Republic of the Philippines

**Tourism Infrastructure & Enterprise Zone Authority**

# PROJECT SPECIFICATIONS

## I. GENERAL CONDITIONS

The work to be undertaken shall include the furnishing of labor, materials, tools and equipment for the following:

Project : **TOURISM FACILITIES AT LUBAO BAMBOO HUB AND ECO-PARK**
Location : **Sta Catalina, Lubao, Pampanga**

A. Scope of Work

The construction work must be executed strictly in accordance with the plans and specifications. The following principal items of work shall include but not limited to the following:

1. General Requirement
2. Floating Restaurant
3. Boardwalk
4. Hanging Bridge
5. Additional Path Walk
6. Electrical Works
7. Other items or works as maybe required by plans and related contract documents necessary to satisfactorily complete the project

The construction procedures shall be done in accordance with the DPWH Standard Specifications, and in full compliance with the approved plans and specifications.

All items not specifically mentioned in the specifications or noted on the plans but which are obviously necessary for the completion of the work shall be included.

## II. SITE WORKS

A. Scope of Work

Furnish all materials and equipment and perform labor required for the disposal of surplus excavated materials, rubbish and debris resulting from site clearing, stripping, site grading and trenching, demolition, removal and foundation excavation.

B. Clearing the Site

The building site shall be leveled according to the plans and cleared of rubbish, roots and other perishable and objectionable matters to a suitable sub-grade.

Surplus materials not required or suitable for fill or backfill and all debris and other materials resulting from demolition work shall be immediately removed from the site premises by the contractor and be disposed of in areas provided by the contractor. Debris and rubbish shall be removed and transported in a manner that will prevent spillage on streets or adjacent areas. In cases of spillage, clean up the streets and adjacent areas that were affected.

C. Staking out the Building Lines

The building lines shall be staked out and all the lines and grades shown in the drawing established before any excavation is started. Batter boards and reference marks shall be erected at place where they will not be disturbed during the excavation. Construct two permanent benchmarks of previously known elevations near the site of construction.

## III. EARTHWORKS

A. Scope of Work

1. This item shall consist of the necessary excavation for foundation of building structures, and other structures not otherwise provided for in the Specifications. Except as otherwise provided for pipe culverts, the backfilling of completed structures and the disposal of all excavated surplus materials, shall be in accordance with these Specifications and in reasonably close conformity with the Plans or as established by the Engineer.

B. Excavation

1. Structural Excavation

a. Structural excavation shall be to the grade, whichever, is lower. The indicated depth is the minimum requirement for excavation. In case suitable bearing materials are encountered at elevations other than those specified or shown on the drawings, the Engineer at his discretions may direct in writing the excavations above or below those indicated on the drawings.

b. No extra excavations shall be done without the written approval of the Engineer. In no case shall footings rest on fill.

c. All structural excavations shall be inspected and approved by the Engineer before pouring any concrete, laying underground services or placing backfill materials.

d. All structural excavations shall extend to a sufficient distance from walls and footings to allow the proper erection and dismantling of forms, installation of service lines and for inspection.

e. Control the grading in the vicinity of all excavated areas to prevent surfaces drainage running into excavations. Remove accumulated water in excavated area by pumping or by other approved methods.

2. Excavation for drainage structures

Excavation for drainage structure shall be made accurately to the lines, grades and elevations shown or as directed. Dimension and elevation of footings and foundation excavations shown are only approximate and may be changed if necessary to assure adequate foundation support. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length width of structural footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm surface, either level, stepped or serrated, as shown, or as direct loose disintegrated rock and thin strata shall be removed. When concrete is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade shall not be made until just before the concrete is to be placed.

3. Shoring

   a. Excavation shall be shored and braced by members of suitable sizes where necessary to prevent danger to persons, injury or erosions.

   b. Shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving.

C. Backfilling

   a. All fillings shall be placed on layers not exceeding four (4) inches in thickens each layer being thoroughly wetted and compacted by approved machine or hand tampered to a density of optimum moisture as determined by the modified ASSHTO T 180, Method D. All compaction tests shall be at the expense of the Contractor.

   b. No footing shall rest on fill and the soil bearing capacity shall not be less than 3000 psf.

   c. After forms have been removed from the footings and piers, the materials from excavation shall be used for backfilling ground. All trash wood chips and other debris shall be removed from areas to be backfilled. The filling shall be made in layers not exceeding 4" thick, each layer thoroughly tamped.

   d. No backfill shall be placed against walls or other vertical surfaces until they have been inspected and backfilling is authorized.

   e. Any excess material resulting from the finish grading operations not required or unsuitable for fill or backfill, shall be disposed by the contractor at his expense.

## IV. CONCRETE WORKS

A. Scope of Work

1. This includes all labor, materials, equipment and incidentals necessary for the construction of all concrete work including reinforcing steels, forms, water stops and miscellaneous related items such as walls, shelves, anchor bolts and embedded items. Placing and finishing of concrete shall be in accordance with this specification and conforming to the lines, grades and dimensions shown on the approved plans. Concrete shall consist of a mixture of Portland cement, fine aggregates, coarse aggregates, and water.

B. General Provisions

1. Minimum concrete strength f'c is 3,000 psi.

2. No hand mixing shall be allowed, except in case of emergency such as mixer breakdown during pouring operations and shall stop at the first allowed construction joints. All concrete shall be machine mixed for at least 1-1/2 minutes after all materials including water are in the mixing drum.

3. The mixer shall be of an approved size and type which will ensure a uniform distribution of material throughout the mass. It shall be equipped with a DEVICE FOR ACCURATELY MEASURING AND CONTROLLING THE AMOUNT OF MIXING WATER IN EACH BATCH.

4. Placing of material in mixer shall be done in such a way that first batch of concrete materials placed in the mixer shall contain sufficient excess of cement, sand and water to coat the inside of the drum without reducing the cement content of the mix to be discharged.

5. Re-tempering of concrete shall not be allowed.

6. All testing shall comply with the latest applicable ASTM Test Methods (ASTM Standard). Samples of aggregate and concrete as placed will be subjected in the work shall conform to the approved samples.

C. Materials

1. Cement shall be Portland Cement of a brand approved by the Project Engineer and conforming to ASTM C150, Type I or Type II.

2. Aggregates

Fine aggregate shall be washed with natural sand conforming to ASTM Standard and shall range in size within the following limits of US Standard Sieve sizes.

| Sieve Designation | Percent (%) Passing |
|---|---|
| No. 4 | 95-160 |
| No. 8 | 80-100 |
| No. 16 | 45-70 |

Maximum Silt Content – 2%

Coarse Aggregate shall be well-graded, crushed stone or washed gravel conforming to ASTM Standard having the following maximum size:

25mm – for plain concrete
20mm – for reinforced concrete sections
19mm – for concrete piles

Maximum Silt Content – 1%

3. Water shall be potable, clean, and free from deleterious amounts of acids, alkalis, oils or organic matter. Seawater must not be used.

4. Admixtures for ready-mixed concrete

   An approved water reducing aspect conforming to ASTM Standard, Type A or D, shall be used and shall entrain 3.0 to 5.0 percent air in the resultant concrete. Proportioning and mixing shall be as recommended by the manufacturer.

D. Quality of Concrete

1. The actual development of mix proportions composed of Portland cement, Admixtures Aggregates and water to produce concrete which conforms to the specific requirements shall be determined by means of prior laboratory tests performed by the contractor with the approved constituents to be used in the work.

