ITEM 10 : SUBGRADE PREPARATION

DESCRIPTION

This Item shall consist of the preparation of the subgrade for the support of overlying structural layers. It shall extend to full width of the pavement.

MATERIAL REQUIREMENTS

Embankments shall be constructed of suitable materials, in consonance with the following definitions:

1. Suitable Material – Material which is acceptable in accordance with the Contract and which can be compacted in the manner specified in this Item.

   Selected Borrow, for topping – soil of such gradation that all particles will pass a sieve with 75 mm (3 inches) square openings and not more than 15 mass percent will pass the 0.075 mm (No. 200) sieve, as determined by AASHTO T 11. The material shall have a plasticity index of not more than 6 as determined by ASSHTO T 90 and a liquid limit of not more than 30 as determined by AASHTO T 89.

2. Unsuitable Material – Material other than suitable materials such as:

   (a) Materials containing detrimental quantities of organic materials, such as grass, roots and sewerage.

   (b) Organic soils such as peat and muck.

   (c) Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.

   (d) Soils with a natural water content exceeding 100%.

   (e) Soils with very low natural density, 800 kg/m3 or lower.

   (f) Soils that cannot be properly compacted as determined by the Engineer.

CONSTRUCTION REQUIREMENTS

PRIOR WORKS

Prior to commencing preparation of the subgrade, all culverts, cross drains, ducts and the like (including their fully compacted backfill), ditches, drains and drainage outlets shall be completed. Any work on the preparation of the subgrade shall not be started unless prior work herein described shall have been approved by the Engineer.

SUBGRADE LEVEL TOLERANCE

The finished compacted surface of the subgrade shall conform to the allowable tolerances as specified hereunder:

Permitted variation from design LEVEL OF SURFACE	+ 20 mm - 30 mm
Permitted SURFACE IRREGULARITY MEASURED BY 3-m STRAIGHT EDGE	30 mm
Permitted variation from design CROSSFALL OR CAMBER	± 0.5 %
Permitted variation from design LONGITUDINAL GRADE over 25 m length	± 0.1 %

SUBGRADE IN COMMON EXCAVATION

Unless otherwise specified, all materials below subgrade level in earth cuts to a depth 150 mm or other depth shown on the Plans or as directed by the Engineer shall be excavated. The material, if suitable, shall be set aside for future use or, if unsuitable, shall be disposed as directed by the Engineer.

Where material has been removed from below subgrade level, the resulting surface shall be compacted to a depth of 150 mm.

All materials immediately below subgrade level in earth cuts to a depth of 150 mm, or to such greater depth as may be specified, shall be compacted in accordance with the materials requirement.

SUBGRADE ON EMBANKMENT

After the embankment has been completed, the full width shall be conditioned by removing any soft or other unstable material that will not compacted properly. The resulting areas and all other low sections, holes, or depressions shall be brought to grade with suitable material. Scarifying, blading, dragging, rolling, or other methods of work shall be performed or used as necessary to provide a thoroughly compacted subgrade shaped to the cross-sections shown on the Plans.

PROTECTION OF COMPLETED WORK

The Contractor shall be required to protect and maintain at his own expense the entire work within the limits of his Contract in good condition satisfactory to the Engineer from the time he first started work until all work shall have been completed. Maintenance shall include repairing and recompacting ruts, ridges, soft spots and deteriorated sections of the subgrade caused by the traffic of the Contractor's vehicle/equipment or that of the public.

ITEM 11 : MASONRY WORKS

GENERAL

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

SCOPE OF WORK

This Section includes the furnishing of all labor and materials to complete the work as shown on the drawings and specified herein. The works shall include but not necessarily be limited to the following:

1. Supply and installation of concrete hollow block (CHB) walls with reinforcement

2. Plastering

3. Installing temporary works like scaffolding, platforms, steps, etc.

GENERAL PROVISIONS

The following publications of the issues below but referred to thereafter by basic designation only form a part of these specifications to the extent indicated by the reference thereto:

American Society for Testing and Materials (ASTM) Publications:

A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A 33 Concrete Aggregates

C 129 Specification for Non-Load Bearing Concrete Masonry Units C

144 Specification for Aggregate for Masonry Mortar

C 270 Mortar for Unit Masonry

MATERIAL REQUIREMENTS

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

CONCRETE HOLLOW BLOCKS (CHB)

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

BEDDING MORTAR

Mortar shall be composed of 1 part of Portland cement, 3 parts of sand and ½ part of lime. It shall have a compressive strength of [14 MPa (2,000 psi)] at 28 days and shall comply with property specifications for type N mortar set forth in ASTM Specification C 270 and as modified herein, proportioned and tested in an approved laboratory at the expense of the Contractor. When tested

for water retention, the mortar shall have a flow after suction, of 75 percent or more when mixed to an initial flow of 125 to 140 percent. When tested for compressive strength, mortar shall be mixed to a flow of 100 to 115 percent. Aggregate for mortar shall conform to ASTM C 144.

PLASTER

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

REINFORCING STEEL BARS AND RODS

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

SAMPLES AND TESTING

1. The following shall be submitted for approval and in addition, representative samples shall be taken periodically from on-the-site stockpiles as required for testing or checking during the progress of the work.

Anchors and ties	:	Two of each type proposed for use
Concrete Hollow Blocks	:	Shapes, sizes and kinds in sufficient numbers to show full range of quality and texture.

2. Sampling and testing, unless otherwise specified, shall be performed by an approved independent commercial testing laboratory at the expense of the Contractor. Certified copies of laboratory test reports, including all test data, shall be submitted at least 10 days before delivery of the units or mortar materials represented by the tests to the project site.

3. Mortar shall be laboratory-proportioned and tested. Certified copies of approved laboratory-established proportions shall be submitted with the required test reports and test data. Approved laboratory-established proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in mortar for the work unless additional evidence is furnished that the mortar meets the specified requirements.

EXECUTION

1. GENERAL

No unit having a film of water on its surface shall be laid. Masonry shall be laid plumb, true to line, with level courses accurately spaced. Bond pattern shall be kept plumb throughout. Corners and reveals shall be plumb and true. Vertical joints shall be shoved tight. Each unit shall be adjusted to final position while mortar is still soft and plastic. Any unit that is disturbed after mortar has stiffened shall be removed and relaid with fresh mortar. Courses shall be so spaced that backing masonry will level off, flush with the face work at all joints where ties occur. Chases and rake-out joints shall be kept free from mortar or other debris.

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

3. Cutting and fitting, including that required to accommodate the work of others shall be done by masonry mechanics. Wherever possible, full units of the proper size shall be used in lieu of cut units. Cut edges shall be clean, true and sharp. Openings shall be carefully cut,

formed or otherwise neatly made for recessed items and for electrical, plumbing, or other mechanical installations so that wall plates, cover plates, or escutcheons required by the installation will completely conceal the openings and will have bottoms in alignment with lower edge of masonry joints. Webs of hollow masonry units shall be cut to the minimum required for the installation. Reinforced masonry lintels shall be provided as indicated above openings over 300mm wide, for pipes, ducts and cable trays, unless steel sleeves are used.

4. Embedded Items

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

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

6. Protection

Surfaces of masonry not being worked on shall be properly protected at all times. At the end of each workday period and when rain is imminent, the top of exposed masonry shall be covered with a strong non-staining waterproof membrane well secured in place and in a manner that will prevent moisture. Adequate provisions shall be made during construction to prevent damages by wind.

7. Mortar

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

8. Jointing

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

9. Placing Reinforcing Steel

Prior to placing grout, all reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout or other coating which might destroy or reduce its bond with grout. Details of reinforcement shall be as indicated in the drawings. Reinforcing shall not be bent or straightened in a manner injurious to the steel. Bars with kinks or bends not shown on the drawings shall not be used. Placement of reinforcement shall be inspected and approved prior to placing grout. One piece vertical bars extending from floor to floor or roof above shall be provided. Vertical bars shall be spliced only where indicated.

a. Positioning Bars

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

b. Splices

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

PAINTING AND CLEANING

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

ITEM 12A : FINISHES

GENERAL

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

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete all finishing works as indicated on the drawings and as specified herein.

Wall, floor, ceiling and other finishing works shall include but are not limited to the following:

WALLS

Exterior

a. Plain cement finished painted with elastomeric paint.

Location as shown in the plans and elevations.

Interior

a. Plain cement finished painted with elastomeric paint.

b. 300mm x 600mm Glazed Ceramic Wall Tiles

Location as shown in the plans and elevations.

Plain Cement Finish

a. Surface Preparation

All surfaces shall be cleaned and projections, dust, loose particles and other materials, which would prevent good bond, shall be removed.

Plaster shall not be applied directly to concrete and masonry surfaces coated with bituminous compounds and surfaces previously painted or plastered.

All surfaces shall be thoroughly wetted before plastering.

b. Trial Mix

A trial mix of at least three (3) different water-cement ratios for a proposed mix shall be prepared under full scale conditions and adequate workability. The proportions by weight of cement to the weight of sand shall not be less than one part of Portland cement to two parts of sand.

The proportion of cement-sand and water necessary to produce the cement plaster of the required consistency shall be subject to the approval of the Engineer. Such approval may be withdrawn at any time and a change in proportions may be required. Based on the approved mix proportions, the Contractor shall prepare a list showing the number of kilograms of the various materials to be used in the cement plaster

finish mix.

No cement plaster finish shall be started without an approved trial mix by the Engineer.

c. Cement Finish Application

A brown coat with sufficient pressure shall be applied to fill the gaps, and to secure a good bond. Moistened for 48 hours, each coat of cement plaster shall be kept after application and allow to dry.

A finish coat shall be applied after the brown coat has set. The brown coat shall be moistened before application of the finish coat. Finish coat shall be floated to plumb, even planes and surfaces.

Final plaster finishes shall be rubber sponged.

d. Tolerance

The Contractor shall finish plaster work plumb, level, square and true within tolerance of 3mm in 3 meters, without cracks and other imperfections.

e. Patching and Cleaning

Upon completion of the building, and when directed, all loose, cracked, damaged or defective plastering shall be cut out and re-plastered in a satisfactory and approved manner.

Painting Works

a. Surface Preparation

Allow new masonry to dry for 14 days (for exterior surfaces) to 28 days (for interior surfaces) under normal conditions before painting. Surface to be painted should be clean and dry, free from oil, grease, dirt, dust, contaminants, and all loose grit and mortar.

Without mesh:

1st Coat: Elastomeric Wall Covering Sealer

2nd Coat: Elastomeric Wall Covering Basecoat

3rd Coat: Elastomeric Wall Covering Topcoat

With mesh:

1st Coat: Elastomeric Wall Covering Sealer

2nd Coat: Elastomeric Wall Covering Basecoat
Reinforcing Membrane: Fiberglass Matting

3rd and 4th Coat: Elastomeric Wall Covering Basecoat

5th Coat: Elastomeric Wall Covering Topcoat

Wall Ceramic Tiles

a. Wall tiles shall be glazed ceramic tiles color as per Architect's approval.

b. Trimmers and moulding shall be lustrous, glazed with size and color corresponding to wall tiles.

c. Portland cement, sand, bonding compound, lime and water shall conform with the requirements.

FLOORS

F1 600mm x 600mm Unglazed Ceramic Floor Tiles

a. Queueing Area
b. Security / Inspection Area
c. Terminal Fee Room
d. Ballistic Room
e. Terminal Management Office
f. Ecumenical Room (Male)
g. Ecumenical Room (Female)
h. Clinic
i. Nursing Mother / Diaper Changing Room
j. Male Toilet
k. Female Toilet
l. PWD Toilet
m. Electrical Room
n. Control Room
o. Pre-Departure Area

Locations are shown in the plan.

F2 600mm x 600mm Non- Slip Ceramic Floor Tiles

a. Main Entrance
b. Boarding Exits

Locations are shown in the plan.

F3 Non- Skid / Rough Cement Floor Finish

a. Ramps

Locations are shown in the plan.

