which will produce a range of strength s encompassing those required for the work. For each water-cement ratio (or cement content) at least three specimens for each age to be tested shall be made, cured and tested for strength in accordance with ASTM C 39 and C 192.

The strength test shall be made at 7, 14 and 28 days at which the concrete is to receive load, as indicated on the plans. A curve shall be established showing the relationship between water-cement ratio (or cement content) and compressive strength. The maximum permissible water-cement ratio for the concrete to be used in the structure shall be that shown by the curve to produce an average strength to satisfy the requirements of the strength test of concrete provided that the water-cement ratio shall be no greater than that required by concrete quality when concrete that is to be subjected to the freezing temperature which weight shall have a water-cement ratio not exceeding 6 gallon per bag (50 kgs.) and it shall contain entrained air.

Table 900.1 Maximum Permissible Water-Cement Ratios for Concrete (Method 1)

Specific Compressive strength at 28 days, psi fc'	Maximum permissible Water-Cement Ratio			
	Non Air-entrained Concrete		Air-entrained Concrete	
	U.S. gal. per 42.5 kg. bag of cement	Absolute Ratio by weight	U.S. gal. per 42.5 kg. bag of cement	Absolute Ratio by weight
2500	7 ¼	0.642	6 ¼	0.554
3000	6 ½	0.576	5 ¼	0.465
3500	5 ¾	0.510	4 ½	0.399
4000	5	0.443	4	0.354

900.3.3 Concrete Proportions and Consistency

The proportion of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles on the form and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work.

900.3.4 Sampling and Testing of Structural Concrete

As work progress, at least one (1) set of sample consisting of three (3) concrete cylinder test specimens, 150 x 300 mm. shall be taken from each class of concrete placed each day, and each set to represent not more than 75 cu.m. of concrete.

900.3.5 Consistency

Concrete shall have a consistency such that it will be workable in the required position. It shall be such a consistency that it will flow around reinforcing steel but individual particles of the coarse aggregate when isolated shall show a coating or mortar containing its proportionate amount of sand. The consistency of concrete shall be gauged by the ability of the equipment to properly placed it and not by the difficulty of mixing water shall be determined by the Engineer and shall not be varied without his consent. Concrete as dry as it is practical to place with the equipment specified shall be used.

900.3.6 Strength Test of Concrete

When strength is the basis of acceptance, each class of concrete shall be represented by at least five test (10 specimens). Two specimens shall be made for each test at a given age, and not less than one test shall be made for each 150 cu. m. of structural concrete, but there shall be at least one test for each days concreting.

The Engineer may require a reasonable number of additional tests during the progress of the work. Samples from which compression test specimens are molded shall be secured in accordance with ASTM C 172. Specimens made to check the adequacy of the proportions for strength of concrete or as basis for acceptance of concrete shall be made and laboratory-cured in accordance with ASTM C 31. Additional test specimens cured entirely under field conditions may be required by the Engineer to check the adequacy of curing and protection of the concrete. Strength tests shall be made in accordance with ASTM C 39.

The age for strength tests shall be 28 days or, where specified, the earlier age at which the concrete is to receive its full load or maximum stress. Additional test may be made at earlier ages to obtain advance information on the adequacy of strength development where age-strength relationships have been established for the materials and proportions used.

To conform to the requirements of this Item:

1. For structures designed in accordance with the Working Stress Design (WSD) method of this chapter, the average of any five consecutive strength tests of the laboratory-cured specimens representing each class of concrete shall be equal on or greater than the specified strength, fc', and not more than 20 percent of the strength test shall have values less than that specified.

2. For structures designed in accordance with the Ultimate Strength Design (USD) method of this chapter, and for prestressed structures the average of any three consecutive strength test of the laboratory cured specimens representing each class of concrete shall be equal to or greater than the specified strength, fc' and not more than 10 percent of the strength tests shall have values less than the specified strength.

When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements. The strengths of the specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Engineer, the strengths of the job-cured specimens, the Contractor may be required to improve the procedures for protecting and curing the concrete, or when test of field-cured cylinders indicate deficiencies in protection and curing, the Engineer may require test in accordance with ASTM Specification C 42 or order load test as outlined in the load tests of structures for that portion of the structure where the questionable concrete has been placed.

900.3.7 Splitting Tensile Test of Concrete

To determine the splitting ration, Fsp, for a particular aggregate, test of concrete shall be made as follows:

1. Twenty four (24) 15 cm. diameter by 30 cm. long (6 in. dia. by 12 in. long) cylinders shall be made in accordance with ASTM C 192, twelve at compressive strength level of approximately 210 kilograms per square centimeter (3000 psi) and twelve at approximately 280 kilograms per square centimeter (4000 psi) or 350 kilograms per square centimeter (5000 psi). After 7 days moist curing followed by 21 days at 23 ºC (73 ºF) and 50% relative humidity, eight of the test cylinders at each of the two strength levels shall be tested for splitting strength and four for compressive strength.

2. The splitting tensile strength shall be determine in accordance with ASTM C 496, and compressive strength in accordance with ASTM C 39.

The ration, Fsp, of splitting tensile strength to the square root of compressive strength shall be obtained by using the average of all 16 splitting tensile test and all 8 compressive tests.

Minimum Strength, Concrete other than fill, shall have a minimum compressive strength at 28 days of 140 kilograms per square centimeter (2000 psi).

900.3.8 Batching

Batching shall conform to the requirements of ITEM 405, Structural Concrete.

900.3.9 Mixing and Delivery

Mixing and delivery shall conform to the requirements of ITEM 405, Structural Concrete.

900.3.9.1 Concrete Surface Finishing: General

This shall be in accordance with ITEM 407, Concrete Structures.

900.3.9.2 Curing Concrete

This shall be in accordance with ITEM 407, Concrete Structures

900.3.9.3 Acceptance of Concrete

The strength of concrete shall be deemed acceptable if the average of three (3) consecutive strength test results is equal to or exceed the specified strength and no individual test result falls below the specified strength by more than 15%.

Concrete deemed to be not acceptable using the above criteria may be rejected unless Contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be obtained from the affected area, cured and tested in accordance with AASHTO T24. Concrete in the area represented by the cores will be deemed acceptable if the average of cores is equal to or at least 85% and no sample core is less than 75% of the specified strength otherwise it shall be rejected.

900.4 Method of Measurement

The quantity of concrete to be paid shall be the quantity shown in the Bill of Quantities schedule, unless changes in design are made in which case the quantity shown in the Bill of Quantities will be adjusted by the amount of the change for the purpose of payment. No deduction will be made for the volume occupied by the pipe less than 101 mm. (4") in diameter nor for reinforcing steel, anchors, weep holes or expansion materials.

900.5 Basis of Payment

The accepted quantities measured as prescribed in Sub-Section 900.7 shall be paid for at the appropriate contract unit price for the pay item listed below as shown in the Bill of Quantities, which price and payment shall be full compensation for furnishing all materials, including metal water stops, joints, joint fillers, weep holes, and rock backing and timber bumpers; for all form and false work; for mixing, placing, furnishing, and curing the concrete; and for all labor, materials, equipment, tools and incidentals to complete the item, except that reinforcing steel shall be paid for at the contract unit price per kilogram for reinforcing steel metal pipes and drains, metal conduits and ducts, and metal expansion angles shall be paid for as structural steel that when the proposal does not include an item for Structural Steel these miscellaneous metal parts shall be paid for as reinforcing steel.

Pay Item No.	Description	Unit of Measurement
900 (1)	Reinforced Concrete	Cubic meter (cu.m.)

ITEM 901 MASONRY WORKS

901.1 Description

The work includes all labor, materials, tools and equipment necessary to install concrete masonry and all appurtenant work in connection with the work as shown on the Drawings and Specifications.

901.2 Materials Requirements

Concrete masonry unit work of the type indicated shall be provided and shall be properly coordinated with the work of their trades. The source of supply of materials, which will affect the appearance of the finished work, shall be changed after the work has started.

901.2.1 Concrete Hollow Blocks

Concrete hollow blocks shall be standard machine fabricated and shall have fine and even texture and well- defined edges. CHB shall conform to the requirements of ASTM Specifications C 90, grade with minimum compressive strength of 2.45 MPa (350 psi) (average of 5 specimens). Samples shall be tested and submitted to the Engineer. Dimensions and tolerances shall be as individually specified on the Plans.

901.2.2 Mortar and Grout

Unless otherwise indicated on the Plans, masonry mortar shall be composed of one (1) part Portland cement, and two (2) parts fine aggregate by volume to which hydrated lime has been added in an amount equal to ten (10) mass percent of the cement. For masonry walls not exceeding 1,8 m (1.6) in height, a mortar composed of one (1) part masonry cement and two (2) parts fine aggregate by volume may be substituted for the above mixture of Portland cement, lime and fine aggregate. Grout shall be of the same materials and proportion as mortar to which additional water shall be added to produce a consistency for pouring without segregation.

