

Construction of Abaca Tuxy Buying Center Buildings and Facilities
Brgy. Sabangan, Caramoran, Catanduanes

TECHNICAL SPECIFICATIONS

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1. GENERAL REQUIREMENTS

1.1 Scope of Work

This section shall include mobilization and demobilization of Contractor's equipment, material and employee to the site; construction of the Contractor's office and facilities; compliance with the contract requirements.

This section shall include the furnishing of labor, materials, transportation, tools, supplies plant, equipment and appurtenance to complete satisfactorily the construction of the proposed subproject.

1.2 Mobilization and Demobilization

The contractor upon receipt of the notice to proceed shall immediately mobilize and transport his equipment, materials and employees to the site and demobilize or remove the same at the completion of subproject.

1.3 Contractors field Office and Facilities

1.3.1 Field Office

During the performance of the contract, the Contractor shall construct and maintain a field office and facilities at the site of the work at which he or his authorized agent shall be holding office and all times, while the work is in progress. The location, dimensions and layout of such field office shall be subject to approval, Construction shanties, sheds and temporary facilities provided as requires for the Contractor's convenience shall be maintain in good condition and neat appearance including finishes as required.

1.3.2 Temporary Light and Power

The Contractor shall provide and maintain temporary electrical service including installation of temporary power and lighting within the construction site. The electrical service shall be adequate in capacity to supply power to construction tools and equipment without over-loading the temporary equipment and wiring for power and lighting shall be in accordance with the applicable provisions of the local governing codes. At the completion of the construction work, all temporary wiring, lighting, equipment and devices shall be removed.

1.3.3 Temporary Toilet

The Contractor shall provide and maintain its sanitary condition enclosed toilet for the use of all construction personnel located within the contract limits, complete with fixtures, water and sewer connections and all appurtenances. Installation shall be in accordance with all applicable codes and regulations of the local authorities having jurisdiction thereof. Upon completion of the work, temporary toilet and their appurtenances shall be removed.

1.3.4 Temporary Water Service

The Contractor shall provide and maintain temporary water supply services, complete with necessary connections and appurtenances. Installed water supply lines shall be used as a source of water for construction purposes subject to the approval of the Project Manager. The Contractor shall pay the cost of operation, maintenance and restoration of the water system. All temporary water service including equipment and piping shall be removed upon completion of work and all worn out and damaged parts of the permanent system shall be replaced and restored in first class condition equal to new.

1.3.5 Security

The Contractor shall provide sufficient security in the construction site to prevent illegal entry or work damaged during nights; holidays and other period when work is not executed; and during working hours. The Contractor shall take ample precautions against fire by keeping away flammable materials, and ensure that such materials are properly handled and stored. Fires shall not be built within the area of construction, except when permitted by the Project Manager.

1.4 Compliance with Contract Requirements

1.4.1 Control of on Site Construction

Prior to start of any definable feature of the work, the Contractor must perform the necessary inspection to include as follows:

- (1) Review of Contract Documents to make sure that material, equipment and products have been tested, submitted and approved.
- (2) Physical examination of materials and equipment to assure its conformity to the specification, plans, shop drawing and other data.
- (3) As soon as the work has been started the Contractor shall conduct initial inspection to check and review the workmanship in compliance with the contract requirements for a particular item of work.
- (4) The Contractor shall perform these inspections on a regular basis to assure continuing compliance with the contract requirements until completion of a particular type of work.

1.4.2 Pre-Construction Meetings

Prior to the start of construction, Contractor's material men whose presence is required must attend pre construction meetings as directed for the purpose of discussing the execution of work. In this conference, the contractor determines the necessary precautions in mitigating the effect of construction on environmental aspect and medical services.

1.4.3 Progress Meetings

Progress meetings shall be called upon by the following for the purpose of discussing the implementation of the work:

- (1) When called upon by the Project Manager / Authorized Representative / Authorized Representative or his representative for the purpose of discussing the execution of work, Contractor's material men whose presence is necessary or requested must attend progress meetings. Each of such meeting shall be held at the time and place designated by the Project Manager / Authorized Representative / Authorized Representative or his representative. Decisions and instructions agreed in these meetings should be binding and conclusive on the contract. Minutes of these meetings shall be recorded and reasonable number of copies shall be furnished to the Contractor for distribution to various materials men and vendors involved.
- (2) The Contractor may also call for a progress meeting for the purpose of coordinating, expediting and scheduling the work. In such meeting, Contractor's material men or vendors, whose presence is necessary is requested to attend.

1.4.4 Progress Report

The Contractor shall prepare and submit progress reports to the Project Manager / Authorized Representative / Authorized Representative every 30 days after the start of the project up to its completion, showing the work completed, work remaining to be done, status of construction equipment and materials at the site.

1.4.5 Survey Data

The Contractor shall layout his work from established base lines and benchmark indicated in the drawing and shall be responsible for all measurement in connection therewith. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, tools, materials and labor as may be required in laying out any part of the work, out of established base lines and bench mark. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks until he is authorized to remove them. If the Contractor, through his negligence prior to the authorized removal destroys such marks, they shall be replaced at the expense of the Contractor.

1.4.6 Construction Photographs

The Contractor shall take photographs during the process of the work once a month, all taken where directed by the Project Manager. At the completion of the project final photographs shall be sent to the Project

Manager. The photographs shall be geotagged; neatly labeled with coordinates or project location and dated.

1.4.7 Cleaning-up

The Contractor shall at all times keep the construction area including storage area used by him free from accumulations of waste material or rubbish. Upon completion of construction, the Contractor shall leave the work and premises in clean, neat workmanlike conditions satisfactory to the PhilFIDA.

1.4.8 Documents to be submitted

The Contractor shall submit the following documents prior to final payment and before issuance of final certificate of payment in accordance with the provisions of the conditions contract.

- (1) The guarantee required by the Conditions of Contract and any other extended guarantees stated in the technical sections of the specifications.
- (2) A set of As-Built drawing shall be submitted showing accurate record of changes or deviations from the contract documents and the shop drawings indicating the work as actually installed. Records shall be arranged in order, in accordance with various sections of the specifications and properly indexed with certifications of endorsement thereof, that each of the revised print of drawings and specifications are complete and accurate. Prior to the application for final payment, and as a condition to its approval by the Project Manager / Authorized Representative / Authorized Representative of PhilFIDA, the Contractor shall deliver the records, drawings and specifications arranged in proper order, indexed and endorsed herein specified.

1.5 Methods of Measurement and Basis of Payment

Cost incurred in providing and maintaining Contractor's field office, temporary light and power, temporary toilet, water and security services, including cost mobilization and demobilization, and cost incurred in the compliance of contract requirements shall not be measured and paid separately, same shall be deemed to be included in the cost of other items work, as part of the Contractor's construction overheads.