F4 Waterproof Finish

a. Toilets
b. Roof Deck

Locations are shown in the plan.

a. Floor tiles shall be color varies and as shown on the drawings or to be designated by the Architect.

b. Portland Cement, sand, water and adhesive shall conform with the requirements.

c. Floor tiles shall be delivered in the manufacturer's original unbroken packages or containers that are labeled plainly with the manufacturer's name and brand. Containers shall be grade scaled. Materials shall be stored in dry weathertight enclosures, and shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

EXECUTION

Floor Tiles

a. Mortar Preparation

Mortar mix proportion and preparation shall be in accordance with the requirements.

b. Surface Preparation

Surfaces to receive the tiles shall be clean, free of dust, dirt, oil, grease, and other deleterious substances. Floor tile operations in spaces receiving wall tile shall not be started until wall tile installation has been completed. Before tile is applied with a dryset mortar bed, the structural floor shall be tested for levelness or uniformity of slope by flooding it with water. Areas where the water ponds shall be filled and leveled with mortar and shall be retested before the setting bed is applied.

c. Placing of Setting Beds and Floor Tile

Mortar setting beds shall have a minimum thickness of 20mm for floors. The structural concrete slab shall be soaked thoroughly with clean fresh water on the day before the setting bed is to be applied. Immediately preceding the application of the setting bed, the structural slab shall again be wetted thoroughly, but no free water shall be permitted to remain on the surface.

A skim coat of neat Portland cement mortar shall then be applied not more than 4mm thick. The mortar shall be spread until its surface is true and even and thoroughly compacted, either level or sloped uniformly for drainage, as the case requires. A setting bed, as large as can be covered with tile before the mortar has reached its initial set, shall be placed on one 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 beveled edge.

All mounted tiles shall be soaked in clean water a minimum of one hour before they are set. Absorptive mounted tile shall be dampened by placing sheets on a wetted cloth in a shallow pan before setting. No free water shall remain on the tiles at the

time of setting. Before the initial set has taken place in the setting bed, a skim coat of neat Portland cement mortar, 0.7mm to 1.6mm thick, shall be trowelled or brushed over the setting bed and/or the back of the tile, or a thin layer of Portland cement, 0.79mm to 2mm thick, may be hand-dusted uniformly over the setting bed and worked lightly with a trowel or brush until thoroughly damp.

The tiles shall then be pressed firmly upon the setting bed, and beaten into the mortar until true and even with the plane of the finished floor line. Beating and leveling shall be completed within one hour after placing tiles or sheets. Borders and defined lines shall be laid before the field or body of the floor. Where floor drains are provided, the floors shall be sloped to drain properly to the drains. Intersections and returns shall be formed accurately.

Cutting of tile, where necessary, shall be done along the outer edges of the floor. As far as practicable, no tiles of less than half size shall be used. Cutting and drilling of tiles shall be done neatly without marring the tile surfaces. The cut edges of tile against trim, bases, thresholds, pipes, built-in fixtures, and similar surfaces shall be ground and jointed carefully. Tile shall fit closely and neatly at all plumbing fixtures and around electrical outlets, pipes and fittings so that cover plates or escutcheons will overlap the tiles properly. Tiles shall be secured firmly in place and loose tiles or tiles sounding hollow shall be removed and replaced. All lines shall be kept straight, parallel, and true, and all finished surfaces brought to true and even planes. The inner edges of borders shall be kept straight and, where practicable, shall form right angles at all returns. The paper and glue shall be removed from mounted tile, without using excess water, within one hour after installing the tiles.

Joints shall be parallel and uniform in width, plumb, level and in alignment. End joints in broken-joint work shall be made as far as practicable, on the center lines of adjoining tiles. Except in special arrangement and design, as indicated or specified, square tiles shall be set with straight joints, and oblong tiles shall be set with broken joints.

Joint widths shall be uniform and spaced to accommodate the tile in the given spaces with a minimum of cutting. Tiles shall be wetted, if they have become dry, before applying grout. Joints 3.2 mm or less in width shall be grouted with a neat Portland cement grout of the consistency of thick cream. Other joints shall be pointed with mortar consisting of one part Portland cement and two parts pointing sand. The grout or mortar for joints on floors shall be white Portland cement or as specified by the Engineer. Grout painting mortar shall be forced into joints by using trowel, brush or finger application. Before the grout or mortar sets, the joints of cushion edge tile shall be struck or tooled to the depth of the cushion, filling all skips or gaps, and the joints of square edged tiles shall be filled completely flush with their surface. Dark cement shall not be seen through grouted white joints.

All surplus mortar or grout shall be removed before it has set or hardened.

d. Cleaning and Curing

Floors shall be covered with waterproofed paper with all joints lapped at least 96 mm and allowed to damp cure for at least 72 hours before foot traffic is permitted thereon.

All completed tile work shall be thoroughly sponged and washed diagonally across joints, and finally polished with clean, dry cloth. Acid cleaning of unglazed tile, when necessary, shall not be done within ten days after setting the tile. All metal shall be covered with approved grease and the tile shall be wetted with clean water, before tile is cleaned with 10% muriatic acid solution. After acid cleaning, the tile shall be flushed with clean water, and the grease coating on metal shall be removed.

Finished tile floors shall be covered with clean building paper before foot traffic is permitted on them. Board walkways shall be placed on floors that are to be continuously used as passage ways by workmen. Thresholds shall be covered with boards. Tiles vertical outside corners (external angles) shall be protected with board corners strips in areas used as passage by workmen.

Ceiling

1. Interior

    1. C1 - Aluminum Clip-in Perforated Panels, Bone White of Equivalent 600mm x 1200mm x 0.70mm

        Ground Floor
        a. Passenger Waiting Area

        Locations are shown in the plan.

    2. C2 - Aluminum Clip-in Perforated Panels, Bone White of Equivalent 600mm x 600mm x 0.70mm

        a. Main Entrance
        b. Security Inspection Area/X-ray
        c. Queueing Area
        d. Terminal Management Office
        e. Control Room
        f. Electrical Room
        g. Janitor's / Storage Room
        h. Female Toilet
        i. Male Toilet
        j. PWD Toilet
        k. Boarding Exits

        Locations are shown in the plan.

3. C3 – 13mm thk. Gypsum Board Painted on 0.40mm thk. Galvanized Steel Ceiling Suspension System @ 0.40m O.C. (Furring), 0.60m O.C. (Carrying Channel) and 1.20m O.C. Both Ways (Suspension Rod)

   a. Clinic
   b. Diaper Changing / Nursing Mother Room
   c. Storage
   d. Male Toilet
   e. Female Toilet
   f. PWD Toilet
   g. Electrical Room
   h. Control Room
   i. Emergency Exit
   j. Service Entrance
   k. Ballistic room
   l. Terminal Fee Room

   Locations are shown in the plan.

4. C4 – 14mm thk. Aluminum Composite Panel

   a. Canopy

   Locations are shown in the plan.

5. C5 – Painted Underside of R.C. Slab

   a. Roof Eaves

   Locations are shown in the plan.

SUBMITTAL

1. Shop drawings for all finishing and painting works for the building shall be submitted in advance to allow twenty-eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.

2. The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

3. Samples of all walls finishes, measuring not less than 1000mm x 1000mm shall be submitted to the Engineer for approval as to its finish texture and workmanship.

GRANITE TILES

a. Selected granite slabs for toilet countertops, fascia and splashboard. Dimensions as shown on the drawings.

b. Shall be sound material with uniform and favorable working qualities and with very limited natural faults.

c. Color, veining and quality shall be approved by Engineer.

d. Veining shall run vertically on all vertical surfaces and direction of veining shall continue in same directions over horizontal surfaces except as directed by the Engineer.

e. Sealer

e. 1. Shall be a commercial penetrating type free from harmful alkali or acid content specially prepared for marble work
e. 2. Shall have a Ph factor between 7 and 9
e. 3. Shall not discolor
e. 4. Shall produce a slip resistant surface
e. 5. Shall have a flash point not less than 35 °C

f. Cleaning Fluid

f. 1. Shall be commercial neutral liquid type especially prepared for marble work
f. 2. Shall have a Ph factor between 7 and 9
f. 3. Shall be free from crystallizing salts or water soluble alkaline salts
f. 4. Shall be biodegradable and phosphate free

Decorative Stones

Decostone collection is an innovative lightweight and thin manufactures stone veneer, very easy in its application. Its color palette consists of versatile earthly colors, complementing a variety of architectural styles and space arrangements. Colors and patterns are subject for approval by the Architect.

Locations as indicated on plans.

Surface Preparation

All backgrounds before glueing should be properly well-cured, have a proper load bearing capacity, constant and homogenous structure, be even, dry and cleaned from the paint, adhesive agents and lubricants remaining – the non-stabile coatings should be removed.

• Before glueing a wall should be, whenever needed, levelled with a levelling mortar.
• The background should be primed with thistle bond – surface primer – you can also buy at our store
• The background should be satisfactorily stable like e.g. concrete, brick, particleboards, aerated concrete, plasterboards, etc.

Tiles Preparation

• The differences in colours and sizes between the elements in one box are consciousness and gives an elevation a natural appearance.
• The tiles should be selected from several boxes simultaneously in order to achieve a homogenous distribution of the colour gradation.
• Clean of all tiles removing the excess

Stone Application

The ambient temperature during glueing and within 48h after glueing should not be lower than +5oC and higher than +25oC.

1.Lay the stones out on the floor first.

2. Start installing the stones, beginning in the bottom corners or the most visible places.

3. The adhesive should be applied with the spatula in 3-4 sites on the tile. Then we press the tile slightly moving it up to the moment of the even distribution of the adhesive.

4. Turn any trimmed edges either directly up or down, away from the focal point. Press the stones into the mortar, twisting them slightly to squeeze out some of the excesses and strengthen the bond. Use a trowel, joint tool, or brush to remove any excess adhesive that has been forced beyond the finished joint, or onto the surface of the stone itself.

5. Glueing should be started from the bottom part. In the case of missed even horizontal support for the tiles, you should start glueing with adjusting using a level and a level staff at the height of circa 11 cm above the floor.

6. The best effect is obtained by glueing the tiles shifted in relation to each other. We recommend a shift of circa 1/3 of the tile length above the floor. One should not glue tiles one below the other.

7. During the installation stone tiles can be cut and formed according to you needs. Cutting of the tiles may be performed with a saw for wood.

8. If you need, you can paint the panels with most of types of paints. Panels should be primed before painting to create better surface for the paint.

INSTALLATION OF DOORS / GLASS PANELS

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

DOORS

D-1 -1.5mm thk. Aluminum Framed Powder Coated Framed Door with 10mm thk. Reflective Tempered Glass (2.42m x 2.60m)

D-2 - 1.5mm thk. Aluminum Framed Powder Coated Framed Door with 10mm thk. Reflective Tempered Glass (1.00m x 2.70m)

D-3 - 1.5mm thk. Aluminum Framed Powder Coated Framed Door with 10mm thk. Reflective Tempered Glass Swing Door w/ Fixed Transom Window (3.70m x 2.70m)

D-4 - 1.5mm thk. Aluminum Framed Powder Coated Framed Door with 10mm thk. Reflective Tempered Glass Swing Door w/ Fixed Transom Window (1.90m x 2.50m)

D-5 - Marine Plywood Flush Door w/ 8mm thk. Clear Glass Vision Panel in Quick Drying Enamel Finish, Lever-type Lockset (0.70m x 2.15m)

D-6 - Marine Plywood Flush Door w/ 8mm thk. Clear Glass Vision Panel in Quick Drying Enamel Finish, Lever-type Lockset (0.90m x 2.15m)

D-7 - Marine Plywood Flush Door w/ 8mm thk. Clear Glass Vision Panel in Quick

Drying Enamel Finish; Lever-type Lockset, 3'3" Hinges (0.90m x 2.15m)

D-8 - Marine Plywood Flush Door w/ 8mm thk. Clear Glass Vision Panel in Quick Drying Enamel Finish; Lever-type Lockset, 3'3" Hinges (0.80m x 2.15m)

D-9 - Marine Plywood Flush-type Door w/ Kick Plate in Quick-drying Enamel (1.00m x 2.15m)

D-10 - Marine Plywood Flush-type Door w/ Vent Louver in Quick-drying Enamel (0.90m x 2.15m)

D-11 - PVC Louver Double Swing Door (0.80m x 2.15m)

D-12 - Cold-rolled Steel Fire-rated Emergency Exit Door w/ Panic Push Bar Lock (1.00m x 2.15m)

INSTALLATION OF WINDOWS

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

WINDOWS

W-1 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (4.00m x 3.25m)

W-2 - 1.5mm thick Aluminum Framed Powder Coated Framed Fixed Window with 10 mm thick Reflective Tempered Clear Glass (3.21m x 3.25m)

W-3 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (1.80m x 1.20m)

W-4 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (1.50m x 1.20m)

W-5 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 8 mm thick Reflective Tempered Glass (0.70m x 1.20m)

W-6 - 1.5mm thick Aluminum Framed Powder Coated Framed Fixed Window with 10 mm thick Reflective Tempered Clear Glass (0.84m x 2.60m)

W-7 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (4.00m x 0.65m)

W-8 - 1.5mm thick Aluminum Framed Powder Coated Awning Window with 10 mm thick Reflective Tempered Clear Glass and Overhead Awning Window (2.40m x 0.60m)

W-9 - 1.5mm thick Aluminum Framed Powder Coated Awning Window with 10mm thick Reflective Tempered Clear Glass (1.20m x 0.60m)

W-10 - 1.5mm thick Aluminum Framed Powder Coated Casement Window with 10mm thick Reflective Tempered Clear Glass (3.60m x 1.20m)

W-11 - 1.5mm thick Aluminum Framed Powder Coated Awning Window with 10mm thick Reflective Tempered Clear Glass (1.80m x 0.60m)

W-12 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (0.80m x 2.50m)

W-13 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (0.80m x 0.60m)

W-14 - 1.5mm thick Aluminum Framed Powder Coated Fixed Window with 10 mm thick Reflective Tempered Clear Glass (0.95m x 0.60m)

Location and details as shown in the plan.