Masonry cement shall conform to the requirements of AASHTO M 150 – 74 (ASTM C 91). Fine aggregate shall conform to the requirements of AASHTO M 45 (ASTM C 144). Water shall conform to the requirements of Item 714, Water.

901.2.3 CHB Wall Reinforcement

1. Vertical and Horizontal Reinforcement

   Unless otherwise specified, the vertical and horizontal reinforcements for CHB shall be 10mm diameter at 400 for all wall thick nesses. Lap splices shall be 300 mm long (minimum).

2. Lintel Beams

   - Unless noted otherwise, lintel beams to be used shall have a depth of 0.20 m and the thickness of CHB wall, reinforced by 4 – 10 mm diameter with 10 mm diameter at 200 ties.
   - Lintel beams shall be provided on top of CHB wall openings. It shall extend at least 0.30 m beyond each opening.

   - Stiffener beams (detail similar to lintel beam) shall be provided on top CHB partition walls not anchored to regular reinforced concrete beams/girders. Stiffener beams shall be provided for walls exceeding 3 meters in height.

3. Dowels

   Where CHB walls adjoin R.C. columns and beams provide dowels on R.C. column and beams prior to pouring to match CHB wall reinforcement size and spacing. Dowels shall be 600 mm long unless noted otherwise.

4. Movement Gaps

   - Where the top of CHB wall adjoins a beam provide 50 mm gap to be filled with a soft material like styrophor.
   - Where the sides of a CHB wall adjoin a column provide 50 mm gap to be filled with soft material like styropor. Rebars shall be retained for stability.

5. Anchors

   Where columns and beams poured without the CHB wall dowels, provide 16 mm diameter expansion bolts to match CHB reinforcement spacing. These anchors shall be drilled and hammered in placed. No chipping off of concrete columns and beams is allowed unless otherwise permitted by the Engineer.

901.3 Construction Requirements

901.3.1 Laying Concrete Masonry Units

901.3.1.1 Workmanship

Units shall be set plumb and true to line with level horizontal joints. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, and at least 50 percent of the cells shall be filled with grout, the cells containing vertical reinforcements to be among those to be filled up. All cells of CHB walls from footing up to at least the ground floor level shall be filled up. Solid units shall be laid with full head and bed joints. Joints shall be uniform and approximately 10 mm wide unless otherwise indicated.

Unless otherwise shown on the drawings, joints of exterior concrete masonry units that will be exposed and painted shall be cut flush and tooled finished with a 6.5 mm depth "V" joint for horizontal joints. Vertical joints between the horizontal joints shall be tooled flush. Joints of interior concrete masonry units shall be cut flush, and the blocks shall be given a cement plaster finish except as otherwise shown on the Drawings. The minimum of cement plaster shall be 10 mm.

901.3.1.2 Setting Embedded Items

All anchor bolts and miscellaneous metalwork embedded in masonry shall be set in accordance with setting plans or instructions furnished by trades supplying the metalwork. Care shall be exercised to insure that all anchors are completely surrounded by grout.

901.3.1.3 Masonry Lintels

The Contractor shall provide properly shored supports for construction of masonry lintels for opening in walls. Shoring shall not be removed for at least seven days after lintels are placed.

901.3.1.4 Placing Reinforcing Bars and Grouting

All reinforcing steel, except dowels in concrete, shall be accurately set in strict accordance with the Drawings and the notes thereon. Vertical steel shall be secured firmly in place by means of frames or other suitable devices. Horizontal steel may be placed as the work progresses. In any core containing reinforcement, the distance between any masonry and the reinforcement shall be at least 12.7 mm (1/2 in) at all points. The masonry contractor shall furnish all tiles, spacers and supports required to hold steel in position during grouting. Cores shall be grouted in lifts not exceeding 1.22 m (4 ft) in height. Grout shall be thoroughly rodded. Splices in reinforcing bars shall be lapped at a distance sufficient to develop the stress in the bar, but not less than 40 bar diameters.

Concrete hollow blocks shall be laid with all cells completely grouted from the wall footing up to the ground level. The rest of the concrete hollow blocks above ground shall have at least 50 percent of the cells grouted, including those containing the vertical reinforcements.

901.3.1.5 Protection and Cleaning

Corners shall be protected from damage, with substantial board covers. Mortar or grout stains on masonry work shall be removed immediately. Any masonry work showing stains from mortar or concrete, or grout at completion of work, shall be replaced or the entire masonry surface sandblasted to provide uniform approved appearance. In cleaning the block, only stiff fiber brushes and wooden scrapers shall be used. Metal implements or acids shall not be used for cleaning blocks. All imperfect joining, nail holes, chipped edges of corners, and similar defects shall be corrected or replaced as directed.

901.4 Method of Measurement

All masonry works shall be measured in square meters installed complete with plastering, mortar and grout and installing reinforcing bars as shown on the drawing and prescribed in the specification.

901.5 Basis for Payments

The accepted quantities measured as prescribed in Sub-Section 901.4 shall be paid for at the appropriate contract unit price for the pay item listed below as shown in the Bill of Quantities, which price and payment shall be full compensation for furnishing all materials, including all form and false work; for mixing, placing, furnishing, and curing the concrete; and for all labor, materials, equipment, tools and incidentals to complete the item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
901 (1)	150 mm thick CHB Walls With Cement plaster finish	square meter (m^2)
902 (2)	100 mm thick CHB Walls With Cement plaster finish	square meter (m^2)

ITEM 1003 CARPENTRY

1003.1 Description

The work under this Item shall consist of furnishing all required materials, fabricated wood work, tools equipment and labor and performing all operations necessary for the satisfactory completion of all carpentry and joinery works in strict accord with applicable drawings, details and this Specifications.

1003.2 Material Requirements

1003.2.1 Lumber

Lumber of the different species herein specified for the various parts of the structure shall be well seasoned, sawn straight, sun dried or kiln dried and free from defects such as loose unsound knots, pitch pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance.

1003.2.1.1 Grade of Lumber and Usage

a. Stress grade is seasoned, closed-grained and high quality lumber of the specified specie free from defects and suitable for sustaining heavy loads.

   Stress grade lumber shall be used for wooden structural members subject to heavy loads, and sub- floor framing embedded or in contact with concrete or masonry.

b. Stress grade lumber of the specified specie is generally of high quality, of good appearance, without imperfections, and suitable for use without waste due to

defects and suitable also for natural finish. Select grade lumber shall be used for flooring, sidings, facia and base boards, trims, mouldings, millwork, railings, stairs, cabinet work, shelvings, doors, windows and frames of openings.

c. Common grade lumber has minimum tight medium knot not larger than 25 mm. in diameter, with minimal imperfections, without sapwood, without decay, insect holes, and suitable for use with some waste due to minor defects and suitable also for paint finish. Common grade lumber shall be used for light framework for wall partitions, ceiling joist and nailers.

1003.2.1.2 Lumber Species and Usage

Unless otherwise specified on the Plans, the following lumber species shall be used as indicated:

a. **Yacal** (stress grade) for structural member such as post, girders, girts, sleepers door and window frames set or in contact with concrete or masonry.

b. **Guijo** (select grade) for door and window frames set in wooden framework, for stairs, for roof framing supporting ceramic or cement tiles, floor joist and other wooden structural parts.

c. **Apitong** (common grade) for roof framing supporting light roofing materials such as galvanized iron, aluminum or PVC sheets, for wall framing, ceiling joist, hangers and nailers.

d. **Tanguile** (select grade) for doors and windows, facia and base boards, trims, mouldings, millwork, railings, stairs, cabinet work, shelvings, flooring and siding.

e. **Narra** (select grade) for stair railings, flooring boards, wall panels, base boards, trims, mouldings, cabinet work, mill work, doors and windows when indicated as such in the Plans.

f. **Dao** (select grade) for parts of the structure as enumerated under Section 1003.2.1.2 (e), when indicated as such on the Plans.

1003.2.1.3 Moisture Content

Rough lumber for framing and siding boards shall be air-dried or sun-dried such that its moisture content shall not exceed 22 percent. Dressed lumber for exterior and interior finishing, for doors and windows, mill work, cabinet work and flooring boards shall be kiln-dried and shall not have a moisture content in excess of 14 percent at the time of installation in the structure.

1003.2.1.4 Substitution in Lumber Specie

Any lumber equally good for the purpose intended may be substituted for the specific kind subject to the prior approval of the Engineer, provided the substitution shall be of equal or better specie acceptable to the Engineer. In case of substitution with better specie, no additional cost therefore shall be allowed to the Contractor.

1003.3 Construction Requirements

1003.3.1 Quality of Materials

All materials to be incorporated in the carpentry and joinery works shall be of the quality specified under Section 2. Before incorporation in work, all materials shall have been inspected/ accepted by the Engineer or his authorized representative.

1003.3.2 Storage and Protection of Materials

Lumber and other materials shall be protected from dampness during and after delivery at the site. Materials shall be delivered well in advance of actual need and in adequate quantity to prelude delay in the work. Lumber shall be piled in orderly stack at least 150 mm. above ground and at sheltered place where it will be of least obstruction to the work.