2. **SITE WORK**

2.1 Scope

The section includes site clearing, earthwork and site drainage and utilities construction of septic tank in accordance with the drawing and specification.

2.2 Applicable Documents

The latest edition of the following Standards and Specifications shall form part of these specifications:

ASTM	American Society for Testing and Materials.
C131	Resistance to Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine.
D698	Moisture-Density Relations of Soils using 5.5 lb. (2.5 kg) Rammer and 12 in (304.8 mm) Drop
	Density of Soil in place by the Sand Cone Method
D1556 D1557	Moisture-Density Relations of Soils using 10 lb. (4.5 kg) Rammer and 18 in (457 mm) Drop.
D2487	Classification of Soils for Engineering Purposes
C-14	Concrete Sewer, , Storm Drain and Culvert Pipe
C-76/C-497	Class II Reinforced Concrete pipes
A-74	Cast Iron Soil Pipes and Fittings
	Other pipes shall conform to the latest ASTM requirements.

2.3 Materials Requirements:

2.3.1 Selected Fill Material

Selected fill materials shall consist of pit run gravel, disintegrated rock, sand and or other similar materials.

The material shall not contain more than 35% passing the No. 200 sieve; and fraction of the material passing the No. 40 sieve shall have a liquid limit not greater than 35 and plasticity index not greater than 12.

2.3.2 Gravel Fill

Gravel fill shall consist of hard durable particles or fragments of stones or gravel. It shall be clean and free from vegetable matters, lumps or balls of clay and other deleterious material. The proportion of the material passing the 0.075 mm (No. 200) sieve shall not be greater than 0.66 (two thirds) of the fraction passing the 0.425 mm (No. 40) sieve. The fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit of not more than 25 plasticity index of not more than 6 as determined by AASHTO T89 and T90. Gravel bedding 100 mm (4") in depth or as shown on the drawing shall be placed, spread and compacted through tamping and underneath footing, slabs, on fill and slabs on grade.

2.3.3 Base and Sub-base Course

Aggregate sub-base shall consist of pit run gravel, talus rock, disintegrated granite, sand, shale cinders, coral or other similar materials, or additional filler for blending, selected under the direction of the Consultant. The maximum dimension of any particle shall not be greater than two-thirds of the required thickness of the layer in which it is to be placed. Over-sized materials if present shall be removed at the pit by screens, or hand picking. If necessary, to obtain proper uniformity, mixing shall blend additional filler. The fraction to aggregate sub-base materials including any additional filler passing the 0.075 mm (No. 200) sieve shall not be more than two-thirds (2/3) of that passing the 0.425 mm (No. 40) sieve. The fraction passing the 0.425-mm sieve shall have a liquid limit not greater than 25 and plasticity index of not more than 6.

2.3.4 Concrete for Site Work

Concrete materials for the site work shall be in accordance with Section 3, concrete, of these specifications. Cement shall be proportioned as follows:

Description of Structure	Compressive Strength
1.) For sidewalks, walkways, catch basins and man holes	1.72 Mpa (2500 psi) at 28 days
2.) Septic Tank	20.7 Mpa (3000 psi) at 28 days

2.4 Construction Requirements

2.4.1 Earthwork

1. Site Demolition

All superficial obstructions shall be demolished and removed from the site to disposal areas approved by the Project Manager

2. Clearing and Grubbing

a. Clearing

All areas within which the structure or related construction has to be accomplished shall be completely cleared of matted roots, tree brushes, snags, vegetation, rubbish, spoils and other objectionable matters. All combustible materials from clearing operation shall be completely burned or removed from the site of work or otherwise disposal off as directed by the Project Manager. All materials to be burned shall be piled neatly and when in suitable condition shall be burned completely. Piling for burning shall be done in such a manner and location as to cause the least fire risk. All burning shall be thorough that the cleared materials can be reduced to ashes. The Contractor shall at all times take special precautions to prevent fire from spreading and shall have available at all times, suitable equipment and supplies, for use in preventing and fighting fires.

b. Grubbing

Grubbing shall consist of the removal of tree stumps, brush and rubbish from the work areas to be occupied by permanent structures, from other areas within the indicated clearing limits as directed by the Project Manager. Trees and shrubs to be retained shall be protected properly from damage. Stumps shall be removed entirely. Roots and matted roots shall be grubbed and cut to at least 450 mm below the existing surface.

3. Structural Excavation

All excavation shall be performed by the Contractor to the excavation lines, grades and slopes and profiles shown in the drawings, or as directed by the Project Manager. All excavation shall be performed in the dry condition, unless otherwise approved by the Project Manager.

a. Excavation for Structure and Trenches

Excavations carried out below the depth indicated on the drawing without the approval of the Project Manager / Authorized Representative / Authorized Representative shall be refilled to the proper grade with thoroughly compacted suitable fill materials to the satisfaction of the Project Manager / Authorized Representative / Authorized Representative except for footing excavation where concrete shall be replaced to the bottom of the excavations; additional work of this nature shall be at the Contractor's expense. Where an existing structure lies adjacent to excavation line, adequate shoring and bracing shall be provided to prevent damage to persons and properties. Shoring, bracing and sheeting shall be removed in a manner to prevent caving-in. The grading in the vicinity of excavated areas shall be done to prevent surface water from running into excavation and embankments. Water pumped from excavations shall be diverted to suitable disposal points. Trenches for pipelines shall be excavated along straight lines and provided with minimum of 150-mm space between the outside of the pipe and the side of the trench or bracing. Additional excavation shall be made for each joint to allow for joining.

Trench excavation, other than rock, shall be excavated at least 50 mm above final invert grade; the remainder of the excavation shall be shaped manually, and graded to provide uniform bearing when the pipe is laid. Unless otherwise indicated, backfill cover over water sewer, drainage and electrical conduit pipes shall not be less than 300-mm depth.

b. Excavation Under Pavement and Concrete Slabs

The entire area of the original ground under pavements and concrete slabs shall be excavated to remove all objectionable matter, sod, muck, rubbish and other unsuitable material to a minimum depth of 300 mm.

4. Filling and Backfilling

Fill and backfill materials shall consist of suitable materials from excavation or from approved borrow areas, and shall be free from roots, wood scraps, vegetations, and other extraneous materials and from large clods of earth or stones greater than 100 mm. No fill material shall be placed until the surface to be filled has been approved.

a. Filling and Backfilling for Structures and Trenches

Filling around structures shall be placed as the construction work progress, insofar practicable. Backfilling of trenches shall progress as rapidly as construction and testing will permit. In backfilling pipe trenches, approved backfill shall be compacted in 200 mm layers to a depth of 150 mm over the pipe and the remainder of the trench depth shall be backfilled and compacted in 300 mm layers; for trenches under road pavements and concrete floor slabs, the backfill shall be placed and compacted in 200 mm layers to the top of the trench.