ITEM 12B : CONCRETE WATERPROOFING

GENERAL

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

SCOPE OF WORK

The work shall cover the waterproofing requirements for building as shown on the drawings.

The work shall consist of furnishing all labor, materials, equipment and other incidentals necessary for the integral waterproofing works where required as shown on the drawings and in accordance with the requirements of these specifications as directed by the Project - In -Charged.

SUBMITTAL

1. Material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.

2. Samples for each waterproofing type.

DELIVERY AND STORAGE

Deliver manufactured waterproofing materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by referenced specification number shall bear the specification number, type, and class of the contents. Store and protect materials in accordance with the manufacturer's instructions, and use within their indicated shelf life. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture. Use pallets and canvas tarpaulins to cover stored materials top to bottom.

PRODUCTS

I. DEEP PENETRATING SEALER

Deep Penetrating Sealer (DPS) is an environmentally friendly, non-toxic, odorless, clear, water-soluble liquid compound, which is safe and easy to use.

Deep Penetrating Sealer (DPS) penetrates below the surface and chemically reacts with the alkali and lime found in concrete. This reaction creates a silica gel membrane within the pores and capillaries of the concrete, permanently sealing it against the ingress of moisture yet allowing the concrete to breathe. Over a period of time, the silica gel membrane hydrates and solidifies into a crystalline structure, increasing the hardness and strength of both new and old concrete while reducing moisture vapor emissions and permanently stopping the penetration

and flow of water and water-borne contaminants such as chlorides and acids, both on the positive or negative side forging a waterproofed and preserved concrete structure.

EXECUTION

- All existing dirt and other surface contaminants adhering on the surface must be thoroughly removed. Apply Concrete Neutralizer using sufficient coats to completely neutralize the surface. Do not wash off. When sufficiently dry, dust lightly to remove crystalline deposits.

- Mix thoroughly the product mixture as per manufacturer's instruction. Any change from the recommended proportion will affect its quality. Scrape the bottoms, sides and corners of the container to ensure complete and full blending. Prepare only enough quantities that can be used within the pot-life period. Do not delay application. Apply DPS by brush or roller or by using an airless spray.

- Allow to cure overnight prior to application of topcoat.

II. **FLEXIBLE MODIFIED CEMENTITIOUS**

Flexible Modified Cementitious (FMC) is a two-component latex modified cementitious coating. It can be simply achieved by mixing the pre-packed dry-mixing powder with the formulated flexible latex admixture, and subsequent brushing the slurry on various substrates. It protects a wide range of buildings and structural concrete components with excellent resistance to water, aggressive chemicals, long-term weathering, and scratching. It is applicable for those structures subjected to long-term water immersion.

1. Free surfaces from dirt or foreign materials. For the waterproofing to work best, manufacturers recommend the surfaces be sand blasted, bush-hammered or acid-etched.

2. Apply 2 coats of the cementitious waterproofing. The first coat could include the manufacturer's materials only. The second coating will include a cement-sand mixture and also have chemical and metallic elements too. If supplementary waterproofing is required, then a third coat may be required. This typically includes sand and cement for that extra protection.

Methods of Application

Trowel

Application of the coating is done using the handheld trowel, by simply applying and spreading the coating using the trowel.

Spray

This method uses spraying equipment like the ones used in painting vehicles.
It is preferred due to its precise finish and efficiency. It is also faster to use the spray than the trowel method.

Brush

Use a typical brush similar to roll brushes that are used in painting houses. It also has a uniform finish and is faster to use compared to the trowel.

It is good to note that different surfaces will dictate the method of application.

ITEM 12C : PAINTING

GENERAL

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

SCOPE OF WORK

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

The work shall consist of furnishing of all labor, materials, equipment and other incidentals necessary for the supply of painting materials and the complete painting of surfaces as shown on the drawings in accordance with this Specification and as directed by the Engineer.

The term paint as hereinafter used includes emulsion paints, varnishes, oils, pigments, thinner and dryers.

All exposed metal surfaces, except metal surfaces embedded in concrete, shall be painted unless otherwise specified.

STANDARD

The following publications listed below, but referred to thereafter by basic designation only, forms a part of these Specifications to the extent indicated by the reference thereto:

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

SUBMITTAL

1. The Contractor shall submit work method statements with lists of materials to the Engineer for approval twenty-eight days before the starting of works. This statement shall include following items:

    a. Type of paint and manufacturer
    b. Manufacturer's specifications
    c. Storage and delivery of materials
    d. Surface preparation
    e. Finish painting and drying
    f. Touch-up painting, if any
    g. Equipment

2. The Contractor, before placing order for the painting materials, shall submit to the Engineer for approval samples of materials. No placing of orders for material shall be made without his approval.

STORAGE AND DELIVERY

1. The Contractor shall deliver all material to the site in the original labeled sealed cans and containers, with labels intact and seal unbroken.

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

b. The Contractor shall deliver materials in ample quantities sufficiently in advance of the need to avoid any delay or interruptions in the works.

2. Paint in thinner shall be stored in accordance with the approved manufacturer's instructions.

a. All regulations required for storage of paint shall be observed and all necessary safety signs required by governing codes shall be posted.

b. Any damage caused by failure to exercise proper precautions in paint storage shall be repaired.

MATERIAL REQUIREMENTS

PAINT

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

Paints for exterior finish must be with tile like durability and elegance, fast drying, solvent based acrylic, highly suitable for coastal or polluted areas with excellent anti-fungus properties and alkali resistance.

100% Acrylic, water based, quick-drying, easy to clean-up and environmentally friendly, resist dirt, stains, alkali, water, humidity, algae, mold and mildew growth and highly durable paint for interior finish.

An all-purpose synthetic quick dry paint for all types of wood and metal surfaces. It has high gloss, good color retention and outstanding durability.

For pipes, valves and equipment, galvanized and ungalvanized ferrous metal, use a 100% acrylic gloss paint, has excellent resistance to ultraviolet rays and resists chalking, cracking and color fading, dries fast and environmentally friendly.

SCHEDULE OF PAINTING

Architectural Items	
a. Exterior Finishes	
1. On Concrete Walls	
Two Coats, Concrete Masonry Paint	Elastomeric Paint or approved equal
2. Unprimed Ferrous Metal	
First Coat	Red Oxide Primer, #310 or approved equal
Second & Third Coat	Quick Dry Enamel or approved equal
3. On Concrete Block Wall	
Masonry Neutralizer	Masonry Neutralizer #44 or approved equal
Three Coats	Elastomeric Paint

Concrete Masonry Paint	or approved equal
4. On Wood	
First Coat Exterior Wood Primer	Flat wall Enamel or approved equal
Second & Third Coat Exterior enamel	Quick Drying Enamel or approved equal
b. Interior Finishes Location of the various finishes are listed in the Finish Schedule on the drawings or else will be confirmed by PPA	
1. On primer and coated metal two coats of interior semi-gloss enamel or as indicated in the Schedule finish	Red Oxide Primer #310, Quick Dry Enamel or approved equal
2. On Plaster	
First Coat	Masonry Neutralizer #44 or approved equal
Three Coats	Elastomeric Paint or approved equal
3. On Wood	
First Coat Enamel undercoater	Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Quick Drying Enamel or approved equal
4. Wood Stain Finish	
First Coat Second & Third Coats Fourth & Fifth Coats	Oil Wood Stain , Lacquer Sanding Seale r#1254 Clear Gloss Lacquer #1250 or approved equal
c. Non – Architectural Items (Piping, valves, equipment, etc.)	
1. Piping, valves, equipment etc. in rooms are to be painted	
2. Galvanized pipes and ducts	
Primer – one coat Finish – one coat	Red Oxide Primer, #310 or approved equal Quick Dry Enamel or approved equal
3. Black steel pipes	
Primer – one coat Finish – one coat	Red Oxide Primer, #310 or approved equal Quick Dry Enamel or approved equal
4. Mechanical Items	
a. Ungalvanized ferrous metal Primer – one coat Finish – one coat	 Red Oxide Primer, #310 or approved equal Quick Dry Enamel or approved equal or approved

	equal
b. Galvanized ferrous metal Primer – one coat Finish – one coat	 Red Oxide Primer, #310 or approved equal Quick Dry Enamel or approved equal or approved equal
c. Submerged galvanized ferrous metal Primer – one coat	Red Oxide Primer, #310 or approved equal
d. Buried miscellaneous ferrous surface valves, & flanged joints (excl. pipe) Primer – one coat	Red Oxide Primer, #310 or approved equal

EXECUTION

SURFACE PREPARATION OF STEEL

1. Steel surfaces shall be cleaned as follows:

   a. All round welds, burrs and sharp surface projections shall be ground smooth and all weld splatter shall be removed prior to blast cleaning.

   b. Sand abrasives, if used, shall be clean, and free from salt and extraneous matter. The sand shall pass through a 2.0mm test sieve, and be substantially retained on a 0.18mm test sieve, with at least 25 percent retained on a 0.355mm test sieve.

   c. Metallic abrasive, if used, shall be sharp, hard and free from dust, and shall pass through a 1.8 mm test sieve.

   d. Blast cleaning operations shall not be conducted on surfaces that will be wet after blasting and before coating, or when the surfaces are less than 10°C above degree points, or when the relative humidity of the air is greater than 95 percent.

   e. Any oil, grease, soil, dust or other foreign matter deposited on the cleaned surfaces shall be removed prior to painting. In the event that rusting occurs after completion of the surface preparation, the surfaces shall be cleaned again in accordance with the specified method.

   f. Particular care shall be taken to prevent the contamination of other corrosive chemicals before the application of the paint. Such contamination shall be removed from the cleaned surface by flash blasting and the paint applied immediately.

   g. Care shall be taken to prevent contamination of cleaned and painted surfaces by cleaning operations in an adjacent area.

   h. Surfaces not to be painted shall be suitably protected from the effects of cleaning and painting operations.

SURFACE PREPARATION OF WOOD

1. Wood surfaces shall be sanded to a fresh surface. Surface mould where present, shall be removed by washing, rubbing down and burning off as necessary. Resinous exudation and large knots shall be removed and replaced with filler or other materials approved by the Engineer.

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

SURFACE PREPARATION OF CONCRETE AND PLASTER

Concrete and cement plaster surfaces to be painted shall be prepared by removing efflorescence, dust, dirt, grease, oil, asphalt, tar, excessive mortar and mortar dropping and by roughening to remove glaze. A zinc sulfate solution shall be applied before prime cost.