1003.3.3 Shop Drawings

Shop drawings complete with essential dimensions and details of construction, as may be required by the Engineer in connection with carpentry and joinery work, shall be submitted for approval before proceeding with the work.

1003.3.4 Rough Carpentry

Rough carpentry covers timber structural framing for roof, flooring, siding, partition and ceiling.

a. Framing shall be stress grade or common grade lumber of the specie specified under Section.

b. Rough carpentry shall be done true to lines, levels and dimensions. It shall be squared, aligned, plumbed and well fitted at joints.

c. Trusses and other roof framing shall be assembled, fitted and set to exact location and slope indicated on the Plans.

d. Fasteners, connectors and anchors of appropriate type and number shall be provided and fitted where necessary.

e. Structural members shall not be cut, bored or notched for the passage of conduits or pipes without prior approval of the Engineer. Members damaged by such cutting or boring shall be reinforced by means of specifically formed and approved steel plates or shapes, otherwise, damaged structural members shall be removed and replaced to the satisfaction of the Engineer.

f. Timber framing in contact with concrete or masonry shall be treated with termite-proofing solution and after drying coated with bituminous paint.

1003.3.5 Finished Carpentry

Finished carpentry covers works on flooring, siding and ceiling board, stairs, cabinets, fabricated woodwork, millwork and trims

a. Framing lumber shall be select grade, free from defects and where exposed in finished work, shall be selected for color and grain.

b. Joints of framing shall be tenoned, mortised or doweled where suitable, closely fitted and secured with water resistant resins glue. Exterior joints shall be mitered and interior angles coped.

c. Panels shall be fitted, allow for contraction or expansion and insure that the panels remain in place without warping, splitting and opening of joints.

d. Fabricated woodwork shall be done preferably at the shop. It shall be done true to details and profiles indicated on the Plans. Where set against concrete or masonry, woodwork shall be installed when curing is completed

e. Exposed wood surfaces shall be free from disfiguring defects such as raised grains, stains, uneven planning, sanding, tool marks and scratches. Exposed surfaces shall be machine or hand sanded to an even smooth surface, ready for finish.

1003.4 Method of Measurement

All carpentry actually installed shall be measured and determined by Subsections 1003.3.3 and 1003.3.5 as provided in the Bill of Quantities accepted to the satisfaction of the Engineer.

1003.5 Basis of Payments

The Items measured and determines as provided in subsection 1003.4 shall be paid for at the unit bid price which payment constitute full compensation of material, labor and incidentals necessary to complete this item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1003 (a)	Rough carpentry (framing, Roof, flooring, partition, ceiling)	square meter

ITEM 1008 ALUMINUM GLASS WINDOWS

1008.1 Description

This Item shall consist of furnishing all aluminum glass window materials, labor, tools and equipment required in undertaking the proper installation as shown on the Plans and in accordance with this Specification.

1008.2 Material Requirements

1008.2.1 Frame and panel members shall be fabricated from extruded aluminum section true to details with clean, straight, sharply defined profiles and free from defects impairing strength or durability. Extruded aluminum section shall conform to the specification requirements defined in ASTM B 211.

1008.2.2 Screws, nuts, washers, bolts, rivets and other miscellaneous fastening devices shall be made of non-corrosive materials such as aluminum, stainless steel, etc.

1008.2.3 Hardware for fixing and locking devices shall be closely matched to the extruded aluminum section and adaptable to the type and method of opening.

1008.2.4 Weather strip shall be first class quality flexible vinyl forming an effective seal and without adverse deformation when installed.

1008.2.5 Glazing shall conform to the requirements specified in Item 1012.

1008.2.6 Pile weather strip shall be silicon treated and free from residual wetting agents made of soft fine hair as on wool, fur, etc.

1008.3 Construction Requirements

For all assembly and fabrication works the cut end shall be true and accurate, free of burrs and rough edges. Cut-outs recesses, mortising and grinding operation for hardware shall be accurately made and properly reinforced.

1008.3.1 Installation Procedure

1008.3.1.1 Main frame shall consist of head, sill and jamb.

1008.3.1.2 Window sash

1008.3.1.3 Window panel shall be jointed at corners with miter and fixed rigidity to ensure weather tightness.

1008.3.1.4 Sliding windows shall be provided with nylon sheave. Sliding panels shall be suspended with concealed roller overhead tracks with bottom guide pitch outward and slotted for complete drainage. The sliding panels shall be provided with interior handles. The locking device shall be spring loaded extruded latch that automatically engages special frame hips.

1008.3.1.5 Casement window type shall be provided with two hinges fabricated from extruded aluminum alloy. They shall open on stay arms having adjustable sliding friction shoes to control window panel operations. Locking device shall be one arm action handle for manual operations complete with strike plate.

1008.3.1.6 All joints between metal surface and masonry shall be fully caulked.

1008.3.1.7 Aluminum parts in contact with steel members shall be properly insulated by a coat of zinc chromate, primer/ bituminous paint applied to the steel surface.

1008.3.1.8 Weather strip shall be furnished on edges at the meeting stiles.

1008.3.2 Shop Finish

Exposed aluminum surfaces shall be electrotype hard coats such as anodize, satin, etc.

1008.3.3 Protection

All aluminum parts shall be protected adequately to ensure against damage during transit and construction phase.

1008.3.4 Cleaning

1008.3.4.1 The Contractor does not only protect all entrance units during the construction phase but shall also be responsible for removal of protective materials and cleaning the aluminum surface including glazing before work is accepted by the Engineer.

1008.3.4.2 Aluminum shall be thoroughly cleaned with kerosene or gasoline, diluted with water and then wipe surface using clean cloth rugs.

1008.3.4.3 No abrasive cleaning materials shall be permitted in cleaning surface.

1008.4 Method of Measurement

Aluminum glass window fully equipped with fixing accessories and locking devices shall be measured in square meters base on actually in place installed and accepted to the satisfaction of the Engineer.

1008.5 Basis of Payment

The area of aluminum glass doors in square meters ready for service as provided in the Bill of Quantities shall be the basis of payment based on the unit bid or contact unit price which price and payment constitute all materials, labor including incidentals.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1008 (1)	Aluminum Sliding Windows	square meter (m^2)
1008 (2)	Aluminum Casement Windows	square meter (m^2)

ITEM 1010 WOODEN DOORS

1010.1 Description

This Item shall consist of Furnishing all materials, hardware, plant, tools, labor and services necessary for complete fabrication and installation of wooden doors and window of the type and size as shown on the Plans and in accordance with the following specifications and applicable specifications under Item 1003 on Carpentry and Joinery Works.

1010.2 Material Requirements

1010.2.1 Lumber

Lumber of doors, window and jambs, and panels when required, shall be kiln-dried with moisture content of not more than 14% and shall be of the specie indicated on the Plans and/ or specified under Item 1003 on Carpentry and Joinery Works.

1010.2.2 Adhesive

Adhesive shall be water resistant resins and shall be non-staining.

1010.2.3 Hardware

Hardware shall be as specified under Item 1004 on Building Hardware.

1010.3 Construction Requirements

1010.3.1 Fabrication

Wooden doors and windows, including frames, shall be fabricated in accordance with the designs and size shown on the Plans. The fabricated products shall be finished square, smooth sanded and free from damage or warping.

a. Panel Doors

Stiles and rails of panel doors shall have a minimum thickness of 44 mm. and width of 140 mm.

Rails minimum thickness of 44 mm and width of 140 mm. Rails shall be framed to stiles by mortise and tenon joints. Rabbets or grooves of stiles and rails to receive panels shall be 6.5 mm. wide and 20 mm. deep. Integral mouldings formed on both faces of stiles and rails framing the panels shall be true to shape and well defined. Intersections of mouldings shall be mitered and closely fitted.

Panels of the same species and having a minimum thickness of 20 mm. shall be beveled around its edges up to a minimum width of 50 mm. both faces. The beveled edges shall closely fit into the groove of stiles and rails, but free to move to prevent splitting when shrinkage occurs.

b. Door Frames

Framing of the specie(s) specified under Item 1003 shall be fabricated in conformity with the profile and sizes shown on the Plans. Frames shall be

assembled with tightly fitted tongue and groove joint mitered at both sides and nailed. The assembled frames shall be finished square and flat on the same plane. Assembled frames shall be braced temporarily to prevent their distortion during delivery to the site and installation.

1010.3.2 Installation

a. Frames shall be set plumb and square in concrete/ masonry work or framework of walls or partitions. Frames set in concrete or masonry shall be painted with hot asphalt at its contact surface and provided with two rows of common wire nails 100 mm. long for anchorage. The nails shall be staggered and spaced at 300 mm. on center along each row. Frame set in concrete shall be installed in place prior to concrete work.