5. Equipment

Equipment used in the performance of the work shall be subject to approval of the project manager. The quality of compaction equipment shall be adequate to ensure thorough uniform compaction as rapidly as material is placed. In all areas not accessible to rollers or compactors, the fill shall be compacted with mechanical hand tamper.

6. Compaction

In fill areas, the top 200mm shall be compacted to a density of at least 95 percent of maximum density and the remaining depth of fill to not less than 90 percent of maximum density; except that under ramps pavements and concrete floor slabs, compaction shall not be less than 85 percent of the maximum density for the entire depth of fill. Unless otherwise indicated where the existing sub-grade in cuts have a density of less than 95 percent, all materials to a depth of 150mm or to such greater depth as maybe specified, shall be compacted not less than 95 percent of the maximum density. Soil moisture during compacting shall be controlled between 80 and 110 percent of optimum moisture content determined in accordance with AASHTO Method T99-84.

7. Disposal of Surplus Excavated Materials

Any surplus material from the excavation and grading operations shall be disposed and spread in spoil areas designated by the Project Manager / Authorized Representative / Authorized Representative except for the materials classed as rubbish and debris, which shall be deposited in the spoil areas and be graded to a reasonably uniform surface.

2.5 Method of Measurement and Basis of Payment

Measurement of accomplished quantities shall be of the ff. methods:

1. Lump sum payment shall be provided for the following:
 - a. Site demolition and clearing shall be deemed to include the cost of salvaging of materials, preservation, storage and disposal.
 - b. Construction of septic tank holding and water storage tank (including reservoir and piping) shall be considered to include the cost of excavation and backfilling, bedding, forms and false work, curing, fasteners and incidentals to complete each item of work.
 - c. Subsurface waste water infiltration system shall be deemed to include the cost of excavation, disposal, gravel filter, silt barrier, overflow and distribution pipes and incidental works to complete this item.
2. The volume of structural excavation to be paid for shall be the number of cubic meters measured in original position of material acceptably excavated in conformity with the plans or as directed by the Payment of quantities accomplished shall be deemed to include the cost of disposal of excess and unsuitable materials, shoring, bracing, water control works and other operations necessary to complete this item.
3. The volume of backfill materials from excavation; fill materials from common borrow; top soiling; construction of embankment; sub-base and base course preparations; and compacted gravel fill bedding to be paid for shall be the number of cubic meters measured in the final position of materials actually provided and installed to include where applicable, furnishing, placing, spreading and compaction in accordance with the plans and specifications and disposal of excess and unsuitable materials, if any.

3. CONCRETE

3.1 Scope of Work

The work includes construction of concrete structures complete in accordance with the standard specifications and conformity with the lines, grades, thickness and typical cross-section shown on the plan.

3.2 Reference Standards

The latest edition of the following standards shall be from a part of this specification:

ACI	American Concrete Institute
211-01	Standard Practice for Selecting Proportions for Normal and Heavyweight Concrete
301	Concrete, Structural for Building
309R	Standard Practice for Consolidation of Concrete
318	Building Code Requirements for Reinforced Concrete
AASHTO M173	American Association of State Highway and Transport Officials Concrete joint sealer, hot-poured elastic type performed
ASTM	American Society for Testing Materials Concrete Aggregates Standard Practice for Making, Curing Concrete Test Specimen in the Field
C33	Concrete Aggregates
C31	Standard Practice for Making, Curing Concrete Test Specimen in the Field
C39	Comprehensive Strength of Cylindrical Concrete Specimen
C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete Standard Specification for Ready-Mixed Concrete
C143	Standard Test Method for Slump of Portland Cement Concrete
C150	Portland Cement, Specification for
C309	Liquid Membrane-Forming Compounds for Curing Concrete
DPWH Blue Book Vol. III (1995)	

3.3 Material Requirement

3.3.1 General

Concrete shall be composed of Portland cement; fine and coarse aggregates, water and admixture as specified all thoroughly mixed and brought to proper consistency, uniformity and temperature for final placement.

3.3.2 Cement

Concrete shall be Portland cement or a brand approved by the Project Manager / Authorized Representative / Authorized Representative and conforming to ASTM Specification C150, Type I of Type II.

3.3.3 Water

Water shall be clean and free from injurious amounts of oils, acids, alkaline, salts, organic materials, or other substances that may be deleterious to concrete or steel.

3.3.4 Admixtures

Admixtures shall be subject to prior approval by the Project Manager. The admixtures shall be capable of maintaining essentially the same composition and performance throughout the work.

3.3.5 Fine Aggregates

Fine aggregates shall consist of natural sand, manufactured sand, or a combination thereof. If the fine aggregate shall be a combination of separately processed sizes, or if batching shall result in a combination of natural and manufactured sand, the different components shall be batched separately. Fine aggregates shall consist of hard, tough, durable, uncoated particles. The specified percentages of fines in the sand may be obtained either by the processing of natural sand or by the production of suitably graded manufactured sand. The shape of particles shall be generally rounded or cubical and reasonably free from flat or elongated pieces. The use of beach sand shall be prohibited.

3.3.6 Coarse Aggregates

Coarse aggregate shall consist of washed gravel, crushed stone or rock, or a combination thereof conforming to ASTM C33. The coarse aggregate, as delivered to the batching plant, shall have uniform and stable moisture content. The approval of deposits shall not be construed as

constituting the approval of all materials taken from the deposits, and the Contractor shall be held responsible for the specified quality of all such materials used in the work. Coarse aggregate shall consist of hard, tough, durable, clean and uncoated particles. All foreign materials and dust shall be removed and shall be generally rounded or cubical, and the coarse aggregate shall be reasonably free from flat and elongated particles. A thin, flat and elongated particle can be as defined as a particle having a maximum dimension greater than five times the minimum dimension. The coarse aggregate shall be graded from fine to coarse. It shall be separated into size groups.

Use 19-mm (3/4") coarse aggregate for slab on grade, columns, beams, suspended slabs and tie beams.

Use 38 mm (1 1/2") coarse for footings

3.3.7 Reinforcing Steel

Reinforcing steel shall be locally manufactured, deformed billet steel bars conforming to Philippine Standard, Grade 275, Intermediate grade (40, 000 psi).