2. Proportioning

   Well in advance of placing any concrete the contractor shall discuss with the Project Engineer the source of materials and concrete mixture proposes to use. Representative samples of aggregate and cement and their test results shall be furnished to the Project Engineer. A pouring permit signed by the Project Engineer should be presented by the contractor prior to pouring of concrete.

   The contractor shall allow ample time to develop a proposed design mix or to modify the proposed design mix within the limits of these specifications whenever in the opinion of the Engineer it becomes or desirable.

   Consistency of the concrete as measured by the requirements of ASTM Standard shall be as shown in Table B below:

Table B

| TYPE OF STRUCTURE | SLUMP (mm) RECOMMENDED | RANGE |
|---|---|---|
| Pavement and slabs on ground | 50 | 28-75 |
| Heavy reinforced foundation walls & footing | 50-75 | 50-100 |
| Plain footings, gravity walls, slabs & beams | 50-75 | 25-100 |
| Thin reinforced walls & columns | 75 | 75-100 |

3. No excessive wet concrete will be permitted. Concrete delivered to the site having slump in excess of that specified in Table B will be rejected.

4. The temperature of the concrete at the time of placement shall normally be 30 degrees centigrade. The contractor will be responsible for employing whatever measures are necessary to comply with these temperature requirements.

5. Formworks

   The contractor shall design, furnish and install all formworks and supports required to confine the concrete and shape it to the lines shown as the drawings. Form design shall conform to ACI 347. Forms shall have sufficient strength to withstand the pressure

resulting from placement and vibration of the concrete and shall be sufficiently tight to prevent loss of mortar from the concrete.

Forms shall be made of either steel or new approved lumber and shall be free from roughness and imperfections.

6. Placing of Concrete

No concrete shall be placed until the forms, reinforcement steel, pipes, conduits, sleeves, anchors and other embedded items have been inspected and approved by the Project Engineer.

Pipes, conduits, dowels and other ferrous items required to be embedded in concrete construction shall be positioned and supported prior to placement of concrete such that there will be a minimum of 50mm clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding it to reinforcement will not be permitted.

Before depositing any concrete, all debris, dirt and water shall be removed from the forms. The surfaces of previously placed concrete, such as horizontal or vertical construction joints, shall be roughened, cleaned from foreign matter and laitance to expose a fresh face and saturated with water at least two hours before and again shortly before the new concrete is placed. Immediately before the new concrete is placed, all hardened surfaces shall receive thorough coating of next cement slurry mixed to consistency of very thick paste at least 50mm thick which shall first be well scrubbed-in by means of stiff bristle brushes. The new concrete then shall be placed before the next cement sets up.

Concrete shall be uniformly placed as near as possible to its final location in the forms. The placing of concrete in forms shall not exceed 0.60m vertical rise per hour.

7. Curing and Protection

a. It is the latest of those specifications to obtain properly cured concrete. The basic requirement of proper curing is to maintain continuous moist surface from the time of placing the concrete until the end of the curing period. The use of curing compounds may be acceptable but shall require prior approval in writing by the Project Engineer.

b. All exposed surfaces including finished surfaces shall be treated immediately after concrete has been poured to provide continuous moist curing for at least 7 days. Walls and vertical surfaces may be covered with continuously saturated burlap or kept moist by other approved means.

c. Formed surfaces shall be thoroughly soaked with water at least twice a day until the forms are removed.

8. Removal of Forms

a. The contractor shall not remove any forms for at least 48 hours or until the concrete has attained a strength of at least 30% of the ultimate strength.

b. Forms for beams and slabs shall not be stripped for at least 150-day degrees and supports shall not be removed until the concrete has attained at least 60% of the specified 28-day strength and is capable of safety supporting its own weight. Construction live loads shall not be placed until concrete has attained its specified 29-day strength – 3000 psi (20.68 MPa).

c. Forms shall be stripped such that they will not damage the concrete.

E. Concrete Reinforcements

1. Scope of Work

This includes the furnishing, fabrication and installation of all steel bars and steel tie wires, clips, supports, chairs and spaces required for the reinforcement of concrete as shown on the drawings and/or specified herein.

2. Standard Specifications

a. All reinforcing steel bars shall be 40,000 psi Intermediate Grade unless otherwise specified.

b. The following standards are required to:

| | |
|---|---|
| ASTM A 82 | Cold drawn steel wire fabric for concrete reinforcements |
| ASTM A 497 | Welded deformed steel wire fabric for concrete reinforcements |
| ASTM A 615 | Deformed billet steel bars for concrete reinforcements |
| ASTM A 315 | Manual of standard practice for detailing reinforce concrete structures |

3. Shop Drawings

a. The contractor shall submit three (3) sets of completely detailed working drawings and schedules of all reinforcement for review to the Project Engineer. The bending diagrams and bar lists shall be detailed in accordance with ACI 315.
b. Fabrication of steel reinforcement steel shall not proceed until the construction joint locations and the shop drawings have been reviewed by the Project Engineer.

4. Substitutions

a. The following reinforcing steel bar sizes shall be used for reinforced concrete design:

| Nominal Diameter (mm) | Approx. Cross Section Area (sq. mm) | Approx. Unit Wt (kg/m) |
|---|---|---|
| #10 | 78 | 0.616 |
| #12 | 113 | 0.888 |
| #16 | 201 | 1.579 |

| | | |
|---|---|---|
| #20 | 314 | 2.466 |
| #25 | 492 | 3.854 |
| #28 | 615 | 4.833 |

b. Should the contractor wish to use reinforcing steel bars having areas different from those shown, all proposed changes shall be submitted to the Project Engineer for approval.

5. Products

a. Materials

Reinforcement steel shall be deformed, new billet steel bars conforming to ASTM A 615, grade 40 for 10mm to 28mm diameter bars, substantially free from mill, scale, rust, grease or other foreign matters.

Rail steel bars will not be permitted in the work.

Reinforcement steel shall bear a mill identification symbol, and shall be tagged with the size and mark number so that different types may be identified and shall be stored off the ground to protect the steel moisture and dirt, until placed in final position.

Steel wire for tying reinforcing bars and water stops shall conform to ASTM A 82.

Welded wire fabric for concrete reinforcement shall conform to 5ASTM A 497.

6. Fabrication of Reinforcement

a. Reinforcement steel shall be accurately formed to the dimensions shown on the shop drawings and bar schedules.

b. All reinforcing bars shall be bend cold around a pin with a free revolving collar having a diameter proportional to the diameter of the bar of not less than the following:

Two to stirrups
Six times for bars up to and indicating 25mm diameter
Eight times for bars over 25mm diameter

c. Reinforcement steel shall not be straightened nor re-bent. Bars with kinks or bends not shown on the drawings will be accepted

7. Installation of Reinforcement

a. Reinforcement bars shall be accurately placed as shown on the drawings, and in accordance with the shop drawings and schedules. The reinforcing bars shall be

secured against displacement with annealed iron wire ties of minimum 1.5mm diameter or suitable clips at the intersection.

b. Except as otherwise indicated on the drawings, reinforcement steel shall be installed with a clearance for concrete cover as follows:

| | |
|---|---|
| Concrete placed directly on earth | 75mm |
| Formed surfaces in contact with the soil, water or exposed to weather | 50mm |
| Concrete cover of main reinforcement for columns and beams | 50mm |
| All other slab surfaces | 25mm |

c. No reinforcing bars shall be welded.

## V. PILING

### A. Description

1. Scope of Work

This Item shall consist of piling, furnished, driven or placed, cut and spliced in accordance with this Specification and in reasonably close conformity with the Plans.