SURFACE PREPARATION FOR FIBER CEMENT SURFACES

Shall be dry and clean prior to application of the specified first-coat material. Oil, grease, or rust stains shall be carefully removed by the use of suitable solvent. Wire brushing will not be permitted. After the first coat has become dry and prior to application of finish coats, touch-up coats shall be applied to suction spots.

ALUMINUM FRAMES FOR DOORS AND WINDOWS

All metal surfaces shall undergo pre-treatment process which includes: desmutting, water-rinsing, degreasing/etching, water rinsing, zinc phosphating, water rinsing and acid rinsing.

Powder coating application, shall be factory applied and shall be done in one operation using an electro-static powder gun. The materials to be coated should be well connected to earth. Coating thickness should be kept to a minimum of 60 microns for exposed areas. On details which are to be treated mechanically after coating (drilling, sawing, etc.), the coating film must not exceed 100 microns.

The powder coating shall be oven cured in the range of 20 minutes at 220° C (metal temperature measured on the area with greatest metal thickness). The temperature variation in the oven should not exceed +/- 10° C.

Handling

Coated items should be cooled to no less than 40° Centigrade before handling. Precautions should be taken to avoid damages on the finished coating during stacking, storing and transportation.

Storage and Delivery

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water and easily accessible for inspection and handling. Store materials neatly on the floor, properly stacked on non-absorptive strips or wood platforms. Protect finished surfaces during shipping and handling using manufacturer's standard method.

WOOD REPAIR

Badly decayed areas shall be removed and repaired. Areas and pieces decayed beyond repair shall be replaced with new pieces that match originals in all respects. Moderately decayed areas, weathered, or gouged wood shall be patched with approved patching compounds, and shall be sanded smooth. The source or cause of wood decay shall be identified and corrected prior to application of patching materials. Wet wood shall be completely dried to a moisture content not exceeding 12 percent, as measured by a moisture meter, to its full depth before patching, unless otherwise authorized. Wood that is to be patched shall be clean of dust, grease, and loose paint.

1. Epoxy Wood Repair

   Epoxy wood repair materials shall be applied in accordance with manufacturer's written instructions. Health and safety instructions shall be followed in accordance with the manufacturer's instructions. Clean mixing equipment shall be used to avoid contamination. Mix and proportions shall be as directed by the manufacturer. Batches shall be only large enough to complete the specific job intended. Patching materials shall be completely cured before painting or reinstallation of patched pieces.

2. Epoxy Consolidant and Epoxy Paste

   Epoxy liquid wood consolidant shall be used:

   1. To penetrate and impregnate deteriorated wood sections in order to reinforce wood fibers that have become softened or absorbent.

   2. As a primer for areas that are to receive epoxy paste filler. Epoxy paste shall be used to fill areas where portions of wood are missing such as holes, cracks, gaps, gouges, and other voids.

MIXING AND THINNING

Mixing and thinning of paint shall be done in accordance with the approved manufacturer's printed instructions. The pot life of each paint as stated by the manufacturer shall not be exceeded.

WEATHER CONDITION

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

APPLICATION

Workmanship shall be first class in every respect. All work shall be done in a workmanship manner so that the finished surfaces shall be free from runs, chop, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such manner as to produce an even film of uniform thickness. Edges, corners, crevices, welds and rivets shall receive special attention to ensure that they receive an adequate thickness of paint.

All painting shall be done by thoroughly experienced workmen.

Safety regulations shall be adhered to at all times, including the wearing of respirators by persons engaged on assisting in spray painting. Adjacent areas and installation shall be protected by the use of cloths or other approved precautionary measures.

Plain enamel and varnish shall be applied carefully with good clean brushes or approved

spraying equipment, except that the initial coat on any surface shall be applied with brush. Sufficient time shall be allowed between coats to assure thorough drying and each coat shall be in proper condition before receiving the next coat.

Sanding and dusting as required shall be performed between coats in varnishing work. Finish coat shall be smooth and free from runs, sags, and other defects. Exterior paint shall not be applied during rainy days.

All paint when applied shall provide a satisfactory film and smooth, even surface. Paint shall be thoroughly stirred and kept at a uniform consistency during application. Powdered metallic pigments added at the time of use shall be mixed by adding the powder in small increments to about one-third of the base paint or vehicle, with thorough mixing to obtain a smooth paste. The remainder of the base paint shall then be thoroughly stirred in.

Different brands of emulsion paints shall not be mixed prior to application of the materials.

Where necessary to suit conditions of surface temperature, weather and method of application, the package paint may be thinned immediately prior to application in accordance with the approved manufacturer's directions, but not in excess of 125 cc of suitable thinner per liter (one pint per gallon). Before using, the paint shall be mixed to a uniform consistency and shall be stirred frequently during application.

Paints other than water-thinned paints shall be applied only to surfaces which are completely free of moisture as determined by sight or touch and only such combinations of humidity to be painted as will cause evaporation rather than condensation.

Surfaces which have been cleaned, pretreated and/or otherwise been prepared for painting shall be primed or painted with one coat of finish paint as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surfaces.

The first coat of paint on all exterior surfaces shall be applied by brush. Interior prime coats and all other subsequent coats on either exterior or interior surfaces may be applied by brush or spray. Whenever spraying is permitted all areas inaccessible to spray painting shall be coated by brushing or other suitable means. Brushes to be used for application of water-emulsions shall be soaked in water for a period of 2 hours prior to use.

All cloths and cotton waste which might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day.

Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Paint spots, or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

No smoking shall be permitted in the vicinity where painting is going on.

TOUCH-UP PAINTING

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

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

During touch-up painting, only loose, cracked, brittle or non-adherent paint shall be removed during cleaning. All exposed edges shall be feathered. Touch-up painting shall be performed in a

manner which will minimize damage to sound paint. Rust spots shall be thoroughly cleaned and edges of the existing paint shall be scraped back to sound material.

DRYING

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

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

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

4. After drying, any areas of paint damaged from any cause shall be removed, the surface again prepared and then touched-up with the same paint and to the same thickness as the undamaged areas as specified in sub-section 4.14.3.7 above.

HANDLING

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

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

INSPECTION

1. All works and materials supplied under this Specification shall be subject to inspection by the Project-In-Charge.

2. The Contractor shall correct such works or replace such materials found defective under these Specifications at his own expense.

ITEM 12D : FACILITIES AND DEVICE FOR PERSONS WITH DISABILITY

SCOPE OF WORK

The work shall consist of furnishing materials, tools, labor and incidentals necessary for the construction/installation of facilities and device for disabled persons as shown on the Drawings and in accordance with the Implementing Rules and Regulations of Batas Pambansa Bilang 344 and this Specification.

MATERIAL REQUIREMENTS

GRAPHIC SIGNS

Graphic signs like the International Symbol of Access shall be fabricated from plastic materials, white color with either dark blue background. Letters and symbols shall be laminated and raised from the background.

HANDRAILS

Handrail for ramp shall be 38mmØ tubular stainless steel buff finished. It shall be provided with a small hole as of a Braille system.

GRABRAIL

Grab rail shall be manufactured from gauge 18 tubular stainless steel 38mmØ and provided with safety grip finish.

CONCRETE MATERIALS FOR RAMPS

1. Portland cement shall conform with the requirement of "Reinforced Concrete".
2. Aggregates shall conform with the requirements of "Reinforced Concrete".
3. Temperature bars shall have diameter of 10mm conforming with the requirements of "Concrete Works".

EXECUTION

GRAPHIC SIGNS

1. Directional and information signs, indicating the location of the ramp for physically handicapped persons, shall be installed / placed at the front of the main entrance of the Building. The signed board size and dimensions shall be based on DOTr approved Standard Design, schedule 40, sign post and the text and arrow shall be in accordance with the International Symbol of Access "B". Manual (See attached drawings and tabulation).
2. Signs shall be placed at the entrance and exits of the ramps and toilets, installed at conspicuous locations. The signboards shall be based on DOTr approved Standard Design Manual (See attached drawings and tabulation).

RAMP

The ramp shall be constructed as shown on the drawings and with a nonskid surface and tactile strips.

ITEM 12E : HANDRAILS, RAILINGS AND GUARDRAILS

GENERAL

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

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete the installation of handrails, railings and guardrails as indicated on the drawings and as specified herein.

SUBMITTAL

1. Manufacturer's technical data for products and processed used in handrails, railing, guardrails system, including finishes and grout.

2. Shop Drawings showing details of fabrication and installation for each type and of handrail, railing, and guardrails required including plans, elevations, sections, profiles of rails, fittings, connections, and anchors.

3. Prepare samples of each type of metal handrails & railings stainless steel hairline finish. Where finish involves normal color and texture variations, include sample sets composed of two or more units showing limits of such variations expected in completed works.

- Include 6" long samples of each distinctly different railing member including guardrails, handrails, top rails, posts, and balusters. Include samples of fittingsand brackets if requested by Architect.

- Include sample of typical welded connection.

QUALITY ASSURANCE

Single Source Responsibility

Obtain handrails, guardrail and railing systems of each type and material from a single manufacturer.

STORAGE

Store handrails, guardrail and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

FABRICATION

General

Fabricate handrails and railing systems to design, dimensions and details shown. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets or size and spacing shown, but not less than required to comply with
requirements indicated for structural performance.

Shop Assembly

Pre-assembled items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

Welded Connections

Fabricate handrails, guardrail and railing systems of materials for interconnections of members of welding. Use welding method, which is appropriate for metal and finish, indicated and develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

Form changes in direction of railing members by bending members by metering, or as indicated on the drawing, as approved by the Architect.

Furnish inserts and other anchorage devices for connecting handrails, guardrail and railing systems to concrete or masonry work. Fabricate anchorage devices, which are capable of withstanding loading imposed by handrails, guardrails and railing systems.

Coordinate anchorage devices with supporting structure.

a. For railing, and guardrail posts set in concrete provide pre-chiseled openings and insert posts as indicated on drawings. Fill opening with non-shrink, non-metallic grout.

MATERIALS

General

Comply with standards indicated for forms and types of metals indicated or required for handrail and railing system components.

a. Stair Railings:

As indicated on plans.

b. Stair Handrail:

As indicated on plans.

c. Guardrail

As indicated on plans.

Refer to plans for the required dimension of various types of stainless steel railings and location.

Fastenings: commercial types, except where special types are shown or required.

Fastenings for all exterior work shall be non-ferrous, unless otherwise shown. Fastenings for steel and aluminum and for all other interior work, where exposed, shall match the fastened metal.

Miscellaneous materials or accessories not listed above shall be provided
as specified hereinafter the various items of work and/or indicated on the drawings, or in accordance with manufacturer's specifications.

Execution

PREPARATION

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

INSTALLATION

a. Safety precaution and procedure shall be observed in determining the sizes and in providing the required clearances by measuring the actual opening to receive the glass.

b. Secure glass with stainless steel brackets.

METAL FINISHES

Comply with NAAMM "Metal Finishes Manual" for recommendations and designations of finishes, except as otherwise indicated.

EXECUTION

PREPARATION

a. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete and masonry construction. Coordinate delivery of such items to project site.

b. Field Measurements
Take field measurements prior to fabrication.

INSTALLATION

GENERAL

a. Fit exposed connections accurately together to form tight, hairline joints.

b. Perform cutting, drilling, and fitting required for installation of handrails, guardrail and railing systems. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels.

c. Field Welding

Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent rail surfaces.

d. Prior to anchoring, adjust handrails and railing systems to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loading.

ANCHORING POSTS

a. Concrete-Anchored Posts: Provide chiseled opening on concrete base as indicated on the drawings to receive railing posts and required anchoring system, holes of all loose material, insert posts, and fill annular space between post and concrete with non-shrink, non-metallic epoxy grout, mixed and placed to comply with grout manufacturer's directions.

RAILING CONNECTIONS

a. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

ANCHORING RAILING ENDS

a. Anchor railing ends to metal surfaces with manufacturer's standard fittings using concealed fasteners, unless otherwise indicated.

b. Anchor Railing Ends to Concrete or Masonry, use drilled-in expansion shields and concealed hanger bolts, unless otherwise indicated.