3.3.8 Forms

Concrete form shall be wood, plywood, steel or other suitable materials. Form surfaces requiring standard or special finish shall be plywood or a non- absorptive hand pressed fiberboard or other suitable materials. Plywood shall not be less than 12 mm thick and shall be free from irregularities, dents and sags. Forms shall be coated with non-staining form coating compound such as form oil of the approved make.

3.3.9 Storage of Materials

(1) Cement

Cement in bags shall be stored in a suitable weatherproof structure as airtight as practicable. Floors shall be elevated above the ground, sufficient to prevent the absorption of moisture. Bags shall be stocked close together to reduce circulation of air but shall not be stocked against outside walls. The manner of storage shall permit easy access for inspection and identification of each shipment. Cement that has been stored for so long that there may be doubt of its quality shall be tested by standard mortar tests to determine its suitability for use, and shall not be used without approval of the Project Manager.

(2) Aggregates

Aggregate shall be stored in such a manner as to avoid the inclusion of foreign materials. Aggregates of different sizes shall be stored in separate piles. Stockpiles of coarse aggregate shall be built in horizontal layers not exceeding 1200 mm in depth to avoid segregation. Should the coarse aggregate become segregated, it shall be remixed to conform to the grading requirements here on before. Sufficient stockpiles shall be maintained at all times to permit continuous placement of concrete at the rate specified.

(3) Reinforcing Steel

Reinforcing steel shall be stored in a manner to avoid excessive rusting or being coated with grease, oil, dirt and other objectionable material

3.4 Construction Requirements

3.4.1 Concrete Proportion

The proportion of all materials in concrete shall be subject to the approval of the Project Manager. The Contractor shall employ at his own expense an approved testing laboratory, which shall design the mix proportions in accordance with ACI 211.01. Strength requirements shall be 20.7 Mpa (3000 psi) for footing, columns, beams, slabs and stairs, lavatory counter, wash basin; 17.2 Mpa (2500 psi) for ramp, slab on grade, water meter box, grease trap; and 13.8 Mpa (2000 psi) for lean concrete or as required by the Project Manager. The adequacy of this test shall be verified by a test on a minimum of 6 cylinders; 3 tested at 7 days, 3 at 28 days, in accordance with ASTM C39.

If, at any time during construction, the concrete resulting from the approved mix design proves to be unsatisfactory for any reason such as too much water, lack of sufficient plasticity to prevent segregation, honeycomb, etc., or insufficient strength, the Contractor shall notify the testing, laboratory and the Project Manager. The laboratory shall modify the design, subject to the approval of the Project Manager / Authorized Representative / Authorized Representative until satisfactory concrete is obtained.

3.4.2 Concrete Samples and Testing

Sampling and testing of concrete shall be done by and at the expense of the Contractor. Throughout the period that the concrete is being poured into cylinder shall be taken from fresh concrete from the forms.

The rests shall be made for each 10 cu. m. of concrete or fraction thereof for each portion of structure as may require by the Project Manager / Authorized Representative / Authorized Representative as follows:

(1) Compression Tests:

At least two (2) sets of samples consisting of three (3) concrete cylinder specimens per set shall be made. Fresh concrete shall be placed inside standard 150 x 300 mm cylindrical mold in three (3) separate equal layers and rodded separately with 25 strokes with a 16 mm diameter tamping rod. Surface shall be leveled with trowel and samples are to be labeled to identify the class, strength of concrete, date taken and part of structure samples are taken. The samples shall be cured in accordance with ASTM C31.

One set of cylinders shall be tested at the age of seven (7) days, and one set at the age of twenty-eight (28) days, in accordance with ASTM C39. Additional cylinder samples may be molded in reserve for further tests, if the results of the twenty-eight (28)-day-test do not meet the requirements.

(2) Slump Tests

Slump tests shall be performed to determine the consistency or workable fluidity of freshly mixed concrete in the field. At least two slump tests shall be made and the sample of concrete from which the test specimens are made shall be representative of the entire batch and shall conform to the procedures are specified in ASTM C143.

Freshly mixed concrete shall be placed in the slump cone 100 x 200 mm x 300 mm in three (3) equal layers. Each layer shall be rodded with 25 strokes of the 16-mm diameter tamping rod with the tamping end rounded to a hemispherical tip of the same diameter. The mold shall be leveled and lifted at once and then measure the slump action immediately by getting the difference in height between the height of the mold and the top of the slumped concrete.

The slump tests shall be performed to determine the consistency or workable fluidity of freshly mixed concrete in the files. At least two slump tests shall be made and the sample of concrete from which test specimens are made shall be representative of the entire batch and shall conform to the procedures as specified in ASTM C143.

The slump for vibrated concrete shall be 50 mm minimum and 100 mm maximum, provided that the required strength of concrete is obtained.

(3) Test Reports

The testing laboratory shall submit four (4) copies of its cylinder which are to include as far as applicable, the following items: Location of pour in the structure, concrete design mix number, concrete design strength, type and manufacturer of cement, amount of any admixture used, slump tests, date of sampling, cylinder application number, days cured in the field, days cured in the laboratory, age and time of testing, crushing stress, type of failure, who made the samples, who shipped the samples to the laboratory and whether concrete strength meets the specifications.

(4) Additional Tests

If, in the opinion of the Project Manager, based on the cylinder reports, concrete with strengths below specification requirements has been placed, the Project Manager, at the expense of the Contractor shall make additional tests. Additional tests may be compression test on cored cylinder, ASRM C42, and/or load tests as outlined in ACT 318 Sec. 202.

3.4.3 Mixing Concrete

Mixing shall be thoroughly done in a mixer of an approved size and type to insure a uniform distribution of the materials throughout the mass:

(1) Site-Mixed Concrete

All structural concrete shall be machine-mixed for at least 1 ½ minutes after all materials including water are in the mixing drum. The time elapsed between the introduction of the mixing of water to the cement and aggregate and placing of the concrete in final position shall not exceed 45 minutes. Placing of the material in the mixer shall be done in such a way that the first batch of concrete materials in the mixer shall contain sufficient excess cement, sand and water to coat the inside of the drum without reducing the cement content of the mix to be discharged. The tempering of concrete, placing additional cement, aggregate or water during mixing period shall not be permitted.

No hand mixing shall be allowed, except in case of emergency of breakdown during pouring operations, subject to the approval of the Project Manager.

(2) Ready-Mixed Concrete

Ready-mixed concrete, when shall be batched, mixed and delivered from a plant approved by the Project Manager, and shall be in strict compliance with the requirements set forth in ASTM C94.