The Contractor shall furnish the piles in accordance with an itemized list, which will be provided by the Engineer, showing the number and lengths of all piles. When cast-in-place concrete piles are specified on the Plans, the Engineer will not furnish the Contractor an itemized list showing the number and length of piles. When test piles and load tests are required in conformance with Sub-section 400.1.2 and 400.1.3, respectively, the data obtained from driving test piles and making test loads will be used in conjunction with other available sub-soil information to determine the number and lengths of piles to be furnished. The Engineer will not prepare the itemized list of piles for any portion of the foundation area until all specified loading tests in the Contract representative of the portion have been completed.

In determining lengths of piles for ordering and to be included for payment, the lengths given in the order list will be based on the lengths which are assumed to remain in the completed structure. The Contractor, shall, without added compensation, increase the lengths to provide for the fresh heading and for such additional length as maybe necessary to suit the Contractor's method of operation.

2. Test Piles

For his own information, the Contractor may drive at the location of the regular piles indicated on the Plans such test piles as he may consider necessary in addition to the test piles specified in the Contract and shall be considered as regular piles.

When called for in the Bill of Quantities, a pile if required to be subjected to load test shall conform to the provision as provided in Subsection 400.1.3, Load Tests. The Contractor shall furnish and drive test piles of the dimensions and at the locations designated by the Engineer.

They shall be of the material shown in the Bill of Quantities and shall be driven to refusal or to such tip elevation or approximate bearing value as the Engineer may request. Test piles shall be driven with the same hammer that is used for driving foundation piles.

When the Engineer requests a load test to determine a bearing value, the first load test pile shall be driven to the specified bearing value as determined by the applicable formula in Subsection 400.1.4 for Timber Pile Bearing Value by Formula. Subsequent test piles to be load-tested shall be driven to the specified bearing value as determined by the applicable formula modified by the results of 164 prior test loads and foundation data. The ground at each test pile shall be excavated to the elevation of the bottom of the footing before the pile is driven.

3. Load Tests

Load tests for piles shall be either Static or Pile Testing by Low-Strain Dynamic Method, High-Strain Dynamic Method and Cross-Hole Sonic Logging.

When load tests are specified, the number and location of piles to be tested will be designated by the Engineer. Load tests shall be done by methods approved by the Engineer. The Contractor shall submit to the Engineer for approval detailed plans of the loading apparatus he intends to use. The apparatus shall be so constructed as to allow the various increments of the load to be placed gradually without causing vibration to the test piles.

If the approved method requires the use of tension (anchor) piles, such tension piles shall be of the same type and diameter as the permanent piles and shall be driven in the location of permanent piles when feasible. Piling not a part of the structure shall be removed or cut off at least 300mm below the bottom of the footing or finished elevation of the ground upon completion of the test load. Permanent piling used as anchor piling which is raised during the test load shall be redriven to original grade and bearing.

3.1 Static Testing

Suitable approved apparatus for determining accurately the load on pile and the settlement of the pile under increment of load shall be supplied by the Contractor.

Test loading shall consist of the application of incremental static loads to a pile and measuring the resultant settlement. The loads shall be applied by a hydraulic jack acting against suitable anchorage, transmitting the load directly to the pile, or other methods designated by the Plans or approved by the Engineer.

The load shall be applied in increments of 5 or 10 tonnes as directed by the Engineer. Gross settlement readings, loads and other data shall be recorded by the Engineer immediately before and after the applications of each load increment.

Each load increment shall be held for an interval of two and one-half minutes. Each succeeding increment shall be as directed by the Engineer or as shown on the Plans and shall be applied immediately after the two and one-half minute interval readings have been made.

When a load-settlement curve obtained from these data shows that the pile has failed; i.e., the load can be held only by the constant pumping and the pile or shaft is being driven into

the ground, pumping shall cease. Gross settlement readings, loads and other data shall be recorded immediately after pumping has ceased and again after an interval of two and one-half minutes for a total period of five (5) minutes. All loads shall then be removed and the member allowed to recover. Gross settlement readings shall be made immediately after all loads 165 have been removed and at each interval of two and one-half minutes for a total period of five (5) minutes.

All load tests shall be carried to failure or to the capacity of the equipment, unless otherwise noted on the Plans.

After the completion of loading tests, the load used shall be removed and the piles including tension piles, shall be utilized in the structure if found by the Engineer to be satisfactory for such use. Test piles not loaded shall be utilized similarly. If any pile, after serving its purpose as a test or tension pile, is found unsatisfactory for utilization in the structure, it shall be removed if so ordered by the Engineer or shall be cut off below the ground line of footings, whichever is applicable.

When diesel or other types of hammers requiring calibration are to be used, the Contractor shall make load tests even though no load tests are called for in the Bill of Quantities, except that load tests will not be required when the hammer is to be used only for driving piles to refusal, rock or a fixed tip elevation or the hammer is of a type and model that has been previously calibrated for similar type, size and length of pile, and foundation material. Calibration data must have been obtained from sources acceptable to the Engineer.

3.2. Pile testing
Pile testing shall be done by Low-Strain Dynamic Method, High-Strain Dynamic Method or Cross-Hole Sonic Logging Method as required in the Plans or as directed by the Engineer.

3.2.1. Low-Strain Dynamic Method
Pile integrity testing by Low-Strain Dynamic Method shall conform to ASTM D 5882.

It is a so-called Low Strain Method, since it requires the impact of only a small hand-held hammer, and also referred to as a Non-Destructive Method.

3.2.2. High-Strain Dynamic Method
Pile integrity testing by High-Strain Dynamic Method shall conform to ASTM D 4945. High-Strain Dynamic Method shall be applied to confirm the design parameters and capacities assumed for the piles as well as to confirm the normal integrity of testing of the piles. It is considered supplemental to the low-strain and sonic-type integrity testing of the cast-in-place piles. It is a non-destructive relatively quick test and it is intended that the test shaft be left in a condition suitable for use in production. The shaft used for the test will be instrumented and tested by the testing specialist, as approved by the Engineer, meeting requirements in accordance to ASTM D 4945.

4. Concrete and Steel Pile Bearing Values
The bearing values for concrete and steel pile will be determined by the Engineer using the following formulas:

a. Modified Hiley's Formula or any formula from brochures of the equipment used, shall be used when the ratio of weight of ram or hammer to weight of pile is greater than one fourth (1/4).

$$Ru = \frac{2WH\,(W)}{(S+K)\,(W+Wp)}$$

$$Ra = \frac{Ru}{FS}$$

Where:

Ru = ultimate capacity of piles (KN)
Ra = capacity of pile (KN)–shall be greater than the required
W = weight of ram or hammer (KN)
H = height of fall of ram (mm)
Wp = weight of pile (KN)
S = average penetration for the last ten blows (mm)
K = 10 mm (unless otherwise observed/computed during driving)
FS = factor of safety (min. = 3)

b. Hiley's Formula shall be used when the ratio of the weight of ram or hammer to weight of pile is less than one fourth (1/4).

$$Ru = \frac{efWH\,(W)}{S+1/2\,(C1+C2+C3)} \times \frac{(W + n^2 Wp)}{(W + Wp)}$$

$$Ra = \frac{Ru}{FS}$$

where:

Ru = ultimate capacity of pile (KN)
Ra = capacity of pile (KN)
ef = efficiency of hammer (refer to table)
W = weight of ram (KN)
Wp = weight of pile (KN)
H = height of fall of ram (mm)
S = average penetration for last ten blows (mm)
C1 = temporary compression allowance for pile head and cap (refer to table)
C2 = RuL/AEp
C3 = range from 2.54mm to 5.08mm for resilient soil to 0 for hard pan (rock, very dense sand and gravel)
length of pile
L = cross-sectional area of pile
A = modulus of elasticity of pile
Ep = coefficient of restitution (refer to table)
n = factor of safety (min. = 3)
FS =

Required minimum penetration of all piles shall be six (6) meters. However, for exposed piles, the embedded length shall be equal or greater than the exposed length but not less than 6.0m.