   Frames set in masonry work may be installed after laying of hollow concrete blocks, bricks or adobe. Space between frames and masonry shall be fully filled with cement mortar proportioned 1:3.

b. Hinged Doors

   Hinged doors, whether panel or flush type with standard height of 2100 mm. and width of not more than 900 mm. shall be hung with four loose-pin butt hinges, 100 mm. x 100 mm. Swing out exterior doors shall be hung with four fast-pin butt hinges. Two hinges shall be fitted 150 mm. from top and bottom edge of door. The other two hinges shall be fitted at third points between top and bottom hinges. Care should be taken to ensure that the hinges are fitted such that their pins are aligned for ease of pin insertion and smoothness of operation. For added smoothness pins should be lightly greased. Hammering of hinges to attain proper alignment shall not be allowed.

   For wider and heavier doors such as narra panel doors, an additional hinge shall be fitted 100 mm. below the top hinge to counteract the door tilting action.

   Mounting screws shall be screwed in place in their entire length, not forced into place by hammering. Hammering of screw into place shall not be permitted.

c. Lock Installation

   Locks of doors shall be fitted at the same height, centered 1000 mm. above the finished floor level. Locks shall be installed in conformity with the templates and instructions supplied with locksets. Holes for mounting locks shall be properly formed to provide snug fit and rigid attachment of the locks to the doors. Strike plates shall be fitted on the door frame in true alignment with the lock latch.

1010.4 Method of Measurement

Frames of doors and windows shall be measured and paid for on the basis of number of sets completely installed and accepted by the Engineer.

Doors and windows shall be measured and for based on the number of square meters or set involved in the completed and accepted installation. Payment per square meter shall include cost of required hardware and all incidental expenses, but exclusive of locks for doors. Locks shall be paid for per set completely installed.

1010.5 Basis of Payment

The different pay items under Wooden Doors and Windows shall be designated the following number, description and unit of measure.

Payment shall be made under;

Pay Item Number	Description	Unit of Measurement
1010 (a)	Frames (Jambs, sills, head transoms and mullions	set
1010 (b)	Doors (Flush or Panel)	set
1010 (d)	Door Locks	set

ITEM 1014 PREPAINTED METAL SHEETS

1014.1 Description

This item shall consist of furnishing all pre-painted metal sheet, materials, tools and equipment, plant including labor required in undertaking the proper installation complete as show on the Plans and in accordance with this Specification.

1014.2 Material Requirements

All material metal sheet and roofing accessories shall be oven baked painted true to profiles indicated on the Plans.

1014.2.1 Pre-Painted Roofing Sheets

Pre-painted roofing sheets shall be fabricated from cold rolled galvanized iron sheets specially tempered steel for extra strength and durability. It shall conform to the material requirements defined in PNS 67:1985. Profile section in identifying the architectural moulded rib to be used are as follows: regular corrugated, Quad-rib, Tri- wave, Rib-wide, twin-rib, etc. Desired color shall be subject to the approval of the Architect/Engineer.

1014.2.2 Gutters, Valleys, Flashing Hip and Ridge

Gutters, Valleys, Flashing Hip and Ridge roll shall be fabricated from gauge 24 (.600 mm thick) cold-rolled plain galvanized iron sheets specially tempered steel. Profile section shall be as indicated on the Plans.

1014.2.3 Fastening hardware

Fastening hardware shall be of galvanized iron straps and rivets. G.I. straps are of .55 mm thick x 16 mm wide x 267 mm long (gauge 26 x 5/8" x 10-1/2") and standard rivets.

1014.2.4 Base metal thickness

Base metal thickness shall correspond to the following gauge designation available locally as follows:

a) Base Metal Thickness — Designated Gauge

Base Metal Thickness	Designated Gauge
.400 mm thick	Gauge 28
.500 mm thick	Gauge 26
.600 mm thick	Gauge 24
.800 mm thick	Gauge 22

b) Protective Coatings — Thickness

Protective Coatings		Thickness
1.	Zinc	34.4 microns (244 gm/m2)

2. Paint coatings

Top coat 15.20 microns
Bottom coat 6.8 microns

c) Overall thickness with protective coats

.400 mm .428-451 mm
.500 mm .532-651 mm
.600 mm .638-651 mm

d) Length of roofing sheets – available in cut to length long span length up to 18.29 meters.

e) Special length and thickness are available by arrangements.

1014.3 Construction Requirements

Before any installation work is commenced, the Contractor shall ascertain that the top face of the purlins are in proper alignment. Correct the alignment as necessary in order to have the top faces of the purlins on an even plane.

1014.3.1 Handling/Lifting/Positioning of Sheets

Sheets shall be handled carefully to prevent damage to the paint coating. Lift all sheets packs on to the roof frame with the overlapping down-turned edge facing towards the side of the roof where installation will commence, otherwise sheets will have to be turned end-to-end during installation.

1014.3.2 Installation Process

1. Start roofing installation by placing the first sheet in position with the downturned edge in line with other building elements and fastened to supports as recommended.

2. Place the downturned edge of the next sheet over the edge of the first sheet, to provide side lap and hold the side lap firmly in place. Continue the same procedure for subsequent sheets until the whole roofing area is covered and/or (Adopt installation procedure provided in the instruction manual for each type of Architectural molded rib profile section.)

3. For walling applications follows the procedure for roofing. Allow a minimum end of 100 mm (4") for vertical walling.

1014.3.3 Gutters, Valleys, Flashing ridge and Hip rolls

Gutters, valleys, flashing ridge and hip rolls be fastened where indicated on the Plans by self-tapping screws or galvanized iron straps and rivets.

1014.3.4 End Laps

In case handling or transport consideration requires to use two or more end lapped sheets to provide full length coverage for the roof run, install each line of sheets from bottom to top or form eave line to apex of roof framing. Provide 150 mm minimum end lap.

1014.3.5 Anchorage/Fastening

1. Pre-painted steel roofing sheets shall be fastened to the wood purlins with standard length G.I. straps and rivets.

2. For steel frame up to 4.5 mm thick use self-drilling screw No. 12 by 35 mm long hexagonal head with neoprene washer.

3. For steel support up to 5 mm thick or more use thread cutting screw No. 12 by

40 mm long hexagonal head with neoprene washer.

4. Side lap fastener use self-drilling screw No. 10 by 16 mm long hexagonal head with neoprene washer.

5. Valley fastened to lumber and for walling use self-drilling wood screw No. 12 by 25 mm long hexagonal head with neoprene washer.

6. Valleys fastened to steel supports use self-drilling screws, hexagonal head with neoprene washer. Drill size is 5 mm diameter.

1014.3.6 Cutting of Sheets

In cutting pre-painted steel roofing sheets and accessories to place the already installed or laid in position, the area around holes or cuts shall be masked to shield the paint from hot fillings.

1014.3.7 Storage and Protection

Pre-painted steel roofing, walling products and accessories should be delivered to the jobsite in strapped bundles. Sheets and/or bundles shall be neatly stacked in the ground and it left in the open it shall be protected by covering the stack materials with loose tarpaulin.

1014.4 Method of Measurement

The work done under this item shall be measured by actual area covered or installed with pre-painted steel roofing and/or walling in square meters and accepted to the satisfaction of the Engineer/Architect.

1014.5 Basis of Payment

The area of pre-painted steel roofing and/or walling in square meters as provided in Section 1014 shall be paid for at the bid or contract unit price which payment shall constitute full compensation including labor, materials, tools and incidents necessary to complete this item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1014 (a)	Pre-painted metal sheets	m^2

ITEM 1018 TILEWORKS

1018.1 Description

1018.1 Scope of Work

This section covers all works required in connection with wall and floor finishes on concrete surfaces in accordance with this Specification and as shown in the Plans.

1018.2 Material Requirement

1018.2.1 Tile Works

1. Floor Tiles

   Tiles shall be standard grade, unglazed vitrified tiles, and 6 mm thick. Color and pattern shall be as specified in the drawings or as approved by the Engineer.

2. Ceramic Tiles

   It shall be of the standard good quality grade, gloss smooth finish; color, texture and size code should be strictly adhered as shown in the Plans.

3. Tile Adhesive

Tile adhesive (tile bonding agent) shall be used as the dry set mortar to install tiles on walls and floors employing the thin-set method conforming to ANSI A108.1b

1018.2.2 Storage and Delivery of Material

Cement and lime shall be stored off the ground under watertight cover, and away from damp walls and surfaces until ready for use. Damaged or deteriorated materials shall be removed from the premises immediately. Manufactured materials shall be delivered in the original unbroken packages or containers that are labeled plainly with the manufacturer's names and brand. Container for tiles shall be grade-sealed. Materials shall be handled in a manner that will prevent the intrusion of deleterious materials that will affect its quality and appearance.

1018.3 Construction Requirements

1018.3.1 Tileworks

1. General

The work consist of furnishing all materials, labor and performing all operations in connection with tile finishing of floors and walls, complete including mortar beds for the tile. Tilework shall not be started until roughing-ins for plumbing and electrical work has been completed and tested. The work of all other trades in the area where the work is to be done shall be protected from damage in a workmanship manner as directed by the Engineer.

2. Mortar for Tiles

A scratch coat for wall tile shall be ABC or approved equivalent. Scratch coat shall have a minimum thickness of 9 mm. The buttering mortar for setting wall tiles and mortar setting bed for floor tiles shall have the same material as that of scratch coat.