The rate of delivery of the mixed concrete shall be such that the interval between placing of successive batches shall not exceed thirty (30) minutes. The elapsed time between the introduction of mixing water to the cement and aggregate, and completion of discharge shall not exceed one (1) hour, or not more than 1 ½ hours if retarder is used. It should be kept constantly agitated during the transit period. Delivery tickets shall contain data on the weight of sand, gravel and amount of cement and water added. The Contractor shall keep legible copies available for examination of the Project Manager.

Tempering of concrete shall not be permitted. The Contractor shall mix only quantities required for immediate use and mixture, which has developed setting, shall not be used. Concrete, which has partially hardened, shall not be tempered.

3.4.4 Concrete Placing

Concrete shall be placed only after all formworks, materials to be embedded, and preparation of surface involved in the placing have been inspected and approved by the Project Manager. The Contractor shall provide equipment and shall employ methods that will minimize separation of aggregates from the concrete mix.

Water shall be removed from excavation before concrete is deposited. Flow of water shall be diverted through proper side drains to a pump, or removed by other approved methods to avoid washing over freshly deposited concrete. Hardened concrete, debris and foreign materials shall be removed from the interior of forms and from inner surfaces of mixing and conveying equipment. Reinforcements shall be secured in position, inspected and approved before pouring concrete. Runaways shall not be provided for wheeled concrete-handling equipment's, such equipment shall not be wheeled over reinforcement nor shall runaways be supported by reinforcements.

Concrete shall be handled from the mixer to the place of final deposits as rapidly as practicable by methods, which shall prevent segregation or loss of the ingredients. It shall be deposited in the forms in approximately layers and as nearly as practicable in its final position to avoid re-handling.

Conveying or handling of concrete by the use of inclined chutes or pipes of more than three (3) meters shall not be permitted. Dumping of concrete into buggies, buckets or wheelbarrows with a free fall of more than one (1) meter shall not be permitted. When placing operations would involve dropping of concrete more than 1 ½ meters, it shall be deposited through a sheet metal or other approved conveyor. As for practicality, the conveyor shall be kept full of concrete during placing and their lower ends shall be kept buried in the newly placed concrete. After the initial set of concrete, the forms shall not be jarred and no strain shall be placed on the ends of the reinforcing bar, which are being projected.

Concrete in columns shall be placed in one continuous operation. Concrete in girders, beams and slabs in superstructures shall be poured in a monolithic and continuous manner. No construction joint shall be allowed on any part of the structure without the approval of the Project Manager.

Consolidate all concrete in accordance with provisions of ACI 309R. Consolidate each layer of concrete greater than 4 inches in depth with high frequency, interval, mechanical equipment supplemented by hand spading and tamping. Consolidate concrete slab 4 inches or less in depth by wood tampers, spading and settling with a heave leveling straight edge. Operate vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Insert and withdraw vibrators approximately 18 inches apart. Penetrate the previously place lift with the vibrator when more than one lift is required. Place concrete in 180-inch maximum vertical lifts. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation of aggregates. Provide adequate number of units and power source at all times. Maintain spare units on hand to ensure adequacy. If in the opinion of the Project Manager / Authorized Representative / Authorized Representative the equipment being used is not adequate to accomplish proper consolidation, the Project Manager / Authorized Representative / Authorized Representative may order delay in further placement of concrete until such equipment is available for use at the location of placement of concrete.

3.4.5 Protection and Curing

(1) General

Concrete surfaces exposed to conditions causing premature drying shall be protected as soon as possible with canvas, straw, burlap and or other satisfactory material and kept moist; or the surfaces are not covered they shall be kept moist by flushing or sprinkling, as directed by the Project Manager. All concrete shall be moist cured for a period of not less than seven (7) consecutive days after placing by an approved method or combination of methods applicable to local conditions.

(2) Moist Curing

The surface of the concrete shall be kept continuously wet watered for a period of seven (7) days, by spraying or covering with burlap or other approved material thoroughly saturated with

water and keeping the covering wet by spraying or intermittent hosing. Water for curing shall be generally lean and free from any element, which might cause objectionable staining or discoloration of the concrete.

3.4.6 Repairs to the Concrete

All imperfections on concrete surfaces are corrected to produce concrete surfaces that conform to the requirements of this section. Unless otherwise approved by the Project Manager, patching with the cement mortar shall repair imperfections on formed surfaces. Cement mortar for patching shall be the same composition as used in the concrete, except for exposed surfaces; part of the cement shall be white cement to provide a finish color matching the surrounding concrete. Honeycomb or otherwise defective areas shall be cut out from solid concrete to a depth of not less than 25 mm. The edges of the cut shall be perpendicular to the surface of the concrete. The area to be patched, at least 15 mm adjacent thereto shall be saturated with water before placing the mortar. The mortar shall be mixed approximately one (1) hour before placing and shall be remixed occasionally during this period with trowel without adding water. A grout of cement and water, mixed to a consistency of paint, shall then be brushed onto the surface to which the mortar is to be bonded. The mortar shall be compacted into place and screened slightly higher than the surrounding surface. Patches on exposed surfaces shall utilize plywood forms, after the removal of forms, shall not be plastered, unless otherwise directed by the Project Manager. All joint marks on the formwork shall be reworked to a smooth surface to match adjacent areas and to present a new appearance.

3.4.7 Forms

(1) General

Forms shall be used whenever necessary to confine the concrete and shape it to the required lines and dimensions, or to protect the concrete from contamination. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall be maintained rigidly in correct position. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Forms for exposed surface shall be lined with form grade plywood. Bolts and rods used for interval ties shall be so arranged that when the forms are removed, they shall not be less than two (2) centimeters from the formed surface.

Removal of forms or shoring is subject to approval by the engineer, and under no circumstances shall bottom form and shoring be removed until after the members have acquired sufficient strength to support their weight and the load thereon. Forms shall remain in place for a minimum time as follows:

Columns, sides of beams, shear and bearing walls	Beams	3 days
Re-shore immediately after stripping beams and girders that support subsequent formwork		14 days

Re-shore immediately after stripping beams and girders that support subsequent formwork.

(2) Cleaning and Oiling Forms

Before placing concrete, the contact surface of the forms shall be cleaned of incrustations of mortar, grout or other foreign material. Forms shall be coated with standard form oil that can effectively prevent sticking and will not stain the concrete surfaces.