Note: Formula for other pile hammers with suggested factor of safety should be as provided/recommended by their respective manufacturer.

## Values of C1 for Hiley Formula

### Temporary Compression Allowance C1 for Pile Head and Cap

| Materials to which blow is applied | Easy Driving: P1 = 3.45 MPa on Pile Butt if no cushion, mm | Medium Driving: P1 = 6.90 MPa on Head or Cap. mm | Hard Driving: P1 = 10.34 MPa on Head or Cap. mm | Very Hard Driving: P1 = 13.88 MPa on Head or Cap. mm |
|---|---|---|---|---|
| Head of timber pile | 1.27 | 2.54 | 3.81 | 5.08 |
| 76–100mm packing inside cap on head of precast concrete piles | 1.27 + 1.778[b] | 2.54 + 3.81[b] | 3.81 + 5.588[b] | 5.08 + 7.62[b] |
| Concrete Pile | 0.635 | 1.27 | 1.905 | 2.54 |
| Steel-covered cap. containing wood packing but steel piling at pipe | 1.016 | 2.032 | 3.048 | 4.064 |
| 4.76mm red electrical tuber disk between two 10mm steel plates. for use with severe driving on Monotube pile | 0.508 | 1.016 | 1.524 | 2.032 |
| Head of steel piling of pipe | 0 | 0 | 0 | 0 |

The first figure represent the compression of the cap and wood dolly or packing above the cap, whereas the second figure represent the compression of the wood packing between the cap and the pile head.

$$P1 = Ru/A$$

Values of Efficiency of Hammer, ef

| Hammer Type | ef |
|---|---|
| Drop Hammer released by trigger | 1.00 |
| Drop Hammer actuated by rope and friction winch | 0.75 |
| McKiernan-Terry Single-acting hammers | 0.85 |
| Warrington-Vulcan Single –acting hammers | 0.75 |
| Differential-acting hammers | 0.75 |
| McKiernan-Terry, Industrial B. Ownhoist, National and Union double-acting hammers | 0.85 |
| Diesel Hammers | 1.00 |

Values of Coefficient of Restitution, n

| Pile Type | Head Condition | Drop, Single Acting or Diesel Hammer | Double Acting Hammers |
|---|---|---|---|
| Reinforced Concrete | Helmet with composite plastic or green heart dolly on top of pile | 0.40 | 0.50 |
| | Helmet with Timber dolly, and packing on top of pile | 0.25 | 0.40 |
| | Hammer direct on pile with pad only | - | 0.50 |
| Steel | Driving cap with Standard plastic or greenheart dolly | 0.50 | 0.50 |
| | Driving cap with Timber dolly | 0.30 | 0.30 |
| | Hammer direct on pile | - | 0.50 |
| Timber | Hammer direct on pile | 0.25 | 0.40 |

The formulas specified in the preceding Subsection for timber piling may be used in determining a rough approximation for the bearing power of precast and cast-in-place concrete piles and of steel piles.

In all cases when the bearing power of concrete and steel piles is determined by formula, the piles shall be driven until the safe bearing power of each is computed to be not less than 27 tonnes.

5. Safe Loads

When the safe bearing power of any pile is found by test or computation to be less than the design load, longer piles or additional piles shall be driven as ordered in writing by the Engineer.

B. Material Requirements

The kind and type of piles shall be as specified on the Plans and Bill of Quantities. No alternative type or kind of piling shall be used.

1. Concrete Piles

Concrete shall conform to the requirements of Item 405, Structural Concrete.

Concrete shall be Class "C" unless otherwise specified in the Plans.

Concrete shall be proportioned to achieve a range of 150 mm to 200 mm slump, self-compacting mix.

The use of appropriate plasticizer/additives to assure mix fluidity and consistency shall be allowed and with the Engineer's approval. A retardant of 173 proven adequacy and approved by the Engineer may be used to ensure that early hardening of concrete during operation will not occur.

Reinforcing steel shall conform to the requirements of Item 404, Reinforcing Steel. Pre-stressing reinforcing steel shall be high-tensile steel wire conforming to AASHTO M 204 or other high-tensile metals conforming to AASHTO Standards.

2. Sheet Piles

Steel sheet piles shall meet the requirements of AASHTO M 202 (ASTM A 328), or AASHTO M 223. All other sheet piles shall meet the requirements 174 prescribed above the particular material specified. The joints shall be practically water-tight when the piles are in place.

C. Construction Requirements

1. Location and Site Preparation

Piles shall be driven where indicated on the Plans or as directed by the Engineer.
All excavations for the foundation on which the piles are to be driven shall be completed before the pile driving, unless otherwise specified or approved by the Engineer. After driving is completed, all loose and displaced materials shall be removed from around the piles by hand excavation, leaving clean solid surface to receive the concrete of the foundation. Any requirement for granular fill and lean concrete shall be indicated on the Plans or as directed by the Engineer.

2. Determination of Pile Length

Pile length and bearing capacity shall be determined by the Engineer from the results of the test piling and load tests.

The criterion for pile length may be one of the following:

1. Piles in sand and gravel shall be driven to a bearing power determined by the use of the pile driving formula or as decided by the Engineer.

2. Piles in clay shall be driven to the depth ordered by the Engineer. However, the bearing power shall be controlled by the pile driving formula if called for by the Engineer.

3. Piles shall be driven to refusal on rock or hard layer when so ordered by the Engineer.

The Contractor shall be responsible for obtaining the correct pile length and bearing capacity according to the criteria given by the Engineer.

3. Pile Driving

All piles shall be driven as shown on the Plans or as ordered in writing by the Engineer. They shall be driven within an allowed variation of 20 mm per metre of pile length from the vertical or batter as shown on the Plans. The maximum allowable variation at the butt end of the pile shall be 75mm in any direction from the location shown on the Plans or as directed by the Engineer. Each pile shall, after driving, be within 150mm from the theoretical location underneath the pile cap or underneath the superstructure in case of pile bents. All piles pushed up by the driving of adjacent piles or any other cause shall be redriven.

Piles shall be used only in places where the minimum penetration of 3 m in firm materials, or 5 m in soft materials can be obtained. Whereas soft upper stratum overlies a hard stratum, the piles shall penetrate the hard materials at sufficient depths to fix the ends rigidly.

All pile driving equipment is subject to the Engineer's approval. The Contractor is responsible for sufficient weight and efficiency of the hammers to drive the piles down to the required depth and bearing capacity. Hammers shall be gravity hammers, single and double acting steam or pneumatic hammers or diesel hammers. Gravity hammers shall not weigh less than 60 percent of the combined weight of the pile and driving head but not less than 2,000 kg. The fall shall be regulated so as to avoid injury to the pile and shall in no case exceed 4.50 m for timber and steel piles and 2.50 m for concrete piles unless otherwise specified or approved by the Engineer.

The plant and equipment furnished for steam hammers shall have sufficient capacity to maintain, under working condition, the pressure at the hammer specified by the manufacturer. The boiler or pressure tank shall be equipped with an accurate pressure gauge and another gauge shall be supplied at the hammer intake to determine the drop in pressure between the gauges. When diesel hammers or any other types requiring calibration are used, they shall be calibrated with test piling and/or test loads in accordance with Subsection 400.1.2, Test Piles.