3. Floor Tiling

a. Preparation of Surfaces

Before tile is applied with a dry-set mortar bed, the structural floor shall be tested for levelness or uniformity of slope by flooding it with water. Areas with water ponds shall be filled, leveled and retested before the setting bed is applied. The slab shall be soaked thoroughly with clean water on the day before the setting bed is applied. Immediately preceding the application of the setting bed, the slab shall again be wetted thoroughly but no free water shall be permitted to remain on the surface. A skim coat of ABC cement mortar shall then be applied not more than 1.5 mm thick. The mortar shall be spread until its surface is true and even, and thoroughly compacted, either level or sloped uniformly for drainage, where required. A setting bed, as far as can be covered with the tile before the mortar shall have reached its initial set, must be placed in one(1) operation, but in the event that more setting mortar has been placed than can be covered, the unfinished portion shall be removed and cut back to a clean leveled edge.

b. Installation of Floor Tile

All tiles shall be soaked in clean water to a minimum of one (1) hour before they are installed. Absorptive mounted tile shall be damped by placing tile on a wetted cloth in a shallow pan before installing. Before the initial set has taken place in the setting bed, a skim of ABC cement mortar .75 mm to 1.5 mm thick, shall be trowelled or brushed over the setting. The tiles shall then be pressed firmly upon the setting bed, and

carefully tapped into the mortar until true and even with the place of the finished floor base. Tapping and leveling shall be completed within one (1) hour after placing tiles. Borders and defined lines shall be laid before the field or body of the floor. Where floor drain is provided, the floor shall be sloped properly to the drains. Cutting of tiles, where necessary, shall be done along the outer edges of tile against trim, base, thresholds, pipes, built-in fixtures, and similar surfaces and shall be geared and joined carefully. Tiles shall be secured firmly in place, and loose tiles or tiles sounding hollow shall be removed and replaced to the satisfaction of the Engineer. All lines shall be kept straight, parallel and true and all finished surface brought to true and even planes.

4. Jointing

   Joints shall be parallel and uniform in width, plumb, level and in alignment. End joints in broken-joint shall be made, as far as practicable, on the center line of the adjoining tiles. Joint widths shall be uniform and measured to accommodate the tiles in the given spaces with a minimum cutting.

5. Grouting

   Grouting shall be done as soon as the mortar beds have sufficiently set. All cement shall be Portland cement, colored or white, as required. Where light colored mortar is required in joints, a mixture of white cement and non- fading mineral oxide shall be used to produce the desired colors. The quantity of mineral oxides shall not exceed 10% of the volume of cement in any case.

6. Cleaning

   Upon completion of grouting, the tile shall be thoroughly cleaned and maintained in this condition until completion of the contract.

1018.4 Method of Measurement

The finished area to be paid for under this item shall be measured by the number of square meter of unglazed floor tile laid and accepted in accordance with the plans and specifications to the satisfaction of the Engineer.

1018.5 Basis of Payment

The accepted quantities measured as stipulated in Sub-Section 8.4.1, Method of Measurement, shall be paid for at the contract unit price for each of the particular pay item listed below, which price and payment shall be full compensation for furnishing and placing all materials, labor, equipment, tools and incidentals necessary to complete each work item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1018.2 (1a)	Unglazed Floor tiles	Square Meter
1018.2 (1b)	Wall tiles	Square Meter

ITEM 1032 PAINTING, VARNISHING AND OTHER RELATED WORKS

1032.1 Description

This Item shall consist of furnishing all paint materials, varnish and other related products, labor, tolls, equipment and plant required in undertaking the proper application on painting, varnishing and related works indicated on the Plans and in accordance with this Specification.

1032.2 Material Requirements

1032.2.1 Paint materials

All types of paint material, varnish and other related product shall be subject to random test as to material composition by the Bureau of Research and Standard, DPWH or the National Institute of Science and Technology. (Use the following approved and tested brand name: Boysen, Davies, Dutch Boy, Fuller O Brien, or any approved equal).

1032.2.2 Tinting Colors

Tinting color shall be first grade quality, pigment ground in alkyd resin that disperses and mixes easily with paint to produce the color desired. Use the same brand of paint and tinting color to effect good paint body.

1032.2.3 Schedule

Exterior Finishes

a.	Plain cement plastered finish to be painted	3 coats Acrylic base masonry paint
b.	Concrete exposed aggregate and/or tool finish	1 coat water repellant
c.	Ferrous metal	1 coat primer and 2 coats enamel paint
d.	Galvanized metal	1 coat zinc chromate primer and 2 coats Portland cement paint
e.	Wood painted finish	3 coats oil based paint
f.	Wood varnished finish	varnish water repellant

Interior Finishes

a.	Plain cement plastered finish to be painted	3 coats Acrylic base masonry paint
b.	Concrete exposed aggregate and/or tool finish	Clean surface
c.	Ferrous metal	1 coat primer and 2 coats enamel paint
d.	Woodwork sea-mist	3 coats of 3 parts thinner 1 part lacquer
e.	Wood varnish	1st coat, of one part sanding sealer to one part solvent, 2nd coat 2/3 sanding sealer to 1/3 solvent
f.	Wood painted finish	3 coats oil based paint
g.	Ceiling boards textured finish	1 coat oil based paint allow to dry then patch surfaces unevenness and apply textured paint coat

1032.3 Construction Requirements

The Contractor prior to commencement of the painting, varnishing and related work shall examine the surfaces to be applied in order not to jeopardize the quality and appearances of the painting varnishing and related works.

1032.3.1 Surface Preparation

All surfaces shall be in proper condition to receive the finish. Woodworks shall be hand-sanded smooth and dusted clean. All knot-holes pitch pockets or sappy portions shall be sealed with natural wood filler. Nail holes, cracks or defects shall be carefully puttied after the first coat, matching the color of paint.

Interior woodworks shall be sandpapered between coats. Cracks holes of imperfections in plaster shall be filled with patching compound and smoothed off to match adjoining surfaces.

Concrete and masonry surfaces shall be coated with concrete neutralizer and allowed to dry before any painting primer coat is applied. When surface is dried apply first coating. Hairline cracks and unevenness shall be patched and sealed with approved putty or patching compound. After all defects are corrected apply the finish coats as specified on the Plans (color scheme approved).

Metal shall be clean, dry and free from millscale and rust. Remove all grease and oils from surfaces. Wash unprimed galvanized metal with etching solution and allow it to dry. Where required to prime coat surface with red lead primer same shall be approved by the Engineer.

In addition the Contractor shall undertake the following:

1. Voids, cracks, nick etc. will be repaired with proper patching material and finished flushed with surrounding surfaces.
2. Marred or damaged shop coats on metal shall be spot primed with appropriate metal primer.
3. Painting and varnishing works shall not be commenced when it is too hot or cold.
4. Allow appropriate ventilation during application and drying period.
5. All hardware will be fitted and removed or protected prior to painting and varnishing works.

1032.3.2 Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall flawed out after application of paint.

Paints made for application by roller must be similar to brushing paint. It must be non-sticky when thinned to spraying viscosity so that it will break up easily droplets.

Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. This procedure changes the required properties of the paint.

1032.3.3 Mixing and Thinning

At the time of application paint shall show no sign of deterioration. Paint shall be thoroughly stirred, strained and kept at a uniform consistency during application. Paints of different manufacture shall not be mixed together. When thinning is necessary, this may be done immediately prior to application in accordance with the manufacturer's directions, but not in excess of 1 pint of suitable thinner per gallon of the paint.

1032.3.4 Storage

All material to be used under this item shall be stored in a single place to be designated by the Engineer and such place shall be kept neat and clean at all time. Necessary precaution to avoid fire must be observed by removing oily rags, waste, etc. at the end of the daily work.

1032.3.5 Cleaning

All cloths and cotton waste which constitute fire hazards shall be placed in metal containers or destroyed at the end of daily works. Upon completion of daily work, all staging, scaffolding and paint containers shall be removed. Paint drips, oil, or stains on adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

1032.3.6 Workmanship in General

a. All paints shall be evenly applied. Coats shall be of proper consistency and well brushed out so as to show a minimum of brush marks.

b. All coats shall be thoroughly dry before the succeeding coat is applied.

c. Where surfaces are not fully covered or cannot be satisfactorily finished in the number of coats specified such preparatory coats and subsequent coats as may be required

shall be applied to attain the desired evenness of surface without extra cost to the owner.

d. Where surface is not in proper condition to receive the coat the Engineer shall be notified immediately.

   Work on the questioned portion(s) shall not start until clearance be proceed is ordered by the Engineer.

e. Hardware, lighting fixture and other similar items shall be removed or protected during the painting varnishing and related work operations and re-installed after completion of the work.

1032.4 Method of Measurement

The areas of concrete, wood and metal surfaces applied with varnish, paint and other related coating materials shall be measured in square meters as desired and accepted to the satisfaction of the Engineer.

1032.5 Basis of Payment

The accepted work shall be paid at the unit bid price, which price and payment constitute full compensation for furnishing all materials, labor, equipment, tools and other incidental necessary to complete this Item.
Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1032 (a)	Painting works	square meter (sq.m.)