(3) Removal of Forms

Forms shall be removed in a manner, which shall prevent damage to concrete structures. Forms shall not be removed without prior approval of the Project Manager. Any repairs of the surface imperfections shall be performed at once and curing shall be started as soon as the surface is sufficiently hard to permit it without further damage. The minimum time period for removal of forms shall govern where it exceeds the minimum specified curing period. Where the formwork for one element supports the formwork of another element, the greater time period shall apply to both elements. Forms shall not be removed before the expiration of the minimum time specified below:

Element	Time Period
Walls columns, sides of beams and girders, and slabs on grade	1
Joist, beam or girder, soffits: (Clear span between structural support):	
Under 3.00 m (10 ft.)	7
3.00 m (10 ft) to 6.00 m (20 ft.)	14
Over 6.00 m (20 ft)	21

Sufficient shoring members to support dead loads including construction loads on beams and slabs shall be provided for a period of eight (8) days in addition to the seven (7) days specified thereto. The time for removal of forms for structures not included thereto shall be as directed by the Project Manager. Concrete work shall be protected from damage during construction,

3.4.8 Reinforcing Steel

(1) General

Steel reinforcement shall be provided together with all the necessary wire tie chairs, spacers, support and other necessary devices.

(2) Cutting and Bending

Reinforcing steel shall be accurately cut and bent in accordance with the approved detailed reinforcement drawings. Reinforcing steel shall not be straightened or re-bend in a manner that will injure the material. Bars with kink or with bends not shown on the approved detailed reinforcing drawings or with cracks or splits of the bends shall not be used. All the bars shall be bent cold. If Contractor elects to have reinforcing steel cut and bent off the site, he shall provide, maintain and operate a small cutting and bending shop on the site and maintain and representative stock of steel. This provision is to take care of minor revisions and additions in an expeditious manner.

The Project Manager / Authorized Representative / Authorized Representative may require the contractor to prepare and submit bar cutting schedule prior to fabrication of reinforcing steel bars.

(3) Placing Reinforcement

Reinforcing steel shall be accurately placed in accordance with approved detailed reinforcement drawings and shall be adequately secured against displacement by using specified tie wires or approved clips at all intersections. After it has been installed, reinforcing steel shall be inspected by the Project Manager / Authorized Representative / Authorized Representative for compliance with requirements as to size, shape, length, splicing, position and number. Reinforcing steel shall be supported by concrete or metal supports, spacers or metal hangers, except for surfaces exposed to the ground or to the weather, where supports shall be concrete. Wooden support spreaders shall not be used. At surfaces where attractive appearance is required, the supports shall be of the type, which shall not cause subsequent staining or marring of the exposed surface.

3.4.9 Joist in Concrete

(1) Construction Joints

Construction joints shall be provided where indicated in the drawing or as directed by the Project Manager. Joints not indicated on the drawings shall be constructed and located as not to impair the strength of structures. When a construction joint is to be made, the surface of the hardened concrete shall be thoroughly cleaned and all laitance removed. In addition, the joint shall be thoroughly wetted and sloshed with a coat of neat cement grout immediately, prior to placing of new concrete.

(2) Expansion and Contraction Joints

Expansion and contraction joints shall be provided where indicated and shall be in accordance with details.

(3) Preformed Strips

Preformed strips shall be placed before the adjoining concrete is poured. The joint scalier shall be applied after concrete on both sides of the joint have been poured and after the joint lines have been trued.

3.5 Methods of Measurement and Basis of Payment

The Project Manager / Authorized Representative / Authorized Representative shall be in accordance with the dimension in the plan or as otherwise direct the measurement of completed work. The quantities to be paid for under this section shall be measured as follows:

- a. The volume to be paid for under this item shall be the number of cubic meters of concrete placed and accepted. Payment for concrete shall be constructed to include the cost of forms, false works, curing, fasteners and accessories necessary to complete this item of work.
- b. The quantities for reinforcing steel to be paid for shall be the final quantity placed and accepted in the completed structure. No measurement for payment shall be made for splices added by the Contractor for his convenience. Payment for the accepted quantities for reinforcing steel shall be deemed to include the cost tie wires, separators, wire, supports, hangers, chairs and other materials necessary to complete the work.

The quantities measured as provided above shall be paid for at the contract price for each of the pay item, which price and payment shall be full compensation for furnishing and placing all materials, labor, equipment, tools and incidentals necessary to complete the work.

4. MASONRY

4.1 Scope of Work

- 4.2 The work includes furnishing and placing of concrete masonry units in conformity with the lines, grades and cross-sections shown on the drawings and in accordance with the specifications.

4.3 Applicable Documents

The latest edition of the following specifications and standards shall form part of this specification to the extent required by the references thereto.

ASTM	America Society for Testing Materials
C144	Standard Specification for Aggregate for Masonry Mortar
PSA	Product Standards Agency Publications (Philippines)
PNS 16	Specification Concrete Hollow Blocks

4.4 Material Requirements

- 4.4.1 Concrete Hollow Blocks
Concrete hollow blocks shall be a standard product of recognized manufacturer to PNS 16, as indicated on the drawings. Exterior and interior masonry units shall be non-load bearing units. However, load-bearing units may be provided in lieu of non-load bearing units. For non-load bearing units, the required compressive strength shall be 25 kg/cm² or 2.48 Mpa.
- 4.4.2 Cement, Reinforcing Steel and Water
Cement, reinforcing steel and water shall be as specified in Section 3.0.

4.5 Construction Requirements

4.5.1 Workmanship

Masonry walls shall be placed level and plumb all around. One section of the walls shall not be placed in advance of the others, unless specifically approved. Unfinished work shall be stepped back for joining with the new work; tooting shall not be permitted. Heights of masonry work shall be checked with an instrument at sills and heads of openings, to maintain the level of the walls. Door and window frames, louvered openings, anchors, pipes and conduits shall be installed carefully and neatly as the masonry work progresses. Spaces around door frames shall be filled solidly with mortar. Drilling, cutting, fitting and patching to accommodate the work of others, shall be performed by skilled workers. Bolts, anchors, inserts, plugs, ties and miscellaneous metal work specified elsewhere shall be placed in position as the work progress. Chases of approved dimensions for pipes and other purposes shall be provided, where indicated or necessary. Top of exposed walls and partitions, not being worked on, shall be covered with a waterproof membrane, well secured in place. Wall and partitions shall be structurally bonded or anchored to each and to concrete wall beams, and columns.

4.5.2 Mortar Mixing

Mortar materials shall be measured in approved container to insure that the specified proportions of materials are controlled and accurately maintained during the progress of the work. Unless specified otherwise, mortar shall be mixed in such a manner that the materials will be distributed uniformly throughout the mass. A sufficient amount of water shall be added gradually and the mass further mixed, not less than 3 minutes, until a mortar of the plasticity required for the purpose intended shall be obtained. The mortar shall be mixed in a manner such that the quality of water can be controlled accurately and uniformly. Mortar boxes, pans of mixing drums shall be kept clean and free of debris or dried mortar. The mortar shall be used before the initial setting of the cement has taken place; tempering of mortar in which cement has started to set shall not be permitted.