Water jets shall be used only when permitted in writing by the Engineer. When water jets are used, the number of jets and the nozzle volume and pressure shall be sufficient to erode freely the material adjacent to the pile.

The plant shall have sufficient capacity to deliver at all time a pressure equivalent to at least 690 KPa at two 19 mm jet nozzles. The jets shall be shut off before the required penetration is reached and the piles shall be driven solely by hammers to final penetration as required by the Engineer.

Piles shall be supported in line and position with leads while being driven. Pile driving leads shall be constructed in such a manner as to afford freedom of movement of the hammer, and shall be held in position by guys or steel braces to insure rigid lateral support to the pile during driving.

The leads shall be of sufficient length to make the use of a follower unnecessary and shall be so designed as to permit proper placing of batter piles. The driving of the piles with 176 followers shall be avoided if practicable and shall be done only under written permission from the Engineer.

The method used in driving piles shall not subject them to excessive and undue abuse producing crushing and spalling of the concrete, injurious splitting, splintering and brooming of the wood or deformation of the steel.

Manipulation of piles to force them into proper position if considered by the Engineer too excessive will not be permitted.

The pile tops shall be protected by driving heads, caps or cushions in accordance with the recommendation of the manufacturer of the pile hammer and to the satisfaction of the Engineer. The driving head shall be provided to maintain the axis of the pile with the axis of the hammer and provide a driving surface normal to the pile.

Full length piles shall be used where practicable. Splicing of piles when permitted, shall be in accordance with the provisions of Subsection 400.3.7 and 400.3.8. All piles shall be continuously driven unless otherwise allowed by the Engineer.

Piles shall not be driven unless required strength is reached/attained.

4. Cast-in-place Concrete Piles

4.1. Drilled Holes

All holes for concrete piles cast in drilled holes shall be drilled dry to tip elevation shown on the Plans.

All holes will be examined for straightness and any hole which on visual inspection from the top shows less than one-half the diameter of the hole at the bottom of the hole will be rejected. Suitable casings shall be furnished and placed when required to prevent caving of the hole before concrete is placed.

All loose material existing at the bottom of the hole after drilling operations have been completed shall be removed before placing concrete.

The use of water for drilling operations or for any other purpose where it may enter the hole will not be permitted. All necessary action shall be taken to prevent surface water from entering the hole and all water which may have infiltrated into the hole shall be removed before placing concrete. 178

Concrete shall be placed by means of suitable tubes. Prior to the initial concrete set, the top 3m of the concrete filled pile or the depth of any reinforcing cage, whichever is greater, shall be consolidated by acceptable vibratory equipment.

Casing, if used in drilling operations, may be left in place or removed from the hole as concrete is placed. The bottom of the casing shall be maintained not more than 1.5 m nor less than 0.3 m below the top of the concrete during withdrawal and placing operations unless otherwise permitted by the Engineer. Separation of the concrete during withdrawal operations shall be avoided by vibrating the casing.

5. Cutting Off and Capping Piles

The top of foundation piles shall be embedded in the concrete footing as shown on the Plans.

Concrete piles shall, when approved by the Engineer, be cut off at such a level that at least 300 mm of undamaged pile can be embedded in the structure above. If a pile is damaged below this level, the Contractor shall repair the pile to the satisfaction of the Engineer.

The longitudinal reinforcement of the piles shall be embedded in the structure above to a length equal to at least 40 times the diameter of the main reinforcing corrugated bars (60 diameters for plain bars). The distance from the side of any pile to the nearest edge of the cap shall not be less than 200 mm.

When the cut off elevation for a precast pile or for the steel shell or pile for a cast in place concrete pile is below the elevation of the bottom of the pile cap, the pile may be built-up from the butt of the pile to the elevation of the bottom of the cap by means of reinforced concrete extension constructed in accordance with Subsection 400.3.10 or as approved by the Engineer.

Cut-offs of structural steel piles shall be made at right angles to the axis of the pile. The cuts shall be made in clear, straight lines and any irregularity due to cutting or burning shall be leveled-off with deposits of weld metal prior to placing bearing caps.

6. Defective Piles

Any pile delivered with defects, or damaged in driving due to internal defects or by improper driving, or driven out of its proper location, or driven below the elevation fixed by the Plans or by the Engineer, shall be corrected at the Contractor's expense by one of the following methods approved by the Engineer for the pile in question:

1. Any pile delivered with defects shall be replaced by a new pile. 186

2. Additional pile shall be driven/casted at the location as directed by the Engineer.

3. The pile shall be spliced or built-up as otherwise provided herein on the underside of the footing lowered to properly embed the pile.

A precast concrete pile shall be considered defective if it has a visible crack, extending around the four sides of the pile, or any defect which, in the opinion of the Engineer, affects the strength or life of the pile.

When a new pile is driven or cast to replace a rejected one, the Contractor at his own expense, shall enlarge the footing as deemed necessary by the Engineer.

7. Pile Records

The Contractor shall keep records of all piles driven or installed. A copy of the record shall be given to the Engineer within two (2) days after each pile is driven. The record form to be used shall be approved by the Engineer.

The pile records shall give full information on the following:

| Driven Piles | Cast-in-Place Piles |
|---|---|
| 1. Pile type and dimension<br>2. Date of casting and concrete quality (for concrete piles)<br>3. Date of driving | 1. Date of boring or driving (For steel shell) & casting<br>2. Pile type and nominal dimension<br>3. Length of finished pile and tip elevation |
| 4. Driving equipment: type, weight & efficiency of hammer, etc.<br>5. Description of cushion on pile head<br>6. Depth driven and tip elevation<br>7. Final set for the last 20 blows (for every 10 piles and when the Engineer so requires the penetration along the whole depth driven shall be recorded)<br>8. For gravity and single-acting hammers: the height of drop<br>9. For double acting-hammers — the frequency of blows<br>10. Details of any interruption in driving<br>11. Level of pile top immediately after driving and the level when all piles in the group are driven<br>12. Details of re-driving | 4. Details of penetration during boring or driving of steel shell (driving records as for driven piles)<br>5. Concrete quality and consistency<br>6. Time interval between boring or driving and concreting<br>7. Volume of concrete placed in concrete |

D. Method of Measurements

1. Cast-In-Place Concrete Piles

The quantity to be paid for will be the sum of actual lengths in meters of the piles cast and left in-place in the completed and accepted work. Measurements will be from the pile tip to the bottom of cap or footing. Portions of piles cast deeper than the required length through over-drilling will not be measured for payment.

2. Load Tests

The quantity of the load tests to be paid for will be the number of tests completed and accepted except that load tests made to calibrate different types of hammers, if not included in the Bill of Quantities, will not be measured for payment.

Anchor and test piling which are not part of the completed structure, will be included in the unit bid price for each "Load Test". Anchor and test piling or anchor and test shafts which are a part of the permanent structure will be paid for under the appropriate item.

3. Splices

The quantity to be paid for will be the number of splices which may be required to drive the pile in excess of the estimated length shown on the Plans for cast-in-place steel pipes or shells or in excess of the order length furnished by the Engineer for all other types of piling. Splices made for the convenience of the Contractor or to fabricate piles cut offs will not be paid for.

E. Basis of Payment

The accepted quantities, measured as prescribed in Section 400.4 shall be paid for at the contract unit price for each of the particular item listed below that is included in the Bill of Quantities, which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment tools and incidentals as well as temporary works, staging areas or crane way necessary to complete the work prescribed in this Item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|---|---|---|
| 400 (1) | Structural Steel Sheet Piles, furnished | Meter |
| 400 (2) | Test Piles, furnished and driven | Meter |
| 400 (3) | Concrete Piles cast in Drilled Holes | Meter |
| 400 (4) | Load Tests | Meter |
| 400 (5) | Bored Piles (dia. __m) | Meter |
| 400 (6) | Permanent Casing (dia. ___m) | Meter |

## VI. MASONRY WORKS

A. Scope of Work

1. This includes the furnishing of all labor, materials, equipment required to construct all concrete masonry unit walls as shown on the drawings and as specified herein.