PROTECTION

a. Protect finishes of railing, handrails and guardrails system from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.

b. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

ITEM 13 : PLUMBING AND SANITARY WORKS

SCOPE OF WORK

The work covered for this section shall consist of furnishing all labor, tools, equipment, materials, and incidentals necessary for the complete installation, testing, and operation of the plumbing and sanitary system within the buildings and premises in accordance with these Specifications and as shown on the drawings or as directed by the Engineer. The septic tank and its effluent and discharge pipelines shall be part of other sections of these specifications.

MATERIAL REQUIREMENTS

SUBMITTAL

1. The Contractor shall submit his work method statement with necessary shop drawings to the Engineer for approval twenty-eight (28) days before the start of the works.

   Shop drawings shall be dated and shall contain the name of the project and location of the subject item in the shop drawing which is to be installed.

   The Engineer will review and approve or return for correction all shop drawings with reasonable promptness. The Contractor shall make any corrections required and file with the Engineer three (3) corrected copies of the shop drawings.

2. The drawings shall indicate the general arrangement of all piping, however, where actual conditions necessitate re-arrangement in the opinion of the Contractor and/or the Engineer, the Contractor shall prepare and submit to the Engineer for approval, within twenty-eight (28) days before placing the order for materials, shop drawings of the proposed re-arrangement. Because of the small scale of the drawings, shop drawings to indicate all offsets, fittings and accessories shall be prepared. The Contractor shall carefully examine the drawings and shall carefully investigate actual structural and finish conditions affecting all his work.

3. The Contractor shall be responsible for the proper fitting of materials, equipment and accessories without substantial alteration and at no cost to the Employer.

4. The Contractor shall be responsible for the proper coordination of the work and shall provide all necessary clearance where necessary.

STANDARDS

Use of materials shall further be governed by other requirement imposed on other sections of these Specifications. Materials shall be subject to tests necessary to ascertain their fitness if the Engineer so requires. All works shall comply with the pertinent provisions of the Plumbing Code of the concerned city or town, the Code on Sanitation of the Philippines, and/or the National Plumbing Code of the Philippines.

MATERIALS

1. Identification of Materials

   Each length of pipe, fittings, traps, fixtures and devices used in the plumbing work shall have cast, stamped or indelibly marked on it, the approved manufacturer's trademark or name, the weight, type and class of product when so required by the standards mentioned above.

2. Alternative Materials

Use of any material not specified in this Specification may be allowed provided such alternate has been approved by the Engineer and provided further that a test, if required, shall be done by an approved agency in accordance with generally accepted standards.

3. Soil, Waste, Drain, Vent Pipes and Fittings

Soil, waste and vent pipes shall be unplasticized Polyvinyl Chloride (uPVC) pipes. Diameter shall be as indicated on the Drawings. It shall conform to ASTM D 1784 or ASTM D 2729.

Drainage pipes shall be reinforced concrete pipes (RCP), diameter shall be as indicated on the Drawings.

4. Jointing Material

The joint material for uPVC pipes shall be PVC solvent cement as recommended by the approved pipe manufacturer.

5. Water Supply Pipes

Water supply pipes shall be polypropylene random-80 (PPR-80) pipes PN 20 conforming to DIN Standards DIN 1988/DIN 8078. Jointing shall be fusion welded.

6. Cleanouts, Plugs and Tee

Cleanouts shall be of the same material as the pipe to be fitted. Cleanouts installed in connection with uPVC hubs and spigot pipes shall consist of a long sweep quarter bend of ¼ as shown on the drawings.

7. Pipe Sleeves

Pipe sleeves shall be installed and properly secured in place at all points where pipes passes through masonry or concrete. Pipe sleeves shall be uPVC pipe, Schedule 40.

8. Downspout

All downspouts shall be Polyethylene (PE) pipes and fittings for water supply. Jointing shall be fusion welding

9. Splash Block

Provide splash blocks at the outlet of downspout emptying at grade which shall be made of pre-cast concrete, with smooth finished counter sunk dishes sloped to drain away from the building. Dimensions as shown on the Drawings.

10. Roof Strainers

The Contractor shall provide fittings and install 100mm G.I. mesh wire strainers where shown or indicated on the drawings and/or where the Engineer directs. Each strainer shall fit the size of the corresponding downspout which is to be installed.

11. Shower, Floor and Urinal Drain

Shower and floor drains shall be made of stainless steel non-tilting grate, perforated or slotted. Urinal drains shall be cast iron dome type drain.

12. Pipe hangers, Inserts and Support

a. Pipe hangers shall be wrought iron, malleable iron pipe hangers spaced not over 1.5 meters apart for uPVC pipes and 3.0 meters apart for iron pipes. Chain straps, perforated bars or wire hangers will not be permitted.

Hangers shall have short turnbuckles or other approved means of adjustment. Turnbuckles may be omitted on hangers where space does not permit their use. Trapeze hangers may be used in lieu of separate hangers for pipes running parallel to each other and close together.

b. Inserts shall be of cast iron or cast steel and shall be of a type to receive a machine bolt head or nut after installation.

c. Wrought iron clamps or collars shall be used to support vertical runs of pipes.

13. Unions

Union pipe 50mmØ and smaller shall be malleable iron. Union on water piping 63mmØ and larger shall be a flanged pattern and shall be of galvanized (zinc-coated) cast iron. Gaskets for flange unions shall be of the best quality fiber plastic or leather.

14. Valves

Valves shall be cast bronze of brass body. Chrome plated finish for all fixture taps and faucets and natural finish for all others, like hose bibbs, gate valves, and which are not tapped directly to a plumbing fixture. Concrete valve boxes shall be installed where required and will be of sufficient size for operating the valve.

15. Fixtures

a. Water Closets

All water closets for toilets as shown on the drawings shall be FLUSH VALVE TYPE AND ENLONGATED FRONT, white with complete fittings and mounting accessories.

b. Lavatories

Shall be vitreous china, wall-hung lavatory with rear overflow holes, fitting ledge suitable for single faucet holes on centers complete with faucet, standard fittings, trap and lavatory brackets, and other accessories.

c. Urinals

c. 1. Urinals for all comfort buildings shall be built-in urinal trough as shown on the drawings.

c. 2. Urinals shall be vitreous china, wall-hung washout urinal, flushing rim, integral trap, 19mm top and shall be provided with water saving flush system.

c. Soap Holder

Soap holder and toilet paper holder shall be vitreous china, wall mounted. All toilet/bath rooms will be provided with soap holder, toilet paper holder and chrome plated towel racks.

d. Faucet for lavatory

Faucet for lavatory shall be in chrome-finish.

k. Grab Bar

Grab bar shall be tubular stainless steel, 25mmØ or as specified in the drawings.

e. Bidet Spray Combination

Installed in every cubicle near on the water closet, colored white or its equivalent

16. Concrete, Reinforcing Steel, Pipe and Steel Plate

Materials for wash pits, catch basins, and manholes shall conform to the requirements as follows:

a. Concrete materials shall conform with the requirements in "Concrete Works" and shall be Class C concrete with a 28-day minimum compressive strength of 21 MPa (3,000 psi).

b. Reinforcing steel shall be as shown on the drawings and shall conform with the requirements of reinforcing steel bars in "Concrete Works."

c. Pipes shall be as shown on the drawings and shall comply with the relevant item of the particular pipe.

d. Steel plates shall be as shown on the Drawings and shall comply with Section "Steel and Metal Works".

EXECUTION

All installation works shall be in conformity with the National Plumbing Code of the Philippines (NPCP).

EXCAVATION, TRENCHES AND BACKFILLING

1. Trenches for all underground pipelines shall be excavated to the required depth. The bottom of trenches shall be tamped hard and graded to secure the required fill. Bell holes shall be excavated so that pipes will rest on solid ground for their entire length.

   Rocks where encountered, shall be excavated to a depth of 150mm below the bottom of the pipe and before the pipe is laid, the space between the bottom of the pipe and the rock shall be filled with sand. Sewer and water pipes shall be laid in separate trenches.

2. After pipelines have been tested, inspected and approved by the Engineer and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris.

Materials for backfilling shall consist of acceptable excavated soil, borrow of sand, gravel or other materials approved by the Engineer and shall be free from trash, lumber or other debris. Backfilling shall be placed in horizontal layers not exceeding 150 mm in thickness and properly moistened to approximate optimum requirements. Each layer shall be compacted by hand or machine tamper or by other suitable equipment to a density that will prevent excessive settlement or shrinkage.

Backfilling shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof.

Water pipes shall have a sand cushion 150mm below and above the pipes.

INSTALLATION OF SOIL, WASTE DRAINS OR VENT PIPES

1. Horizontal Drainage Pipe and Vent Piping

Horizontal waste pipes 75mmØ and smaller shall have a minimum grade of 6.5mm per 0.30m and for 100mmØ and larger, 3.2mm per 0.30m. All main vertical soil and waste stacks shall be extended full size above the roof line as vents, except where otherwise specifically shown.

Where practicable, two (2) or more vent pipes shall be connected together and extended as one pipe through the roof. Vent pipes in roof spaces shall be run as close as possible to the underside of roof with horizontal piping pitched to stacks using fittings as required without forming traps in pipes.

Vertical pipe vents may be connected to a vent line carrying other fixtures. The connection shall be at least 1.20m above the floor on which the fixtures are located to prevent the use of vent lines as waste. Horizontal waste lines receiving the discharge from two (2) or more fixtures shall be provided with vents, unless separate venting of fixtures is noted.

2. Fittings

All changes in pipe sizes on soil waste lines shall be made with reducing fittings or recessed reducers. All changes in direction shall be made by the appropriate use of forty five (45) degree wyes. Long sweep quarter bends or elbows may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical and on the discharge from water closets.

Where it becomes necessary to use short radius fittings in any location, the approval of the Engineer shall be obtained before they are installed.

3. Joints

a. PVC Soil Pipe

All joints in uPVC soils, waste, and vent pipe shall be accomplished by the use of PVC solvent cement.

b. All joints for uPVC shall be accomplished by applying the manufacturer's recommended solvent before connection to the pipe.

4. Cleanouts

Cleanouts at the bottom of each soil stack, waste stack, and where else indicated shall be the same size at the pipe.

Cleanouts on floors shall be by uPVC plug adapter fit into the hub and fitted with uPVC screw plugged flush with the floor.

Cleanout shall be provided at every change in direction greater than 45 degrees.

5. Flashings

All pipes passing through the roof shall be provided with lead flashings. All flashings shall be built to 40 lbs. bituminous felts and shall extend up to the pipe and down-over to top of pipe at least 150mm and along the roof not less than 300mm and shall lap over flashing to make a weatherproof joint.

6. Traps

Each fixture and piece of equipment requiring connections to the drainage system, except fixtures with continuous waste, shall be equipped with a trap. Traps shall be specified to be supplied with the fixtures. Each trap shall be placed as near to the fixtures as possible.
Traps installed on threaded pipes shall be recessed drainage pattern.

7. Pipe Sleeves, Hangers, and Supports

Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete except unframed floors on earth.

Pipes shall not be permitted to pass through footings or beams unless noted on the drawings.

Pipe sleeves in floors shall extend not less than 25mm and not more than 50mm above the finished floor. After installation of the pipe, the space around the pipe shall be packed with plastic material and made watertight. Flashing shields for sleeves passing through the waterproofing membrane shall be thoroughly mopped into the membrane. The space between the pipe and sleeves shall be made watertight by inserting approved sealing and caulking materials.

INSTALLATION OF WATER PIPES, FITTINGS, AND CONNECTIONS

1. Gate Valves and Outlets

Gate valves shall be installed close to the point of connection to the existing service line outside the building. The piping shall be extended to all fixture outlets and equipment from the gate valves. Outlets where indicated shall be capped or plugged and left ready for future connections.

2. Mains, Branches, and Runouts

All runs of piping shall be installed as shown on the drawings. The piping shall be cut accurately to measurements, and installed at the building site by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken the structural portions of the buildings.

All pipes above ground shall be run parallel with the lines of the building unless otherwise shown on the drawings. Branch pipes from service lines may be taken off on top of mains, bottom of mains, or side of mains, using such cross-over fittings as may be required by structural or installation conditions.