4.5.3 Proportion of Mortar Grout

Fine mortar grout shall be mixed in the volumetric proportion of one part Portland cement, ¼ part hydrated lime and 3 parts sand. Coarse grout shall be mixed in proportion of one part Portland cement, ¼ hydrated lime, 3 parts sand and 3 parts pea gravel passing a 3/8-inch sieve.

4.5.4 Use of Fine and Coarse Grout

Fine grout shall be used in grout spaces less than 50 mm in horizontal dimension or when clearance between reinforcement and masonry is more than 17mm.

4.5.5 Mortar Joints

Mortar joint shall be uniform in thickness, and the average thickness of any three consecutive joints shall be 9.50 mm. "Gage rods" shall be made and approved prior to starting the work and shall be used throughout the work. Changes in coursing or bonding after the work has started shall not be permitted. The jointer shall be slightly larger than the width of the joints, so that complete contact is made along the edge of the units, compressing and sealing the surface of the joint. Joints in masonry, which will not be exposed, shall be stuck flush. Joints shall be brushed to remove all loose and excess mortar. All horizontal joint shall be on level and vertical joints shall be plumbed and aligned from the top to the bottom of the wall with a tolerance of plus or minus 12 mm.

4.5.6 Concrete Masonry Unit

The first course of concrete masonry unit shall be laid in full bed of mortar, for the full width of the unit; the succeeding courses shall be laid with broken joints. Concrete masonry units with the cells verticals shall have bed-joints formed by applying the mortar to the entire top of the surface of the inner and outer face shell, and the head joints formed by applying mortar of a width of about 25 mm to the ends of the adjoining units laid previously. The mortar for joints shall be smooth, not furrowed, and shall be of such thickness that it will be forced out of joints as the units are being placed in position. Where anchors, bolts, ties and reinforcing bars occur within the cell of the units, such cells shall be solidly filled with mortar or grout as the work progress.

4.5.7 Reinforcement

Horizontal tie reinforcement shall be provided where indicated. Reinforcement shall be continuous and provided in the longest available lengths. Reinforcement above and below openings shall extend and be embedded into the columns, unless otherwise shown on the drawings. Splices shall overlap not less than 150 mm. Reinforcement shall be embedded in the mortar joints in the manner that all parts shall be protected by mortar. The two top courses of filler block walls shall have their cores filled with grout when placed in position.

Unless otherwise shown on the drawings, the size and spacing of bars shall be as follows:

For Vertical Bars:

150 mm (6") CHB	12 mm (1/2") dia. At 600 mm {24"} on centers
100 mm (4") CHB	10 mm (3/8") dia. At 600 mm

For horizontal bars:

12 mm (1/2") dia at 600 mm
(24") on center (every third Course)
for 150 mm (6") and 100 m (4") CHBs.

4.5.8 Bonding and Anchoring

Masonry walls and partitions shall be accurately anchored or bonded at points where they intersect, and where they abut or adjoin the concrete frame of the building. All anchors shall be completely embedded in mortar.

4.5.9 Grout Placement

Grout shall be performed on the interior side of wall, except as approved otherwise, sills, ledges, offsets and other surfaces to be left exposed shall be protected from grout falling on such surfaces and be and shall be removed immediately. Grout shall be stirred before placing to avoid segregation of the aggregate and shall be sufficiently fluid to flow into joints and around the reinforcement without leaving any voids. Grout shall be placed by pumping or pouring from buckets equipped with spouts, in lifts not exceeding 1.2 meters high. Grout shall be puddle thoroughly to eliminate voids without displacing the masonry units from its original position. Masonry units displaced by grouting operation shall be removed and re-laid to its proper alignment using fresh mortar grout.

4.5.10 Tests and Test Reports

The testing requirements stated herein or incorporated in referenced contract documents may be waived provided certified copies of report of tests from approved laboratories performed on previously manufactured materials are submitted and approved. Test reports shall be accompanied by notarized copies from the manufacturer certifying that the previously tested material is of the same type, quality manufacturer, and make those

4.6 Method of Measurement and Basis of Payment

In measuring the quantity of masonry units for payment, the dimensions to be used shall be as shown on the plans or as directed by the Project Manager / Authorized Representative / Authorized Representative in writing. Projections extended beyond the faces of the wall shall not be included. The area to be paid for in this section shall be the number of square meters of concrete masonry wall and partition placed and accepted in accordance with the plans and specifications. Payment of accomplished work shall be deemed to include the cost of mortar grout, reinforcing steel, tie wires, false work and other necessary works to complete this item.

The quantity of concrete masonry walls and partition shall be paid for at the contract unit price shown in the bid schedule, which payment shall be full compensation for furnishing and placing all materials, labor, equipment, tools and incidentals necessary to complete the work.

5. METALS

5.1 Scope of Work

The work includes the furnishing, fabrication, erection or installation of structural steel roof framing, Stainless Handrails and miscellaneous metal work in accordance with this specification and as shown in the drawings.

5.2 Applicable Specifications & Standard

The latest edition of the following specifications and standards referred to hereinafter by basic designation only, shall form part of the specification:

ASTM	American Society for Testing and Materials
A36/A36M	Specification for Structural Steel
A53	Steel Pipe Zinc Coated Welded and Seamless Black and Hot-Dip
A307	Bolts and Studs, 60, 000 psi Tensile Strength
A570	Hot-rolled Carbon Steel Sheet and Strip, Structural Quality
A611	Steel, Cold-Rolled Steel, Carbon, Structural Quality
AWS	American Welding Society
D1.1	Structural Welding Code, Steel
AISC	American Institute of Steel Construction, Specification for the Design, Fabrication, Erection of Structural Steel for Buildings
AISI	American Iron Steel Institute, Specification for the Design of Light Gage Cold-Formed Steel Structural Members

5.3 Material Requirement

5.3.1 Structural Steel Shapes Plates and Bars

Unless otherwise shown or specified on the drawing, structural steel shapes plates and bars shall conform to ASTM specification A36/A6M.

5.3.2 Hot-Formed Steel Sheet and Strip

Unless otherwise shown or specified on the drawings, hot-formed steel and strip shall conform steel and strip shall conform to ASTM A570.

5.3.3 Screw and Expansion Bolts

Screw and Expansion bolts be of standard commercial grade, and of the sizes and types indicated as approved by the Project Manager

5.3.4 Electrodes

Electrodes for arc welding shall be E60. or E70, AWS D1.1

5.3.5 Galvanizing

Unless otherwise specified, galvanizing shall be of standard quality, hot-dipped process of 1.25 ounces per square foot of coating. Galvanized surface that are damaged prior to final acceptance shall be repaired using and approved repair compound to the satisfaction of the Project Manager.