2. The work under this section shall include but not be limited to the following:

   a. Concrete hollow blocks
   b. Masonry reinforcing bars for concrete blocks
   c. Grouting
   d. Connecting wall anchors, ties, bolts and related embedded items

B. Standard Specification

1. The following standards are referred to:

| | |
|---|---|
| ASTM C33 | Concrete Aggregates |
| ASTM C90 | Hollow Load-Bearing Concrete Masonry Units |
| ASTM C144 | Aggregate for Masonry Mortar |
| ASTM C150 | Portland Cement |
| SAO #15-2 | Standardization of Concrete Hollow Blocks |

C. Protection of Materials

1. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature.

D. Materials

1. Cement

   Portland cement shall conform to ASTM Specification C150, Type I.

2. Sand for Mortar

   Sand shall be clean, durable particles, free from injurious amounts of organic matter. The sand shall conform to ASTM specification C144 or C33 as required.

3. Water

   Water shall be free from injurious amounts of oils, acids, alkalis, organic matter, and shall be clean and fresh.

4. Concrete Hollow Blocks (CHB)

   Concrete block shall conform to ASTM C90, Grade N, and/or to the Phil. Bureau of Standards SAD No. 15-2.

E. Mortar Mixes

1. Masonry mortar for setting blocks shall be in the proportion of one part cement to 3 parts sand or as otherwise approved by the Project Engineer. Mortars shall be mixed with water in an amount compatible with workability.

2. Mixing shall be done immediately before usage.

F. Execution

1. All masonry shall be laid plumb and true to lines and built to the thickness and bond required with courses level and joints and bond uniform. Masonry shall be carried up in a uniform manner.

2. Concrete blocks shall be laid in running bond, unless otherwise indicated with joints not exceeding 10mm and uniform throughout and finished slightly concave and smooth. All blocks shall be laid in a full bed of mortar applied to shell and webs.

3. All necessary block cutting shall be neatly done by saws.

4. Control joints shall be installed at the locations noted and detailed on the drawings.

G. Lintels, Ties and Miscellaneous Items

1. The contractor shall build in all miscellaneous items specified in other sections to be set in masonry including frames, lintels, reinforcing steel, electrical boxes and fixtures, sleeves, grilles, anchors and other miscellaneous items. All anchorage, attachments, and

bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar.

H. Grouting

1. Grout and cement mortar for setting structural columns, railings, frames in walls and where otherwise required shall be done with mortar of 1 part cement to 1 part sand. Before placing grout, thoroughly clean all surfaces. Grout shall be tamped into place with a blunt tool to fill the entire void.

## VI. CARPENTRY WORKS

A. Scope of Work

1. Furnish materials and equipment and perform labor required to complete wooden framings and related rough carpentry works as indicated in the plans and/or specified herein.

2. Include in the works nailing strips, scaffoldings, plates, straps, joists, hangers, rods, dowels, rough hardware, fasteners, and other miscellaneous iron and steel items pertinent to rough carpentry work.

B. Materials

1. Lumber shall be of approved quality of the respective kinds required for the various parts of the work, well-seasoned, thoroughly dry, straight and free from large, loose or unsound knob, sap shakes or other imperfections impairing its strength, durability or appearance.

2. Framing lumber shall be of rough dimensions shown on drawings.

3. All exposed woodwork shall be smoothly dressed and well sand papered.

4. Moisture content shall not exceed 18% unless otherwise specified.

5. All lumber, excluding scaffoldings, are to be pressure treated, conforming to 67% stress grade lumber in accordance to the requirements of the Phil. National Building Code, latest edition.

6. Fastening shall be common nails, glue as specified flat head wood screws, round head wood screws, bolts or log screws where specifically called for.

7. Conceal fastenings as far as possible, where not possible, locate them in inconspicuous place, where nailing is permitted through woodwork face conceal nail heads.

C. Substitution of Lumber

1. Any lumber equally good for the purpose intended may be substituted for kinds specified provided however, that the substitution be authorized in writing by the Project Engineer.

D. Rough Hardware and Metal Fasteners

1. Plates, straps, nails, spikes, bolts, joists, hangers, rods, dowels, fasteners and miscellaneous iron and steel items shall be of sizes and types to rigidly secure member in place.

## VII. STEEL WORKS

A. Scope of Work

1. Furnish all materials and equipment and perform labor and services required to complete fabrication and erection of all structural steel and other miscellaneous steel in accordance with the plans.

B. Materials

1. Structural steel shall conform to American Society of Testing Materials (ASTM) A-36, with Fy of 248 MPa.

2. Electrodes for welding shall conform to the latest requirements of the American Welding Society (AWS).

3. Use only approved brand of red lead paint and linseed oil for all shop painting for structural steel.

C. Execution

1. Tighten all bolts to a bolt tension not less than the proof load given in the applicable ASTM Specifications for the type of bolt used.

2. Never let compression members deviate from straightness by more than 1/100 of the axial length between points which are to be laterally supported.

3. Let completed members free from twists, bends, and open joints. Sharp kinks or bends shall be the cause of rejection of materials.

4. Give all steelwork, except those to be encased in concrete, one coat of shop paint.

5. Make all work well formed to shape and size shown and assemble as detailed in the plans.

6. Weld or bolt connections as indicated in the plans. Make all details of assembly strong with sufficient stiffness. Form joints exposed to weather in a manner that excludes water.

7. Provide all work with proper clearances. Fabricate and install in a manner to provide for expansion and contraction but will ensure rigidity and provide close fitting of sections.

8. Provide a protective coating which is resistant to alkaline, mortar and plaster to be applied to all sections after fabrication.

## VIII. DOORS AND WINDOWS

A. Scope of Work

1. This item includes furnishing all the materials, hardware, tools, labor and services necessary for the complete fabrication and installation of doors and windows in accordance with the Plans and the specifications. Provide shop drawings of fabricated items showing sizes of all members, details of connections, fabrication, and installation and submit corner section samples for doors and jambs all for the approval of the Architect/Contractor.

B. Doors

1. Erect all frames square and true to line and level with secure fastening to structures and anchors. Install formed steel stiffeners and reinforcement within frames at all points where top screw fastenings are used in connections with embedded strap anchorage.

2. All lumbers for wooden doors including door bars, cabinet and closet doors and all woodwork of similar nature shall be kiln-dried with not more than 14% moisture content.

3. Have all pre-fabricated doors installed by authorized representative of the manufacturer, but not before all plastering are completed.

4. Cut, trim, and fit each door to its frame and hardware accurately.

5. Give allowance for painter's finish and possible swelling or shrinkage.

6. Clean all surfaces and test all framing and hardware. Make all repairs and adjustment to the work, leaving it in a satisfactory condition.

7. All doors shall operate freely and watertight and all hardware shall be properly installed and functioning.

8. All doors must be guaranteed against warping, twisting, and cracking. The contractor is obligated to replace entirely any or all defective doors.

C. Windows

1. Factory fabricate all frames for pre-fabricated windows in accordance with the design and dimensions indicated in the plans.