ELECTRICAL WORKS

ITEM 1100 CONDUITS, BOXES & FITTINGS

1100.1 Description

This Item shall consist of the furnishing and installation of the complete conduit work consisting of electrical conduits; conduit boxes such as junction boxes, utility boxes, octagonal and square boxes; conduit fittings such as couplings, locknuts and bushing and other electrical materials needed to complete the conduit roughing-in works.

1100.2 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. The electrical materials to be used shall be of the standard products of the manufacturers regularly engaged in the production of equipment and materials required for this project and shall be the manufacturer's latest standard design that complies with the specification requirements. The Contractor shall submit for approval a complete description of all materials and equipment to be used before commencing the work. The descriptions shall include catalogue numbers, illustrations, diagrams, dimensional data, etc., as required to describe fully the materials.

Conduits

(a) Rigid Steel Conduit shall be electrical metal tubing (EMT) conduit, hot dip galvanized, conforming to ANSI Standard C80.1, or "American Standard Specifications for Steel Conduit, zinc coated" unless shown otherwise in the drawings. The conduit fittings and covers shall be galvanized,

threaded, or cadmium plated, grey iron or malleable iron castings. Composite rubber gasket shall be provided in all openings requiring covers. Outlets and pull boxes shall be of the sizes and types shown in the Plan.

(b) Rigid PVC Conduit shall be NEMA TC2, type EPC-PVC and shall be schedule 40. Enamel coated steel conduits and conduits with rough inner surfaces are not acceptable.

Conduit Boxes and Fittings

All conduit boxes and fittings shall be Code gauge steel and galvanized. Outlet boxes and fittings shall be galvanized pressed steel of standard make. In general, outlet boxes shall be at least 100 mm. square or octagonal, 53 mm. deep and 16 mm. minimum gauge.

1100.3 Construction Requirement

All works throughout shall be executed in the best practice in a workmanlike manner by qualified and experienced electricians under the immediate supervision of a duly licensed Electrical Engineer.

Conduits

Conduits should be cut square with hacksaw and ends reamed. Running or non-tapered threads shall not be used. Each run of conduit between boxes or equipment shall be electrically continuous. Threads shall conform to the American Standard for tapered pipe threads. In making bends only conduit bending apparatus will be used. The use of a pipe tee or vise for bending conduits shall not be permitted. Conduits entering slip holes in boxes shall be secured with a locknut on each side of the box wall and terminated with a bushing.

All joints between lengths of conduits and threaded connections to boxes, fittings and equipment enclosures shall be made watertight. Conduits shall be sloped towards drain points. Conduits shall be rigidly supported and braced to avoid shifting during placement of concrete. Conduits extending out of floors, walls, or beams shall be at right angles to the surfaces.

Spacing of conduits shall be such as to permit the flow of concrete between them. A minimum spacing of not less than 5 cm. shall be maintained, except where conduits enter boxes. Where conduits are placed in two or more layers or rows, the conduits in the upper or inner layers shall be placed directly over or behind the lower or outer layers, respectively.

Conduits terminating at the face of concrete for initial or future extensions as exposed runs shall be terminated with plugged couplings set flush with the floor, ceilings or wall. Galvanized iron plugs shall be provided for conduits, which are to be extended in the future. Where it is not practical to employ flush couplings, the conduit ends shall be suitably boxed or otherwise protected and plugged.

Conduits running in floors and terminating at motors or other equipment mounted on concrete bases shall be brought up to the equipment within the concrete base wherever possible. Conduit boxes shall be flush with the finished wall with covers and openings easily accessible. The Contractor shall remove and reset all boxes not properly installed or shifted out of line during concreting to the satisfaction of the Engineer.

Conduit Boxes & Fittings

Each outlet in the drawing or raceway system shall be provided with an outlet box to suit the conditions encountered. Boxes for exposed work or in wet locations shall be of the cast metal type having threaded hubs. Boxes for concealed work shall be the cadmium-plated or zinc-coated sheet metal type. Each box shall have sufficient volume to accommodate the number of conductors entering the box. Boxes shall not be less than 50 mm deep unless shallower boxes are required by structural conditions that are specifically approved by the Engineer. Ceiling and bracket outlet boxes shall not be less than 100 mm octagonal except that smaller boxes may be used where required by the particular fixtures to be installed. Switch and receptacle boxes shall be approximately 100 mm x 50 mm x 50 mm. Telephone outlets shall be 100 mm square except that 100 mm x 54 mm x 40 mm boxes may be used where only one raceway enter the outlet. Boxes installed in concealed locations shall be set flush with the finished surfaces and shall be provided with the proper extension rings or plaster covers where required. Boxes shall be installed in a rigid and satisfactory manner and shall be

supported by bar hangers in frame construction, or shall be fastened directly with wood screws on wood. Location of outlets shown on the drawings are approximates; the Contractor shall study the building plans in relation to the spaces and equipment surrounding each outlet so that the lighting fixtures are symmetrically located according to the room layout. When necessary, with the approval of the Consultant, outlets shall be relocated to avoid interference with mechanical equipment or structural features.

Conduit Boxes & Fittings

Provide conduit boxes for pulling and splicing wires and outlet boxes for installation of wiring devices. As a rule, provide junction boxes or pull boxes in all runs greater than 30 meters in length, for horizontal runs. For other lengths, provide boxes as required for splices or pulling. Pull boxes shall be installed in conspicuous but accessible locations.

Support boxes independently of conduits entering by means of bolts, red hangers or other suitable means.

Conduit boxes shall be installed plumb and securely fastened. They shall be set flush with the surface of the structure in which they are installed where conduits are run concealed.

All convenience and wall switch outlet boxes for concealed conduit work shall be deep, rectangular flush type boxes. Four inch octagonal flush type boxes shall be used for all ceiling light outlets and shall be of the deep type where three or more conduits connect to a single box

Floor mounted outlet boxes required shall be waterproof type with flush brass floor plate and brass bell nozzle.

All boxes shall be painted with anti-rust red lead paint after installation. All conduits shall be fitted with approved standard galvanized bushing and locknuts where they enter cabinets and conduit boxes.

Junction and pull boxes of code gauge steel shall be provided as indicated or as required to facilitate the pulling of wires and cables.

1100.4 Method of Measurement

The work under this Item are inclusive in Item 1101 (Wires and Wiring Devices) and shall be measured either by lengths, pieces, pairs, lot and actually placed and installed as shown on the Plans.

1100.6 General Specifications

The work to be done under this division of specifications consist of the fabrication, furnishing, delivery and installation, complete in all details of the electrical work, at the subject premises and all work materials incidental to the proper completion of the installation, except those portions of the work which are expressly stated to be done by other fields. All works shall be done in accordance with the rules and regulations and with the specifications.

1100.7 Specifications on:

1. Lightning Fixtures and Lamp

   All lightning fixtures and lamps shall be Light Emitting Diode(LED) type as specified and listed on the Lighting Fixture Schedule and shall be furnished and installed complete.

   Fixtures are designated by letters and illustrations shall be indicative of the general type desired and shall not restrict selection to fixtures of any particular manufacturer. Fixtures of similar design and equivalent light distribution and brightness characteristics having equal finish and quality may be acceptable but subject to the approval of the Engineer.

2. Material Requirements

   All materials to be used shall conform to the BPS specification

3. Construction Requirements

All grounding system installation shall be executed in accordance with the approved plans.

Grounding system shall include building perimeter ground wires, ground rods, clamps, connectors, ground wells and ground wire taps as shown in the approved design.

1100.8 Auxiliary Systems

All auxiliary systems such as telephone and intercom system, time clock system, fire alarm system and public address/paging system installations shall be done in accordance with the approved design.

All materials to be used shall conform to the Bureau of Product Standards (BPS) specifications.

1100.9 Important requirement regarding supervision of the work and submission of certificate of completion. All wiring installation herein shall be done under the direct supervision of a licensed Electrical Engineer at the expense of the Contractor. The Contractor shall submit the request for the Clearance to Proceed duly approved by the owner's representative.

1100.10 Test and Guarantee

Upon completion of the electrical construction work, the Contractor shall provide all test equipment and personnel and to submit written copies of all test results. The Contractor shall guarantee the electrical installation are done and in accordance with the approved Plans and specification. The Contractor shall guarantee that the electrical system are free from all grounds from all defective workmanship and materials and will remain so for a period of one year from date and acceptance of works. Any defect shall be remedied by the Contractor at his own expense.

ITEM 1101 WIRES AND WIRING DEVICES

1101.1 Description

This Item shall consist of the furnishing and installation of all wires and wiring devices consisting of electrical wires and cables, wall switches, convenience receptacles, heavy duty receptacles and other devices shown on the approved Plans but not mentioned in this Specification.