All service pipes, valves, and fittings shall be kept at a sufficient distance from the other work to permit finished covering not less than 6.5mm from such other work and not less than 13mm between finished covering on different services. No water piping shall be buried in floors unless specifically indicated on the drawings or approved. Changes in pipe sizes shall be made with reducing fittings.

The use of long screws and bushings is prohibited.

3. Joints

Joints and connections in the plumbing system shall be gas-tight and watertight for the pressures required by the test.

After cutting and before threading all pipes shall be reamed and shall have burrs removed. All screwed joints shall be applied with an approved graphite compound or TEFLON tape to facilitate connections. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

Caulking of threaded joints or top to prevent leaks shall not be permitted.

Unions shall be provided where required for disconnection. Threaded swing bolts shall be used for branch connections to risers and mains.

4. Unions

Where required unions shall not be concealed in walls, ceilings or partitions.

5. Tests

The following tests shall be conducted by the Contractor at his expense under the supervision of the Engineer.

a. Tests for Drainage and Venting System

The entire drainage and venting system shall have necessary openings plugged to permit the entire system to be filled with water to the level of the highest vent stack above the roof. The system shall hold the water for 30 minutes with a drop not greater than 100mm.

b. Sterilization

The entire water supply piping system shall be sterilized with a solution containing not less than fifty (50) parts per million of available chlorine, either liquid chlorine or a solution of sodium hypochlorite. The sterilizing solution shall remain in the system for a period of not less than 8 hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chloride content is not more than 0.2 parts per million.

c. Pressure Test for Water Lines

1. After the pipe has been installed, the joints are completed and with joints exposed for examination, all newly installed pipe or any valve section, thereof, shall be subjected to hydrostatic pressure one and one half (1½) the designed working pressure of the system or as specified by the

Engineer.

2. The duration of each pressure test shall be at least 20 minutes unless otherwise specified by the Engineer.

3. Each section of the pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this, tap shall be made if necessary, at the highest point of the pipe under test and after completion of the test, the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fittings, valves, joint and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expense. The test shall then be repeated until satisfactory results are obtained.

d. Leakage Test for Water Lines

1. Leakage test shall be conducted after satisfactory completion of the pressure test and shall consist of an examination of all exposed joints for leakage as well as an overall leakage test of the completed pipeline.

2. The pressure to be maintained during the test shall be the designed working pressure of the system.

3. Leakage test shall be made only after a minimum of 24 hours after the pipe to be tested has been filled with water.

4. The duration of each leakage test shall be two hours unless otherwise specified by the Engineer.

5. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of a positive displacement type pump and reservoir connected to the pipe in a manner satisfactory to the Engineer.

6. Before starting the leakage test, all air shall be expelled from the pipe. All exposed pipes, fittings, valves and joints shall be examined for leakage during the test.

7. Allowable leakage rate per 100 joints per inch of Pipe Diameter at Pressure Stipulated.

PRESSURE		LEAKAGE RATE	
psi	kg/cm^2	liters/hr.	liters/2 hrs.
50	3.50	1.45	2.90
75	5.30	1.75	3.50
100	7.00	2.05	4.10
125	8.80	2.30	4.60
150	10.50	2.50	5.00
200	14.00	2.90	5.80

e. Defective Work

1. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Engineer.

2. All repairs to piping shall be made with new materials at the expense of the Contractor.

3. No caulking of screwed joints or holes will be accepted.

ASSEMBLY, INSTALLATION AND CONNECTION OF FIXTURES

Fixtures shall be supported and fastened in a satisfactory manner. Where secured to concrete or masonry work walls, fixtures and equipment shall be fastened with brass bolts or machine screws in lead-sleeve type anchorage units or with brass expansion bolts. Expansion bolts shall enter 7.5 cm into solid concrete or masonry works and shall be fitted with loose tubing or sleeves of proper length to bring expansion sleeves into the solid concrete masonry walls.

Where wood screws are used, screws shall go into solid pieces set between studs. Where through-bolts are used, bolts shall be provided with plates or washers at back set, so that they will be concealed by plaster. Bolts and nuts shall be hexagonal and exposed nuts, cap nuts, and screw heads shall be provided with chromium plated brass washers.

PROTECTION OF FIXTURES

Pipe openings shall be closed with caps or plugs during installation. Fixtures shall be tightly covered and protected against dirt, water and chemical injury. At the completion of all works, all fixtures shall be thoroughly cleaned and delivered in a condition satisfactory to the Engineer.

FIXTURES AND FASTENING

All fixtures shall be supported and fastened in a satisfactory manner as follows:

1. Where secured to concrete or concrete hollow block walls, they shall be fastened with one quarter inch brass bolts with twenty threads to the inch and of sufficient length to extend at least 7.5 cm into solid concrete or hollow block work, fitted with loose tubing or sleeve insert and shall be securely anchored and installed flush with the finished wall and shall be completely concealed when the fixtures are installed.

2. Where through-bolts are used, they shall be provided with plates or washers back set so that heads, nuts and washers will be concealed by plaster. Bolts and nuts shall be hexagonal. Exposed bolts, nuts, capnuts and screw heads shall be provided with chromium plated brass washers.

GUARANTEE

Upon completion and before final acceptance of the equipment installation, the Contractor shall furnish the Engineer a written guarantee stating that all equipment installed under this Section free from defects. The guarantee shall be for a period of one (1) year from the date of final acceptance of the work. Any part of the equipment that becomes defective during the term of the guarantee shall be replaced, renewed and/or made good by the Contractor, at his own expense and in a manner satisfactory to the Engineer.

Guarantees made by the approved manufacturers or suppliers beyond one year, shall be transferred to PPA without any expense on his part.

CLEANING UP

Upon completion of the work, all parts of the installation shall be thoroughly cleaned of grease, metal cuttings and sludge which may have accumulated during the testing operation.

PLUMBING, FIXTURES AND TOILET ACCESSORIES INSTALLATION

All installation works shall be as shown on the drawings and shall conform to the applicable standards set forth by the Philippine National Plumbing Code. All fixtures shall be fastened and/or supported in accordance with the given requirements.

ITEM 14 : ELECTRICAL WORKS

GENERAL DESCRIPTION

The work to be done under this Item of Specifications consists of fabrication, furnishing, delivery and installation, complete with all details of electrical work, in the subject area and all work materials related to the proper completion of the installation, except for those parts of the work that are expressly stated to be performed by others. All works shall be in accordance with the governing Codes and Regulations and the Specifications, unless the same are inconsistent with such codes, etc., as may later govern. The requirements regarding the materials and equipment required for the complete installation of the work specified herein and indicated on the drawings. The Specifications are intended to provide a broad outline of the equipment required, but are not intended to include all design details and construction specifications.

WORK INCLUDED

The work to be done under this Item shall include the furnishing of all tools, labor, supervision, equipment, fixtures and all necessary materials, each complete and in proper working condition unless one or other is specifically excluded or stated otherwise in this specifications but not limited to the following items of works.

a. All works and material for a complete lighting and power systems including cables and conduits, circuit breakers, panel board and connection to all lighting fixtures and power outlets, air condition, switches, supports and accessories.

b. All steel support for conduits, wires, panel board, boxes, lighting fixtures, etc. as indicated or as required to the completion of the installation.

c. Termination of all electrical system and the complete grounding system.

d. A complete testing and commissioning of all electrical and auxiliary systems. The Contractor shall provide all necessary testing instruments.

e. All items incidentals to and or required for the proper completion such as painting of boxes, conduits and the likes.

f. Coordination with other companies/offices including handling of all material related to material testing and application of electrical permits in the expense of the Contractor.

g. Preparation of necessary shop drawings required for the proper execution of the works subject to the approval of the Engineer.

SUBMITTALS

Obtain approval before procurement, fabrication or delivery of items to the job site. Partial submittals will not be entertained and will be returned without review. Submittals shall include the manufacturer's name, trade name, place of manufacturer, catalogue model of number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference and technical society publication references, and other information necessary to establish contract compliance of each item to be furnished.

a. Shop Drawings

In addition to the requirements of the contract clauses, shop drawings shall meet the following requirements:

1. Drawings shall be a minimum of 210 mm x 297 mm in size or in A3 size, except as specified otherwise.

2. Drawings shall include wiring diagrams and installation details indicating the proposed location layout and arrangement, control panels, accessories, and other items that must be shown to assure a coordinated installation.

3. Wiring diagrams shall identify circuit termination and the internal wiring for each item of equipment and its interconnection.

4. Drawings shall indicate adequate clearances for operation, maintenance and replacement of equipment devices. If the layout is disapproved, revise the layout and resubmit.

b. Manufacturer's Data

Submittals for each manufactured item shall include manufacturer's descriptive literature, equipment drawings, diagrams, performance and characteristic curves and catalog cuts. Each submittal shall have the manufacturer's name, trade name, catalogue model or number, name plate data, size, layout dimensions, capacity, specification references and all other information necessary to establish contract compliance.

c. Standard Compliance

When material or equipment must conform to the standards of organizations such as American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL), proof of such conformance shall be submitted to the Engineer for approval.

If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable test and is approved by the Engineer. The certificate shall state that the item has been tested in accordance with specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval.

The certificate shall identify the manufacturer, the product and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

DELIVERY AND STORAGE

Equipment and materials shall be properly stored and adequately protected and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturer's recommendations and as approved by the Engineer. Electrical conduit shall be stored to provide protection from the weather and accidental damage. Cables shall be sealed, stored and handled carefully to avoid damage to the outer

covering or insulation and damage from moisture and weather. Damaged or defective items shall be replaced with new items at no cost to the Owner.

CATALOGUED PRODUCTS

Materials and equipment shall be catalogued products of manufacturers regularly engaged in production of such materials or equipment and shall be at manufacturer's latest standard design that complies with the specification requirements. When two or more units of the same type, class and size of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer. Each major component of equipment shall have the manufacturer's name, address and the model of the serial number on a nameplate securely affixed in a conspicuous places, the name plate of the distributing agent will not be acceptable.

MANUFACTURER'S RECOMMENDATIONS

Where installation procedures or any parts thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendation prior to installation. Installation of the items shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or materials.

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of the Contractor and to the satisfaction of the Owner and Engineers, who will jointly interpret the meaning of the drawings and specifications and shall have the authority to reject any work materials which, in their judgment, are not in full accordance therewith

The Contractor shall have on file, for ready access and reference, a set of drawings indicating all work as actually installed incorporating in the same all changes and additions. Upon the termination of the Contract, he shall prepare a set of tracings indicating thereon the Electrical Work as actually and finally installed. These drawings shall be turned over to the Engineers.

The Contractor shall be responsible for keeping stocks of material and equipment stored at the premise in a neat and orderly manner. The exposed surfaces of wirings, conduit system or equipment which have become covered with dirt, plaster or other material during handling and construction shall be thoroughly cleaned by Contractor before such surfaces are prepared for final finish, painting or concealment within the building structure.

The Contractor shall employ skilled craftsmen experienced in installation of the types of electrical materials and equipment specified. Use specialized installation tools and equipment as applicable. Produce acceptance installation free of defects.

MATERIALS / TESTS

All materials to be installed shall be brand new and shall conform to specifications except as otherwise noted on the drawings. All materials where not specified shall be of the best of their respective kind. Samples of said material including its manufacturer's data shall be submitted for approval. Necessary tests on the installations shall be made by the Contractor in the presence of the Engineer. These tests shall include but not limited to ground test, performance test, phase sequence test, etc. Records of approved tests result shall be relayed to the Engineer in writing. This Contractor shall within ten (10) days after the award of the contract, submit a list of materials he proposes to use. All materials installed without prior approval shall be at the risk of the Contractor.

COORDINATION / GUARANTEES / SUSPENSION OR DELAY

The Contractor shall be familiar with the specifications of the other trades and coordinate with them thoroughly so that he can arrange his work and dispose his materials without interfering the work of other Contractors. The Contractor shall guarantee that the electrical systems shall be free from all defects of workmanship and of materials, and that it will remain so for a period of one year from the date of acceptance by the Engineer. Any remedy to correct defects deemed to be caused by such shall be made at the expense of the Contractor.