2. Set and anchor frames as shown in details and/or in approved shop drawings.

3. Set frames plumb and square and brace where necessary to prevent distortion.

4. Adjust all frames and attach hardware before glazing.

5. Secure all windows to be watertight and all hardware operating free and easy.

D. Hardware

1. Furnish all the hardware necessary for the installation and completion of doors and windows.

2. Submit samples of locksets, hinges, door pulls, door stops, door closers, and other finish hardware and accessories for Architect's/Contractor's approval.

3. Install hardware to fill details shown in the plans and as per manufacturer's specifications. Supply all necessary templates and instructions required.

E. Materials

1. D1: D-1: 800mm W x 2100mm H Flush door type, Door frame: 2" x 6" solid wood, Hinges: Stanley or Hager
2. D2: 600mm W x 2100mm H Flush door type w/ louver, Door frame: 2" x 6" solid wood, Hinges: Stanley or Hager

3. W1: 1400mm W x 600mm H aluminum frame jalousie type window w/ insect screen (powder coat finish)

4. W2: 600mm W x 600mm H aluminum frame jalousie type window w/ insect screen (powder coat finish)

## IX. ROOFING

A. Scope of Work

1. Furnish materials and equipment and perform labor required to complete fitting and installation of roofing, flashing components, strap and rivet units as well as the application of supplementary materials to make the roof watertight and leak-proof.

B. Execution

1. Care should be exercised in the proper anchorage of all roofing frames.
2. Installation of roofing including valleys, hips, ridge, and flashings shall be as per manufacturer's installation procedure.

3. Side lap fasteners shall be done by rivets and washers paced from 12" to 18" on centers.

4. Provide gutter, flashings, and counter flashings, gauge 0.600mm pre-painted galvanized sheets or any approved equivalent at all critical points where water may seep through.

C. Materials

1. 4" thk. nipa shingles with ½ marine plywood backing and cogon roof netting.

## X. FINISHING

A. Tile Works

1. Scope of Work

    a. Furnish materials and equipment and perform labor required to complete all types of tile works as indicated and scheduled on the plans.

    b. Samples of each type of tiles including all required beads, moulding, and trim units shall be submitted for the approval of the Architect/Contractor.

2. Execution

    a. All surfaces to receive tile work shall be cleaned of loose materials and given proper surface preparation prior to tile work. Tiles shall not be installed on surfaces that are unsuitable and will prevent proper installation of tiles.

    b. Keep tile joints parallel and straight over the entire area by using straight edges.

    c. Lay tiles from center lines outward and make adjustments at walls.

2. Materials

    a. Floor Tiles and wall tiles: 300mm x 300mm ceramic tiles

B. Ceiling

1. Scope of Work

    a. Furnish all required materials, tools, equipment and labor necessary for the completion and installation of all ceiling works in accordance with the details and plans.

    b. Provide and install the necessary materials required in areas indicated in the plans.

2. Materials

    a. Fiber cement board with metal studs and metal screws.

C. Cement Plaster Finish

1. Scope of Work

    a. Furnish all materials and equipment and perform labor needed to complete all cement plaster finishes.

2. Materials

    a. Fine aggregates shall be clean, washed sharp and free from dirt, clay, organic matter or other deleterious substances.

b. Mortar mixture shall be freshly prepared and uniformly mixed in proportion by volume of one part Portland cement to three (3) parts sand.

3. Execution

a. Provide all wall indicated with three coats of cement plaster (scratch coat, brown coat, and finish coat). Mix each coat in the proportion of one part Portland cement to three parts sand by volume.

b. Apply the scratch coat with sufficient material and pressure to ensure a good bond and the scratch to a rough surface. Provide a thickness of 3/8" for scratch coat. Dampen with water before applying brown coat.

c. Apply brown coat, one day after applying scratch coat, with a thickness of 3/8" and level to a flat even surface. When stiff enough, trowel with a wooden float and cross hatch or bottom lightly and evenly to secure a good mechanical bond for the finish coat. Wet the surface and keep from drying out for at least three (3) days.

d. Apply finish coat seven (7) days after the application of brown coat. Provide thickness of 1/8", keep the finish coat damp but not saturated for a period of seven (7) days.

D. Painting

1. Scope of Work

a. This item consists of furnishing all paint materials, varnish, and other related products, tools, equipment, and labor required in undertaking the proper application of painting, varnishing, and related works indicated on the plans. See drawings for location, quantity, and extent of surfaces to receive paint and varnish.

2. Materials

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

b. Concrete neutralizer shall be first grade quality concentrate diluted with clean water and applied as surface conditioner of new interior and exterior walls thus improving paint adhesion and durability.

c. Silicon water repellent shall be transparent water shield especially formulated to repel rain and moisture on exterior masonry surfaces.

d. Patching compound shall be fine powder type material like calcimine that can be mixed into putty consistency, with oil base primers and paints to fill minor surface dents and imperfections.

e. Varnish shall be a homogeneous solution of resin, drying oil, drier and solvent. It shall be extremely durable clear coating, high resistant to wear and tear without cracking, peeling, whitening, spotting.

f. Sanding sealer shall be quick drying lacquer, formulated to provide quick dry, good holdout of succeeding coats, and containing sanding agents to allow dry sanding of sealer.
g. Glazing putty shall be alkyd-type product for filling minor surface unevenness.

f. Painting Schedule:
For New Concrete/ Masonry Surfaces:
One coat of Acrylic Flat base paint
Two coats of Acrylic Semi-Gloss base paint

3. Execution

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

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

c. Where surfaces are not fully covered or cannot be satisfactorily finished in the number of coats specified such preparatory coats and subsequent coats as may be required shall be applied to attain the desire evenness of surface without extra cost to the owner.

d. Where surface is not in proper condition to receive the coat the Engineer shall be notified immediately. Work on the questioned portion(s) shall not start until clearance be proceed is ordered by the Engineer.

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

## XI. PLUMBING WORKS

A. Scope of Work

1. Furnish all materials, tools, equipment, and fixtures as required in the plans for the satisfactory performance of the entire plumbing system and perform labor in accordance with the latest edition of the National Plumbing Code, Mechanical Code of the Philippines, and this specification.
2. All sanitary/plumbing works shall be done under the supervision of a Mechanical/Sanitary Engineer and in strict accordance with these specifications and of the methods as prescribed by the latest edition of the Philippine Plumbing Code, Sanitation Code of the Philippine and the Mechanical Code of the Philippines.

B. Materials

1. Soil and waste pipe shall be "Branded" conforming to ASTM-D1784 and made from class 12454 with dimensions of pipe and fitting conforming to ISO 161/1 and ISO 3606 and furnished in standard cutting length of 3 meters with sockets designed for rubber O-ring seal.

2. Polypropylene Random Copolymer piping shall be PN-20, type ASTM F-2389 and in accordance to NSF/ANSI Standard 61 Drinking Water System Components

3. Gate valves and hose bibs shall be bronze as per ASTM B-62 "Great Volume".

4. Faucets shall be chrome plated with stem length suitable for its intended location. Faucets and other accessories shall be approved brand.

5. Trap each fixture trap, except those cast integral or in combination with fixture in which the top seal is readily accessible for is the trap is removable shall have an accessible brass trap screw of ample size.

6. Clean-out shall be of the same size and materials as soil and waste pipe.

7. Pipe sleeves shall be galvanized iron pipe schedule 40.

8. Pipe support shall be fabricated from flat bar, round bar or angular bar of approximate sizes.

9. Water closets, Lavatories, Urinals and other fixtures and accessories shall be designer approved brand and approved model, for all units.

C. Installation

1. Install all plumbing fixtures free and open in a manner to afford access in cleaning.

2. Water piping shall intended to all fixtures, outlets and equipment from the gate valve installed in the branch near the riser.