1101.2 Material Requirements

Wires and cables shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the PSA mark unless specified or indicated otherwise, all power and lighting conductor shall be insulated for 600 Volts. All wires shall be copper, soft drawn and annealed, smooth and cylindrical form and shall be centrally located inside the insulation. All wiring devices shall be standard product of reputable electrical manufacturers. Wall switches shall be rated at least 10A, 250 Volts and shall be spring operated, flush, tumbler type. Duplex convenience receptacles shall be rated at least 15A, 250 Volts, flush, parallel slot single heavy duty receptacles shall be rated at least 20 A, 250 Volts, wire, flush, polarize type.

Conductors in conduits shall be moisture and heat-resistant rubber or thermoplastic insulated. In dry locations, wires and cables shall be type THW for sizes 8 mm. and smaller and type THW or THHN for sizes 14 sq. mm. and larger. In damp or wet locations as defined by the Philippine Electric Code, wires and cables shall be type THW. All conductors shall have 600 volts insulation unless otherwise specified in the drawings. Wire shall be stranded copper for 5.5 mm. diameter and larger sizes. Wires for the telephone and signaling systems shall be twisted telephone wires, thermoplastic insulated. The number and sizes shall be as specified in the drawings.

1101.3 Construction Requirements

Conductors of wires shall not be drawn in conduit until after the cement plaster is dry and the conduits are thoroughly cleaned and free from dirt and moisture. In drawing wires into conduits, sufficient slack shall be allowed to permit easy connection for fixtures, switches, receptacles and other wiring

devices without the use of additional splice:

All conductors of convenience outlets and lighting branch circuit home runs shall be wired with a minimum of 3.5 mm. in size. Circuit homeruns to panel boards shall not be smaller than 3.5 mm. but a homerun to panel board more than 30 meters shall not be smaller than 5.5 mm. No conductor shall be less than 2 mm. in size.

All wires of 14 mm. and larger in size shall be connected to panel and apparatus by means of approved type lugs or connectors of the solderless type, sufficiently large enough to enclose all strands of the conductors and securely fasten. They shall not loosen under vibration of normal strain.

All joints, taps and splices on wires larger than 14 mm. shall be made of suitable solderless connectors of the approved type and size. They shall be taped with rubber and PVC tapes providing insulation no less than that of the conductors.

No splices or joints shall be permitted in either feeder or branch conductors except within outlet boxes or accessible junction boxes (pull boxes). All joints in branch circuit wiring shall be made mechanically and electrically secured by approved splicing devices taped with rubber and PVC tapes in a manner which will make their insulation as that of the conductor.

All wall switches and receptacle shall be fitted with standard bakelite face plate covers. Device plate for flush mounting shall be installed with all four edges in continuous contract finished wall surfaces without the use of coiled wire or similar devices. Plaster fillings will not be permitted. Plate installed in wet locations shall be gasketed.

When more than one switch or device is indicated in a single location gang plate shall be used.

1101.3.1 Quality Assurance Provisions

All installation shall be completed on or before final acceptance of the project including the tests and commissioning. Equipment shall be demonstrated to operate in accordance with the requirements of this specification. The Contractor shall furnish all instruments, tools and personnel required for the tests. As an exception to requirements that may be stated elsewhere in the contract agreement, the Engineer shall be given five (5) working days notice prior to each test. All defects disclosed as a result of such test that are due to the Contractor and shall be remedied to the satisfaction of the Engineer.

(a) Devices subject to Manual Operation

Each device subject to manual operation shall be tested five (5) times demonstrating satisfactory operation each time.

(b) Test on 600 Volts Wiring

Test of all 600 volts wiring to verify that no circuits or accidental grounds exist. Perform insulation resistance test on all wiring using an instrument which apply a voltage of approximately 500 volts to provide a direct reading of resistance; minimum resistance shall be 250,000 ohms that the resistance to ground is not excessive. Test each ground rod for resistance to ground before making any connections to the rod, then tie entire grounding system together and test for resistance to ground. Make resistance measurements in normally dry weather condition, not less than 48 hours after rainfall. Submit written results of each test to the Engineer and indicate the locations of the rod as well as the resistance and soil conditions at the time of the measurements were made.

1101.4 Method of Measurement

The work under this Item shall be measured either by meters, rolls, pieces, set, actually placed and installed as shown on the Plans.

1101.5 Basis of Payment

All work performed and measured and as provided for in his Bill of Quantities shall be paid for at the

Unit Bid or contract unit price which payment shall constitute full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1101 (1)	Electric wire (size), conduits with Fittings	meter
1101 (2)	Single pole tumbler switch	set
1101 (3)	Two-gang Tumbler switch	set
1101 (4)	Three-gang Tumbler switch	set
1101 (5)	Duplex convenience outlet	set
1101 (6)	Heavy duty convenience receptacle	set
1101 (7)	Standard Telephone outlet Bakelite cover	set
1101 (8)	Bare copper wire	meters
1101 (9)	Grounding clamp for electric wire	pieces
1101 (10)	Service entrance assembly with Reinforced concrete Pedestal pole With anchor bolt	pole
1101 (11)	Meter base assembly exposed rigid RCP with weather cap & grounding rod copper weld 20 mm. diameter x 3 m.	set

PART I – MATERIALS DETAILS

ITEM 700 – HYDRAULIC CEMENT

700.1 Portland Cement and Masonry Cement

Cement shall conform to the requirements of the following cited Specifications for the type specified or permitted.

Type	Specifications
Portland Cement	AASHTO M 85 (ASTM C 150)
Blended Hydraulic Cements	AASHTO M 240 (ASTM C 595)
Masonry Cement	AASHTO M 150-74 (ASTM C 91)

When Types IV and V (AASHTO M 85), P and PA (AASHTO M 150) cements are used, proper recognition shall be given to the effects of slower strength gain on concrete proportioning and construction practices.Types S and SA cements will be permitted only when blended with Portland Cement in proportions approved by the Engineer.

Unless otherwise permitted by the Engineer, the product of only one mill of any one brand and type of Portland Cement shall be used on the project.

The Contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which, for any reason, has become partially set or which contains lumps of caked cement will be rejected.Cement salvaged from discarded or used bags shall not be used.

ITEM 703 – AGGREGATES

703.1 Fine Aggregate for Concrete and Incidentals

703.1.1 Concrete

Fine Aggregate for concrete shall conform to the requirements of AASHTO M6, with no deleterious substances in excess of the following percentages:

Clay lumps	1
Coal and lignite	1
Material passing 0.075 mm sieve	4
Other substances – as shown in the Special Provisions	

Lightweight aggregate, if required or permitted by the Special Provisions, shall meet the pertinent requirements of AASHTO M 195.

703.1.2 Granular backfill filter materialfor under drains and filler for paved waterways shall be permeable and shall meet the requirements of AASHTO M 6, except that soundness tests will not be required and minor variations in grading and content of deleterious substances may be approved by the Engineer.

703.1.3 Aggregate for minor concrete structures shall be clean, durable, uniformly graded sand and gravel, crushed slag or crushed stone, 100 percent of which will pass a 37.5 mm (1-1/2 inches) sieve and containing not more than 5 percent passing the 0.075 mm (No. 200) sieve.

703.2 Coarse Aggregate for Portland Cement Concrete

Coarse aggregate for concrete shall meet the requirements of AASHTO M 80. Lightweight aggregate, if required or permitted by the Special Provisions, shall conform to the requirements of AASHTO M 195, for the grading specified.

703.3 Aggregate for Portland Cement Treated and Stabilized Base Course

The crushed and uncrushed granular material shall consist of hard durable stones and rocks of accepted quality, free from an excess of flat, elongated, soft or disintegrated pieces or other objectionable matter.The method used in obtaining the aggregate shall be such that the finished product shall be as consistent as practical.

All materials passing the 4.75 mm (No. 4) mesh produced in the crushing operation of either the stone or gravel shall be incorporated in the base material to the extent permitted by the gradation requirements. The plasticity index shall not be less 4 or more than 10.

703.4 Aggregate for Untreated Subbase, Base or Surface Courses

Aggregate shall consist of hard, durable particles or fragments of crushed stone, crushed slag or crushed or natural gravel.Materials that break up when alternately wetted and dried shall not be used.

Coarse aggregate is the material retained on the 2.00 mm (No. 10) sieve and shall have a percentage of wear of not more than 50 for subbase and not more than 45 for Base and Surface Courses as determine by AASHTO Method T 96.

Fine aggregate is the material passing the 2.00 mm (No. 10) sieve and shall consist of natural or crushed sand and fine mineral particles.The fraction passing the 0.075 mm (No. 200) sieve shall not be greater than 0.66 (two-thirds) of the fraction passing the 0.425 mm (No. 40) sieve.For base courses, the fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6, while for subbase course; the liquid limit shall not be greater than 35 plasticity index not greater than 12.

For surface courses, the fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 35 and a plasticity index not less than 4 or greater than 9. All materials shall be free from vegetable matter and lumps or balls of clay. Whencrushed aggregate is specified, not less than 50 mass percent of the particles retained on the 4.75 mm (No. 4) sieve shall have at least one fractured face.

Gradation of each designated size of aggregate shall be obtained by crushing, screening and blending processes as may be necessary.