The Contractor shall not suspend or delay the work without justifiable cause. Subsequent delays shall be deemed as a sufficient cause for penalties or termination of contract in which the Engineer shall have the right to take-over the work and all materials on the site and make arrangements necessary to complete the work. It shall be the sole responsibility of the Contractor to ensure that the Electrical sub-contractor conducts coordination of his activities to other trades.

SLEEVES / INSERTS / CUTTING / PATCHING

The Contractor shall provide all openings, sleeves, also inserts in walls, floors, and beams as required for his work. All unused openings shall be grouted in. The Contractor shall do all patching requirements necessary and these shall be done so as to exactly match the surrounding area without the evidence of alteration or patching.

TEMPORARY LIGHT AND POWER

The Contractor shall make all arrangements and pay for the provisions of the necessary electrical power of the type and capacity required for the performance of the work of all trades engaged in the construction of the building.

CODES, INSPECTION, PERMITS AND FEES

The work under this contract is to be installed according to the requirements of the latest edition of the Philippine Electrical Code, the rules and regulations of the local authorities of Zamboanga City Electric Cooperative.

All necessary permits and electrical fees required for this work shall be obtained by and at the expense of the Contractor. The contractor shall furnish the Engineers and the Owner final Certificate Final Electrical Inspection (CFEI) and approval from the proper government authorities after completion of the work. The Contractor shall prepare all as-built and all forms and documents required by the approving authorities.

Power service application including drawings for the work shall be obtained by and at the expense of the Contractor. The Contractor shall comply with all requirements of the utility company regarding service applications.

ELECTRICAL CHARACTERISTICS

The electrical characteristics for this project shall be 230V, three phase (3Ø) wire, and 60Hz or as per system requirements as shown in the plan.

CLEANING UP

The Contractor shall remove all dirt, debris, and rubbish and waste materials caused by him in the process of his work. He shall also remove all tools, temporary power installation, scaffolding and surplus materials after completion and acceptance of work.

MATERIAL REQUIREMENTS

NAMEPLATES

Provide laminated plastic nameplates for each panel board, switch, and device. Each nameplate inscription shall identify the function and when applicable, the position. Nameplate shall be melamine plastic, 3.2mm thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the black core. Minimum size of nameplates shall be 25mm x 38mm. Lettering shall be a minimum of 6mm, high normal block style.

EXECUTION

NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

INTERIOR WIRING SYSTEMS

SUBMITTALS

a. Shop Drawings: Submit for the following:

1. Location of panel boards and circuit breaker
2. Conduit support / hanger's installation drawing

b. Manufacturer's data: Submit for the following:

1. Circuit Breakers
2. Switches
3. Conduit and fittings (each type)
4. Device Plates
5. Insulated conductors
6. Utility / junction boxes
7. 3 Prong duplex Convenience Outlet with grounding
8. Floor Duplex Convenience Outlet
9. Weatherproof Convenience Outlet

PRODUCTS

CONDUIT AND FITTINGS

a. Conduit shall be polyvinyl-chloride conduit (PVC) where specified, shall be heavy wall, high impact resistant Schedule 40, with factory made bends, couplings and fittings. PVC cement for joints shall be of the same brand as for the PVC pipe.

b. No conduits shall be used in any system smaller than 20mm (1/2") diameter electric trade size, nor shall have more than four (4) 90 degree bends in any one run and where necessary, pull boxes shall be provided as directed.

c. No wire shall be pulled into any conduit until the conduit system is completed in all details, in the case of concealed work until all rough plastering masonry has been completed, and in the case of exposed work until the conduit work has been completed in every detail.

d. The ends of all conduits shall have tightly plugged to exclude plaster, dust and moisture while the construction of the building is in progress. All conduits shall be reamed to remove all burrs.

OUTLETS, BOXES AND FITTINGS

a. All outlets whatever kind, for all system, there shall be provided a suitable fitting, which shall be either a box or other device especially designed to receive the type of fitting to be mounted thereon.

b. The Contractor shall consult with the Engineer as to the nature of the various fittings to be used before installing his outlet fittings, and shall conform strictly in the use of fittings, to the nature of the appliance to be mounted on them, so that the work, when the completed will be a finished design.

c. All outlets on concealed conduit work provide galvanized pressed steel outlet boxes on standard make. These boxes shall be in all cases standard and where such boxes are not available on the market, special boxes shall be secured by the Contractor at his owned expense. In general outlet boxes shall be at least 100mm diameter, 53mm deep and No. 16 minimum gauge.

JUNCTION AND PULL BOXES

a. Junction and pull boxes, of code gauge steel, galvanized shall be provided as indicated or as required for facilitating the pulling of wires and cables. Pull boxes as finished places shall be located and installed with the permission and to the satisfaction of the Engineer.

b. All junction and pull boxes on exposed conduit work shall be provided with hubs for threaded pipe entry and covers provided with neoprene gaskets.

WIRES AND CABLES

a. All wires shall be copper, soft-drawn and annealed, shall be 100% conductivity, shall be smooth and true of a cylindrical form and shall be within the actual size called for.

b. All wires and cables shall comply with the requirements of the Underwriters Laboratories, the ASTM and ICEA as they apply to the particular usage.

c. Wires and cables for power and lighting system shall be plastic insulated for 600 volts working pressure type "THHN/THWN-2" unless otherwise noted on plans or specified.

d. Tag Marking

In general, branch circuit conductors and cables shall be properly marked by means of a printed tag taped on each wire indicating origin/load and or panel(s) where load is connected.

e. Splices and Termination Components

If applicable, for wire connectors and for insulating tape. Connectors for 5.5 mm^2 and smaller diameter wires shall be insulated, pressure-type in accordance with (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

DEVICE PLATES

Provide, one piece device plates for outlets and fittings to suit the devices installed. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel or cast metal having round or beveled edges. Plates on finished walls shall be satin finish stainless steel or brushed –finished aluminum, minimum 0.03 inch thick. Screws shall be machine type with countersunk heads in a color to match the finish of the plate. The use of sectional type device plates will not be permitted. Plates installed in wet locations shall be sealed in gasket. Device plates for telephone and intercommunication outlets shall have a 3/8 inch bushed opening in center.

WALL SWITCHES AND PLATES

Wall switches in general shall be rated 10 amperes at 230 volts or with ampere and voltage ratings as required. Switches shall be flush mounting and of the rocker type, spring operated. The type of switches shall be tumbler operation and the color, plating and appearance of wall plates shall be as selected by the Engineer. Appropriate samples shall be submitted prior to purchase of wall switches and face plates.

WALL RECEPTACLE AND PLATES

a. Receptacle outlets shall be 15 amperes, 230 volts, 2 pole, 3 wire parallel slot, grounding type. Parallel slot outlet rated 15 amps. 125 v grounded type shall be acceptable for use with 230v system. Locking type and other special purpose outlets shall be as indicated in the plans.

b. Provide weather proof receptacle plate cover for each convenience receptacle outlet indicated as weatherproof.

PANELS AND CABINETS

a. Standard panels and cabinets, as much as possible shall be used and assembled on job. All panels shall be dead front construction, furnished with trims for flush or surface mounting. Cabinets shall be of code gauge steel with gutters at least 100mm wide and if necessary, it has to be made wider. The trim for all panels shall be finished in industrial grey enamel over a coat of rust inhibitor.

b. Lighting panels shall be equipped with branch circuit breakers as required and mains as noted on Plans or Panel Schedule.

c. Panel board main bus work shall be ampacity rated to equal or exceed overcurrent protective device immediately ahead of it. All buss work shall be properly secured to withstand available short circuit forces at the location.

d. Distribution panels shall be of the same type as lighting panels except equipped with one pole, two poles and three poles air circuit breakers of sizes, voltages ratings and interrupting capacity as called for on plans.

INDIVIDUAL BREAKERS

a. Provide individual circuit breakers where indicated on plans. Voltage ratings shall be suitable in each case of service application. Enclosures shall be General Purpose, NEMA type I, except where specifically noted on plans or assembled on panel cabinets.

All protective devices shall meet NEMA and U.L specifications. Short circuit rating shall be as indicated on the plan.

b. Circuit breakers shall consist of a quick-make, quick -break type entirely trip-free operating mechanism with contacts, arc-interrupter, and thermal magnetic trip unit for each pole, all enclosed in a molded-phenolic case. The thermal magnetic trip unit shall provide time-delayed overload protection, and in case of overload or short circuit current in any one pole the circuit trips instantaneously. Circuit breaker shall be trip indicating, when tripped position of breaker handle midway between "ON" and "OFF" positions.

c. All circuit breakers shall be bolt-on type unless noted otherwise.

d. All circuit breakers rated above 225 amps shall have interchangeable trip units. Unless otherwise specified, minimum interrupting rating for 230 volts circuit breakers shall be 10,000 amperes.

PANELBOARD BUSES

All bus panels shall be copper support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or lapping. Provide separate ground bus for connecting grounding conductors; bond to steel cabinet.

EXECUTION

INSTALLATION

a. Wiring Methods

Provide insulated conductors installed in conduits, except where specifically indicated or specified otherwise or required by PEC and NFPA to be installed otherwise. Provide insulated, equipment grounding conductor in feeder and branch circuits, including lighting circuits. Provide insulated, conductor for grounding conductors installed in conduits or raceways.

b. Conduit Installation

Unless indicated otherwise, conceal conduit within finished walls, ceilings, and floors. Keep conduit a minimum of 150mm away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in crawl space under slab as if exposed.

1. Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.

2. Conduit Support:

Conduit shall be supported by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded studs, or spring tension clamps on steelwork. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceilings shall be vibration resistant and shock resistant. Holes cut to depth of more than 40mm in reinforced concrete beams or to depth of more than 20mm in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations.

3. Changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

4. The Contractor shall install pull wires in empty conduits in which wire is to be installed by others. The pull wire shall be 2.0mm^2 zinc- coated steel or plastic having not less than 91 kgs tensile strength. Leave not less than 300mm of slack at each end of the pull wire.

5. Conduit Installed in Concrete Floor Slabs

   Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduit horizontally for at least three diameters, except in cabinet locations. Curved portions of bends shall not be visible above the finish slab. Increase slab thickness as necessary to provide minimum 25 mm cover over conduits. Where embedded conduits cross expansion joints, provide suitable watertight expansion fittings and bonding jumpers. Conduit larger than 25mm trade size shall be parallel with or at right angles to main reinforcement; when at right angles to the reinforcements, the conduit shall be closed to one of the supports of the slab.

6. Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by PEC and NFPA 70, where insulated bushings are used, and where bushing cannot be brought into firm contact with the box; otherwise, use minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by PEC and NFPA 70.

7. Flexible Connection:

   Provide flexible connection of short length, 1.8 meters maximum for recessed and semi-recessed lighting fixtures.

c. Boxes, Outlets, and Supports

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when installed exposed up to 2.1meters above interior floors and walkways, or when installed in hazardous areas. Boxes in other locations shall be sheet steel, except that

aluminum boxes may be used with aluminum conduit. Each box shall have the volume required by PEC and NFPA 70 for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall not be less than 100 mm2 or octagonal, except that smaller boxes may be installed as required for fixture configurations as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature. Fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports, or make adequate provisions for distributing load over ceiling support members. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved type fastener maximum 600mm from the box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

1. Boxes for use with raceway systems shall be minimum 40mm deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 100mm2, except that 100 by 50mm boxes may be used where only one raceway enters outlet.

2. Pull Boxes:

   Pull boxes shall be constructed of not less than the minimum size required by PEC and NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through common pull box, the Contractor shall tag the feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

d. Mounting Heights

The Contractor shall mount panelboards, and circuit breakers, and main disconnecting panel so the height of the operating handle at its highest position is maximum 1.8 meters above floor. Mount lighting switches 1.4 meters above finished floor, receptacles 300mm above finished floor and other devices. The Contractor shall measure mounting heights of wiring devices and outlets to center of device or outlet.

e. Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made.

f. Splices

Make splices in accessible locations. Make splices in conductors 5.5 mm^2 and smaller diameter with insulated, pressure-type connector. Make splices in conductors 8.0 mm^2 and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

g. Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Plates shall be installed with alignment tolerance of 3mm. Use of sectional-type device plates are not permitted. Plates installed in wet areas must be gasketed.

h. Electrical Penetrations

Openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings shall be sealed to maintain fire resistive integrity as tested per ASTM E 814.

i. Grounding and Bonding

In accordance with PEC and NFPA 70. Ground all exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and non-metallic raceways, and conductor of wiring systems. Make ground connection to driven ground rods on exterior of building. Where ground fault protection is employed, ensure that connection of ground does not interfere with correct operation of fault protection.