3. All piping above ground shall run parallel with the line of the buildings unless otherwise shown in the drawings.

4. All soil and drainage pipe shall be pitched at 2% but in no case flatter than 1%.

5. All joints shall be air and water tight.

6. Roughing-in for pipes and fixtures shall be carried along the line of building constructor correctly located opening of proper sizes shall be provided where required in the wall and floor for the passage of the pipes. All items to be embedded in concrete shall be thoroughly clean.

7. Every plumbing fixture or equipment requiring connection to the drainage system shall be equipped with a trap, which shall be placed as near to the fixture as possible. No fixture shall be double trapped.

D. Septic Vault and Catch Basin

1. All concrete works, steel works, and masonry works for the septic vault and grease trap shall conform to these specifications. Concrete Hollow Blocks shall be machine made

and shall have a nominal size of 150mm (6") thick x 200mm (8") x 400mm (16") conforming to the requirements of ASTM C 90.

## XIII. ELECTRICAL WORKS

A. Electrical General Notes

1. All works shall be executed in accordance with the latest provision of the Philippine Electrical Code, the local ordinances, the rules and regulations of the local enforcing Authority, and the requirements of the local power company.

2. All works herein shall be directly supervised by a duly registered Electrical Engineer as enforced by the new Electrical Engineering Law or RA 7920.

3. All works shall be done in accordance with the plans and specifications.

4. All materials to be used shall be brand new and of the best quality and of the approved type and shall bear the manufacturer's name including the PS mark. Pull boxes shall be provided in appropriate areas even if not indicated in the plan.

5. Power supply shall be single- phase, 230VAC, 60Hz to be fed from the nearest available power source

6. Mounting of the luminaire shall be recessed mounted both for square lamp and for the pin light.

7. Distribution voltage shall be 230V, 1-phase, 2wire feeder conductors + ground and conduit shall be installed as shown on the drawing and no change in size shall be made without consent of the Owner. Feeder conductors shall be continuous and without splices between terminals.

8. Lighting Fixtures shall conform to the required specifications written below.

B. Materials & Lighting Specifications

*Lighting Fixtures*

The Contractor shall furnish and install all lighting fixture as indicated on the drawings, including mounting channels and supports if required by the situation.

1. Circular LED loghts,15W G10 daylight, luminous flux-1500 lm, 5500-6500k ,aluminum housing , high brightness LED, 85- 265VAC/60Hz , holder G10 Q (4 pin).

2. Downlight with 7W LED bulb, 230VAC, SL 75K Series, 300 lumens package. 140mm ø x 28mm (H) dimension luminaire, 5500 K, CCT, 80 CRI, 230VAC, 60 Hz.

3. Solar Spike lights – with .2 W LED bulb with mono crystalline solar panel, 300mm height.

*Wires & Cables*

Wires and Cables shall be of the approved type and bearing the PS mark. 99.9 % copper unless specified or indicated otherwise. All power and lighting conductors shall be insulated for 600VAC minimal. Cable shall be type THHN/THWN as manufactured by reputable manufacturer.

**Boxes**
Outlet boxes shall be PVC schedule 40 with 20mmø KO.

*Conduit*

1. PVC electrical conduit shall be supplied in standard effective lengths of 3.0m.

2. Conduit's fittings shall be US Underwriters Laboratories (UL) listed or approved local equivalent.

3. Conduit shall be 20mmø & 40mmø RSC for the main cable, schedule 40 PVC all thru out up to the Panelboard.

*Switches & Convenience Outlets*

1. All switches and Convenience outlets shall be rated at 250VAC, 16A as manufactured by a reputable company.

**Circuit breakers and Panelboard**
1. Circuit breakers for panel board shall be molded case circuit breaker with quick-made, quick- break, trip-free mechanisms. They shall meet US Federal Specifications and NEMA standard.

C. Installation

*1. Grounding*

The following shall be grounded in accordance with the drawings and the requirements of the Philippine Electrical Code with standards grounding practices:

a. Metallic conduit and raceway system including gutters, cabinets and boxes.
b. Non-current carrying metal parts of all electrical equipment including fixtures and motors.

*2. Branch Circuit*

The drawing indicates the general methods of installations of all circuit wiring and the outlet which are to be supplied from this circuit. Branch circuit conduits shall be run from panelboard to outlets as directed as the building conditions will allow.

Circuit allocations shall be indicated on the drawings. Where it becomes necessary to correct any outlet to circuit other than that shown on the drawings, this shall be done without extra charge and only upon written consent of the Owner. No wire smaller than 2.0mm$^2$

(#14AWG) and 3.5mm$^2$ (#12 AWG) shall be used for any lighting and power circuits, respectively.

*3. Panel boards and cabinets*

Panel boards shall be mounted with their centers at 1.40m above the floor unless otherwise indicated by field conditions.

*4. Locations of outlets and switches*

The approximate location of each fixture receptacle, special purpose outlet and switch is indicated on the drawings. The exact location is to be determined later at the site as the work progresses.

*5. Wires and boxes*

No wire shall be drawn into the raceway until works is completed, which may cause injury to the wires, and until permission is given by the Owner in writing. Only powdered lubricant not injurious to cable insulation and raceways shall be used only when lubrication is necessary.

*6. Outlets, switches and junction boxes*

The contractor shall install standard boxes at all outlets for lights, appliances and switches and other point as required by the installations.

*7. Splices*

Branch circuit splices shall be soldered or joined by used insulated splicing device (wire nuts). All soldered joints shall be made mechanically strong before soldering and shall be carefully soldered without the use of acid, then taped with rubber tape to a thickness equal to that of the insulation and with a covering of friction tape of two layer. . Where solid conductors are to be connected directly to devices without the use of lugs, such as lighting switches and plug receptacles, the wires shall be formed into a clockwise loop fitted around the screws.

*8. Conduit System*

Not more than four 90 degrees bond shall occur in any run. When it becomes necessary to have more than four 90 degrees bends in any run, an intermediate pull box shall be installed to facilitate pull-in wires. All conduits run shall as called for on the drawings. Conduits shall be installed in such manner as not to weaken or interfere with the structure or the building. No horizontal runs embedded conduit shall be permitted in solid wall and partitions. Conduits below grade line shall be encased in concrete enveloped with minimum thickness of 50mm (2") or embedded in floor slab. Exposed conduit shall run parallel or at right angles with lines of the buildings and shall be securely fastened in place by means of approved fastening. Conduits support shall be fastened to walls by means of screws or bolts with expansion sleeves. The use of wooden or lead plug is not permitted. Conduits shall be cut by hacksaw, the ends shall be reamed after being firmly attached to cabinets or boxes by means of locknuts.

D. Testing

a. Ground test

The entire installation shall be free from improper ground and from short circuits. Each panel shall be tested with means connected. Lamps removed or omitted from the sockets and all switches closed. Each individual power equipment shall be connected for proper and intended operation. In no case shall the resistance be less than that allowed by the Regulations for electrical equipment of building. Failures shall be corrected in any manner satisfactory to the Architect and Engineer.

b. Performance test

The electrical contractor shall test all system of entire electrical installation for proper operational conditions. These conditions shall apply to the power and lighting installation, voltage drop, grounding defects.

Prepared By:

**LOVELY M. CASTILLANO**
Civil - Estimator

**ENGR. JUNELL IAN MEDINO**
Sanitary Engineer

**ENGR. ANGELITO A. ROQUE**
Electrical Engineer

Checked By:

**ENGR. NOEL F. YAMBAO**
*Officer-in-Charge*, PMD

Noted:

**ENGR. JEOFFREY L. MACALALAD**
*Officer-in-Charge*, PEPD