Materials otherwise meeting the requirements of this Section will be acceptable whenever such materials

produce a compacted course meeting applicable density requirements as specified in Subsections 200.3.3, 201.3.3, 202.3.3 and 203.3.6.

ITEM 709 – PAINTS

709.1 Description

This Item covers all paint materials including Vehicles, Pigment, Pastes, Driers, Thinners and Mixed Paints for steel and wooden structures.

709.2 Material Requirements

709.2.1 General

Paint, except, aluminum paint, shall consist of pigments of the required fineness and composition ground to the desired consistency in linseed oil in a suitable grinding machine, to which shall be added additional oil, thinner and drier as required.

Aluminum paint shall consist of aluminum bronze powder or paste of the required fineness and composition to which shall be added the specified amount of vehicle.

The paint shall be furnished for use in ready mixed, paste or powder form. All paint shall meet the following general requirements:

a. The paint shall show no excessive settling and shall easily be re-dispersed with a paddle to a smooth, homogenous state. The paint shall show no curdling, livering, caking or color separation and shall be free from lumps and skins.

b. The paint as received shall brush easily, possess good leveling properties and shall show no running or sagging when applied to a smooth vertical surface.

c. The paint shall dry to a smooth uniform finish free from roughness grit, unevenness and other imperfections.

d. The paint shall not skin within 48 hours in three quarters filled closed container.

e. The paint shall show no thickening, curdling, gelling or hard caking after six (6) months storage in full, tightly covered container at a temperature of 21°C (70°F).

709.2.2 The paint shall conform to the requirements of the indicated specifications as follows:

Red Lead Ready-Mixed Paint Type I, II, III and IV	AASHTO M 72
Aluminum Paint	AASHTO M 69
Type I and II White & Tinted Ready-Mixed Paint	AASHTO M 70
Foliage Green Bridge Paint	AASHTO M 67
Black Paint for Bridges and Timber Structures	AASHTO M 68
Basic Lead Silicon Chromate, Ready-Mixed Primer	AASHTO M 229

709.2.3 The constituents' parts of the paint shall meet the following specifications:

Red Lead (97% Pb_3O_4)	ASTM D 83
Iron Oxide (85% Fe_2O_3)	ASTM D 84
Aluminum Powder and Paste	ASTM D 962
Magnesium Silicate	ASTM D 605
Mica Pigment	ASTM D 607
Titanium Dioxide	ASTM D 476
Chrome Yellow	ASTM D 211
Calcium Carbonate	ASTM D 1199

Basic Lead-Silicon Chromate	ASTM D 1638
Basic Carbonate White Lead	ASTM D 81
Zinc Oxide	ASTM D 79
Chrome Oxide Green	ASTM D 263
Carbon Black	ASTM D 561
Lampblack	ASTM D 209
Prussian Blue	ASTM D 261
Boiled Linseed Oil	ASTM D 260
Raw Linseed Oil	ASTM D 234
Pale Heat Bodied Linseed Oil	Fed Spec. TT-0-367
Alkyd Resin	Fed. Spec. TT-R-266
Mineral Spirit	ASTM D 235
Driers	ASTM D 600
Turpentine	ASTM D 13

709.3 Proportion for Mixing

It is the intent of these Specifications to provide a paint of proper brushing consistency, which will not run, streak or sag and which will have satisfactory drying qualities.

709.3.1 Aluminum Paint, Field Coats on Structural Steel

The paint shall be mixed in the proportion of 0.242 kg of aluminum powder of paste per liter of vehicle of long oil spar varnish (2 lb/gal) producing a paint containing 21 mass percent pigment and 79 percent vehicle.The weighed amount of powder or paste shall be placed in a suitable mixing container and the measured volume of vehicle then poured over it.The paste or powder shall be incorporated in the paint by vigorous stirring with a paddle.The powder or paste will readily disperse in the vehicle. Before removing any paint from the container, the paint shall be thoroughly stirred to insure a uniform mixture and the paint shall be suitably stirred during the use. The amount of paint enough for one day's use only shall be mixed at one time.

When two field coats of aluminum paint are specified, the first coat shall be tinted with lampblack paste or Prussian blue paste in the quantity of 0.024 kg/L or more (1/5 lb/gal) of paints.The exact quantity used shall be sufficient to give a contrast in color which can be readily distinguished. When three field coats of aluminum paint are specified the second coat shall be tinted.

709.3.2 Aluminum Paint, Field Coats on Creosoted Timber

This paint shall be mixed as specified for Aluminum Paint for Structural Steel except that the proportions shall be 0.272 kg of aluminum powder or paste per liter of vehicle (2-1/2 lb/gal).

Other paint composition may be used when and as stipulated in the Special Provisions.

709.4 Containers and Markings

All paints shall be shipped in strong, substantial containers plainly marked with mass, color and volume in liters of the paint content, a true statement of the percentage composition of the pigment, the proportions of the pigment to vehicle, the name and address of the manufacturers and the stencil of the authorized inspecting agency. Any package or container not so marked will not be accepted for use under this Specification.

ITEM 710 – REINFORCING STEEL AND WIRE ROPE

710.1 Reinforcing Steel

Reinforcing steel shall conform to the requirements of the following Specifications:

Deformed Billet-Steel Bars for Concrete Reinforcement	AASHTO M 31 (ASTM A 615)
Deformed Steel Wire	

for Concrete Reinforcement	AASHTO M 225 (ASTM A 496)
Welded Steel Wire Fabric for Concrete Reinforcement	AASHTO M 55 (ASTM A 185)
Cold-Drawn Steel Wire for Concrete Reinforcement	AASHTO M 32 (ASTM A 82)
Fabricated Steel Bar or Rod Mats for Concrete Reinforcement	AASHTO M 54 (ASTM A 184)
Welded Deformed Steel Wire Fabric of Concrete Reinforcement	AASHTO M 221 (ASTM A 497)
Plastic Coated Dowel Bars	AASHTO M 254 Type A
Low Alloy Steel Deformed Bars for Concrete Reinforcement	ASTM A 206

Bar reinforcement for concrete structures, except No. 2 bars shall be deformed in accordance with AASHTO M 42, M 31 and M 53 for Nos. 3 through 11.

Dowel and tie bars shall conform to the requirements of AASHTO M 31 or AASHTO M 42 except that rail steel shall not be used for tie bars that are to be bent and re-straightened during construction. Tie bars shall be deformed bars. Dowel bars shall be plain round bars.They shall be free from burring or other deformation restricting slippage in the concrete.Before delivery to the site of the work, a minimum of one half (1/2) the length of each dowel bar shall be painted with one coat of approved lead or tar paint.

The sleeves for dowel bars shall be metal of an approved design to cover 50 mm (2 inches), plus or minus 6.3 mm of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 25 mm (1 inch) from the end of the dowel bar. Sleeves shall be of such design that they do not collapse during construction.

Plastic coated dowel bar conforming to AASHTO M 254 may be used.

ITEM 714 – WATER

714.1 Description

This Item covers criteria for acceptance of Questionable Water either natural or wash water for use in concrete.

714.2 Requirements

The mixing water shall be clear and apparently clean.If it contains quantities or substances that discolor it or make it smell or taste unusual or objectionable, or cause suspicion, it shall not be used unless service records of concrete made with it (or other information) indicated that it is not injurious to the quality, shall be subject to the acceptance criteria as shown in Table 714.1 and Table 714.2 or as designated by the purchaser.

When wash water is permitted, the producer will provide satisfactory proof or data of non-detrimental effects if potentially reactive aggregates are to be used. Use of wash water will be discontinued if undesirable reactions with admixtures or aggregates occur.

Table 714.1
Acceptance Criteria For Questionable Water Supplies

	Limits
Compressive strength, min. % Control at 7 days	90
Time of Setting deviation from control	from 1:00 earlier to 1:30 later
Time of Setting (Gillmore Test)	
Initial	No marked change
Final Set	No marked change
Appearance	Clear
Color	Colorless
Odor	Odorless
Total Solids	500 parts/million max
PH value	4.5 to 8.5

Table 714.2
Chemical Limitation for Wash Water

	Limits
Chemical Requirements, Minimum Concentration	
Chloride as $C1^{(-1)}$ expressed as a mass percent of cement when added to the $C1^{(-1)}$ in the other components of the concrete mixtures shall not exceed the following levels:	
1. Prestressed Concrete	0.06 percent
2. Conventionally reinforced concrete in a moist environment and exposed to chloride	0.10 percent
3. Conventionally reinforced concrete in a moist environment but not exposed to chloride	0.15 percent
4. Above ground building construction where the concrete will stay dry	No limit for corrosion
Sulfate as SO_4, ppm[A]	3000
Alkalies as (Na_2O + 0.658 K_2O), ppm	600
Total Solids, ppm	50000

[A] *Wash water reused as mixing water in concrete may exceed the listed concentrations of sulfate if it can be shown that the concentration calculated in the total mixing water, including mixing water on the aggregate and other sources, does not exceed that stated limits.*

Water will be tested in accordance with, and shall meet the suggested requirements of AASHTO T 26.

Water known to be of potable quality may be used without test.

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