1. Grounding Conductor

Provide insulated, equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, conductor for grounding conductors installed in conduit or raceways.

2. Resistance

Maximum resistance-to-ground of grounding system shall not exceed 10 ohms under normally dry conditions. Where the resistance obtained exceeds 10 ohms, contact the Engineer for further instructions.

FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give the Engineer five (5) working days notice prior to each test.

a. Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

b. Test on 600 volt wiring

Test 600 volt wiring to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 14mm^2 (6 AWG) and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 25,000 ohms.

c. Grounding System Test

The Grounding system shall be tested to ensure continuity and resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance

measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to the Engineer and indicate location of rods as well as resistance and soil conditions at the time measurements were made.

INTERIOR LIGHTING

SUBMITTALS

Data, shop drawings showing mounting heights, and reports shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting system specified.

a. Manufacturer's Data

1. Recessed Mounted Type (1200 x 600 mm), LED Panel Light
2. Recessed Mounted Type (600 x 600 mm), LED Panel Light
3. Vertical Downlight recess mounted type with glass cover, 230V, 11 watt LED bulb, warm white/ daylight / cool white.

PRODUCT

LED PANEL LIGHT

a. LED Panel Light

LED Panel Light is the general lighting alternative for those who want to incorporate cost-efficiency, brighter lighting, and elegant design. Available in different sizes, shapes and color temperatures the LED panel is your "go to" lighting solution for that classy feel at a low price. Built within a sturdy case the array of LED diodes emit light in unison as they are concentrated; And bounced through layers of material which enhance and diffuse the light in uniformity. The housing not only ensures protection from adverse environmental conditions; but also serves as a heat sink to minimize thermal output keeping the area cool.

LED panel lights have a long lifespan (42 times longer than incandescent bulbs). And, contain no harmful gasses or toxins like its fluorescent counterparts. Whether you want to give that savvy look to your office; ensure excellent lighting for your school or even light up your home (kitchen, common rooms / living space and/or study) and achieve that luxurious feel your friends will surely envy, our LED panel lights are the perfect cost-effective, eco-friendly and energy efficient solution for you. Above all, LED Panel lights are the great application for hotels, offices, balcony, and many more.

LED Panel Light have a wide range of applications from lighting households, schools, and offices, illuminating covered parking lots, warehouses, cold storage rooms and practically anything that can fit the standard fluorescent lamp ballast/fixtures.

b. Vertical downlight recess mounted type

This fixture with glass cover looks very simple but provides protection to led bulbs. Metal sheet housing gives durability, while mirrored reflection brings additional lighting effect. Vertical downlight equipped with a glass cover that provides a smart overhead illumination solution, very modern and contemporary for decoration.

RECESS AND FLUSH MOUNTED FIXTURES

The Contractor shall install the type of materials as shown on the plan.

EXECUTION

INSTALLATION

The electrical installation of interior lighting shall conform to the requirements of the approved plan.

GROUNDING

Ground non-current-carrying parts of equipment as specified in "Interior Wiring Systems." Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

FIELD TESTS

The Contractor will provide electric power and apparatus / instruments required and carry out the field tests.

a. Operating Test

Upon completion of the installation, conduct an operating test to show that the equipment operate in accordance with the requirements of this section.

b Insulation Resistance Test

Perform as specified in "Interior Wiring Systems", both before and after connection of fixtures and equipment.

c. Ground Resistance Tests
Perform as specified in "Interior Wiring System."

ITEM 15 : PORT LIGHTING SYSTEM

SCOPE OF WORK

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

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

GENERAL REQUIREMENTS

a) All works shall be done in accordance with the requirements of the publications and agencies having jurisdiction, as well as the requirements of the approved standards.

1.	National Fire Protection Association	-	(NFPA)
2.	National Electrical Manufacturer Association	-	(NEMA)
3.	Underwriter Laboratories, Inc.	-	(UL)
4.	Philippine Electrical Code Philippine National Standard	- -	(PEC) (PNS)
5.	Federation Specification: Circuit Breaker, Molded Case, Branch Circuit and Service		
6.	American National Standard Institute	-	(ANSI)
7.	American Society for Testing and Materials	-	(ASTM)
8.	Illuminating Engineering Society	-	(IES)
9.	Light Emitting Diode	-	(LED)

b) The electrical power of the Port lighting system will be connected to the Main Disconnected Panel. While the supply voltage should be 230 volts, single phase (1Ø), and 60 hertz.

c) The Contractor shall employ a licensed Registered Electrical Engineer or Master electrician to perform or to supervise and to conduct the continuous inspection of all electrical work.

d) The Contractor shall first obtain approval from the Authority before procurement, fabrication or delivery of electrical materials to the site. Partial submittals will not be acceptable and will be returned without review. Submittals shall include the Manufacturer's Name, Trade Name, Place of Manufacture, Catalog Model or Number, Nameplate Data, Size, Layout Dimensions, Capacity, Project Specification and Paragraph Reference, Technical Society Publication References and other information necessary to establish contract compliance of each item to be furnished.

e) All excavations fill and backfill and concrete works involved herein, shall be carried to the required elevations and shall conform to the provisions of specification under Earthwork and Concrete Construction of this tender document.

f) The materials and equipment to be furnished shall be standard products of reputable manufacturer engaged in the reproduction of such materials and equipment.

g) The Contractor shall furnish and install electrical materials as shown in the drawings. A licensed Electrical Engineer or Master Electrician is required to implement the installation of the electrical system.

h) Electrical installation shall conform to the requirements of Philippine Electrical Code (PEC) and the other approved standards.

i) The contractor shall install all electrical works with the supervision of the qualified Registered Electrical Engineer (REE) or Master Electrician. All electrical installation applications regardless of capacity and voltage whether new, addition or revision shall be accompanied by electrical plans signed and sealed by a duly licensed Professional Electrical Engineer (PEE).

MATERIAL REQUIREMENTS

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

PRODUCTS

WIRES AND CABLES

The conductor material to be furnished and installed shall be copper wire Heat-Resistant Thermoplastic (THHN/THWN-2). All conductors shall be rated 600 volts insulation and shall be standard for all sizes.

CONDUIT AND FITTINGS

Underground PVC conduit shall be polyvinyl chloride with concrete covered. It shall be manufactured to schedule 40 outside diameter. All fittings and bends shall be solvent bonded using manufacturers recommended product.

INTEGRATED SOLAR STREET LIGHTS

Specifications:

Solar Module Type	:	120 watt Monocrystalline or equivalent
Service Life	:	25 years
Battery Type Life PO4	:	Life PO4 (Lithium Phosphate) 12.8V, 57AH
Service Life	:	6 years
Charge Time	:	6-8 hrs. (Depending on irradiation levels)
Discharge Time	:	15 hrs Full Power / 30 hrs Half Power
LED Lamp	:	12V, 70 watt
Lumens	:	10000 - 10800 lm
Viewing Angle	:	120 degrees
Service Life	:	50,000hrs (11 yrs. @ 12hrs per night)
Working Temperature	:	- 30 C / 70 C
Color	:	6500K – 7000K
Mounting Height	:	7 - 10 meter
Distance Range	:	25 -35 meter

Warranty	:	3 years
Certificates	:	CE / ROHS / IP65
Product Weight	:	27 kg

PRODUCTS (APPLICATION):

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

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

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

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

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

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

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

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

CONCRETE DUCT BANK and HANDHOLE

The contractor shall construct concrete duct bank and handhole as shown in the approved plans.

SWITCHES:

Weatherproof die cast aluminum toggle switch (NEMA-3R) attached to Single Angle Bar Floodlight Steel Tapered Lamp Post.

SINGLE ANGLE BAR FLOODLIGHT STEEL TAPERED LAMP POST
SINGLE ARM STEEL TAPERED LAMP POST

Lamp Post shall be 10.0 m ht. Single Angle Bar Floodlight steel tapered lamp post, furnished installed and tested as shown on the approved plans. The post/s shall be dimensioned for a wind velocity of 185 km/hr. It shall be locally fabricated or manufactured. The post shall be Hot – Dipped Galvanized, prime-coated with red lead and shall be painted at site with the final coating preferably aluminum paint to be approved by the Engineer.

EXECUTION

INSTALLATION

Single Angle Bar Floodlight Steel Tapered Lamp Post and Single Arm Steel Tapered Lamp Post shall be installed as shown on the approved plans.

Pole Setting: Depth as shown on the approved plans.

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

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

WORKMANSHIP

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

TESTING OPERATIONS

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

GUARANTEE

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

ITEM 16 : SAFETY SIGNAGES AND BARRICADES

DESCRIPTION

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

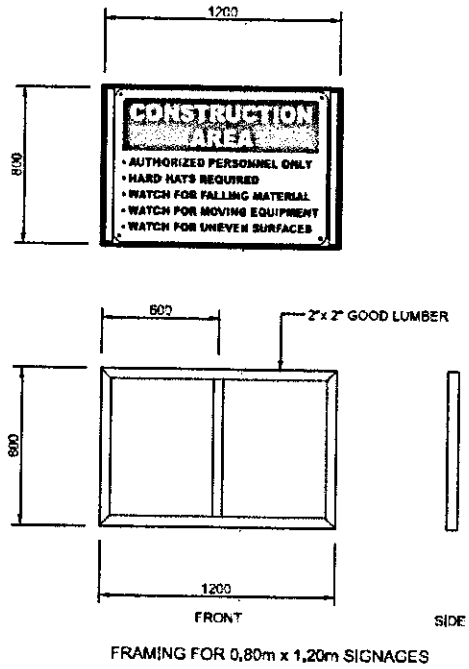
SPECIFICATION

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

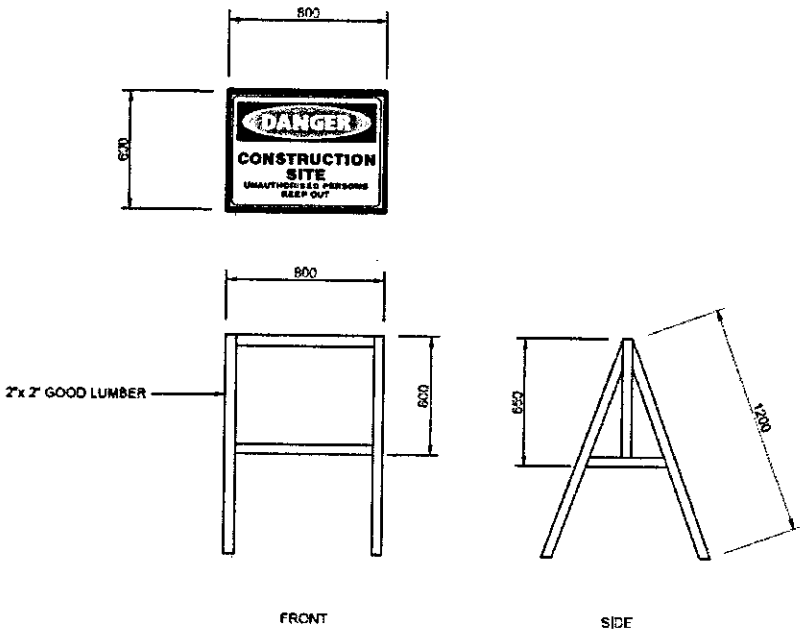
The sizes of the standard signages shall be 2-2/3ft x 4ft (800mm X 1,200mm) for fixed type and 2ft x 2–2/3ft (600mm x 800mm) for mobile type. For barricade standard 2ft x 2–2/3ft (600mm x 800mm) shall be provided.

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

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



FRAMING FOR 0.80m x 1.20m SIGNAGES



FRAMING FOR 0.60m x 0.80m SIGNAGES AND BARRICADES

STANDARD PLAN FOR SIGNAGES AND BARRICADES