5.3.6 Miscellaneous Metals

Miscellaneous metals including fastenings, anchorage's and incidentals not specifically mentioned herein or in other section of this specifications but are required to complete the work, for which there are no detailed drawings, shall be provided and installed in accordance with standard practice of the trades as approved by the Project Manager.

5.3.7 Delivery, Storage and Handling

Fabricated materials delivered to job site shall be stored in clean and protected dry areas in manufacturer's protective package. Structural steel materials to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Skids placed near enough together to prevent injury from deflection shall support long members, such as purlins and chords. The Contractor shall check the quantity and quality of materials turned over to him against the delivery list and report promptly in writing any shortage or damage discovered.

5.4 Construction Requirements

5.4.1 General

Fabrication and erection of structural steel shall be in accordance with AISC specification for the design, except as specified herein. The Contractor shall submit to the Project Manager / Authorized Representative / Authorized Representative for approval of shop drawings showing the proposed method of fabrication and installation of all metal work. No work shall be started until the shop drawings have been approved. And all work shall conform to the approved shop drawings.

5.4.2 Fabrication of Steel Structure

The work shall be well formed at the shape and size shown and assembled as detailed. Structural members shall be fabricated and assembled in the shop to the greatest extent as possible. Shearing and punching shall be produced in clean, true lines and surfaces with burrs removed. Nuts shall be drawn up tight. Joints, which are to be exposed to the weather, shall be water tight. Hole shall be cut, drilled or punched at right angles to the surface of the metal. Holes in base or bearing plates shall be drilled.

(1) Welding

Structural steel shall be welded in accordance with the standard code of Arc and Gas Welding in Building Construction of the American Welding Society. Qualified welders shall perform all welding work only.

(2) Shop Painting

Unless otherwise specified or indicated in the drawings, all structural steel work (except galvanized surfaced and surfaces that will be painted with epoxy) shall be given a shop coat of red lead or zinc chromate primer.

5.4.3 Erection

The steel structure shall be erected true to line and grades. Bracings and supports shall be introduced whenever necessary to take care of all the loads to which the structure may be subjected. Such bracings shall be left in place as long as may be required for safety. As erection progress, the work shall be securely bolted to take care of all the dead loads, wind and erection stresses. No reaming of undersize bolt holes shall be permitted, and erection bolts shall not be used for lining up members.

(1) Drift Pins

Drift pins may be used only to bring together several parts; they shall not be used in such a manner as to distort or damage the metal.

(2) Gas Cutting

The use of gas cutting torch in the fields for correcting fabrication errors shall not be permitted on any major member in the structural framing. Its use may be permitted only when the member is not under stress, and subject to the approval of the Project Manager.

(3) Base Plates and Bearing Plates

Base plates and large bearing plates shall be supported in steel wedges or shims until the supported members have been plumbed, following which the entire bearing are shall be grouted with no-shrink cement grout.

(4) Grouting Mortar for Setting Base Plates

Concrete grout shall be a non-shrinking type grouting mortar. The mortar subject to the approval by the Project Manager / Authorized Representative / Authorized Representative can either be a mixture of Portland cement, well graded fine aggregate, aluminum powder; and water or an approved commercial grouting mortar containing non-metallic chemical oxidizing agent. If adopted, the approved product shall be delivered to the site of the work in original sealed container bearing the trade name of the manufacturer. Surfaces to receive the mortar shall be clean and shall be moistened thoroughly before placing the mortar. Exposed surfaces of mortar shall be water cured with burlap for at least seven (7) days.

(5) Setting Up

Steel shall be erected plumb, level and properly guyed. In setting or erecting structural steel, the individual piece shall be considered plumb or level where the error does not exceed 1 to 500.

(6) Inspection

The Contractor shall give the Project Manager / Authorized Representative / Authorized Representative at least fifteen (15) days' notice prior to the start of work at the mill shop, so that the required inspection may be made. The term "mill" means any rolling, mill, shop or foundry where material for the work is to be manufactured or fabricated. No materials shall be rolled or fabricated until the said inspection has been provided.

The Contractor shall furnish the Project Manager / Authorized Representative / Authorized Representative with copies of the certificate mill reports of the structural steel structure preferably before but not later than the delivery of steel structure to the job site.

The Contractor shall furnish all facilities for inspection and the Project Manager / Authorized Representative / Authorized Representative shall be given free access to the mill or shop and premises at all times. The Contractor shall furnish without charge all labor; machinery, materials and tools necessary to prepare test specimens.

Inspection at the mill or shop is intended as a means of facilitating work and avoiding errors. It is expressly understood that it will not relieve the Contractor from any

onsibility for imperfect materials or workmanship and the necessity for replacing the same. The acceptance of any material or furnished member at the mill or shop by the Project Manager / Authorized Representative / Authorized Representative shall preclude their subsequent rejections if found defective before final acceptance of the work. Inspection of welding works will be in accordance with the provision of Section 5 of the "Standard Code for Arc and Gas Welding in Building Construction" of the American Welding Society.

5.5 Method of Measurement and Basis of Payment

The quantity of structural steel roof framing to be paid for shall be the number of kilos completed in place and accepted. Payment for the accepted quantities shall be deemed to include the cost of steel plates, anchor bolts buckles, sag rods, cross bracing, purlins mounting accessories and other works necessary to complete this work item.

The quantity to be paid for stair nosing and railing shall be the number of linear meter placed and accepted. Payment shall be construed to include the cost of false work, anchors, and other materials used in mounting this item.

The quantity determined as provided above shall be paid for the contract price for each of the pay item listed in the bid schedule, which price and payment shall be full compensation for furnishing and placing all materials, labor, equipment, tools and incidentals necessary to complete the work.

6. CARPENTRY AND JOINERY

6.1 Scope of Work

This section includes all rough and finish carpentry and joinery works, as shown in the drawings and in accordance with this specification.

6.2 Material Requirements

6.2.1 Plywood/Fiber Cement Board

Ceiling and partition shall be to 6-mm thick marine plywood or 4.5mm fiber cement board as specified in the plans or in the scope of work.

For interior walls or partitions as shown in the plans or as required, fiber cement board shall be installed in accordance with the manufacturers specifications:

Wall Framing (galvanized steel section) Standard materials are C-Stud, U- Track, Rivet or wafer screw, expansion bolt 6mm, drywall screw 25, 38, 40mm, corner metal bead or corner super bead.

6.2.2 Fasteners

Fasteners shall be of the type and size best suited for the purpose as shown in the drawing. Fasteners shall be zinc coated regular commercial size as indicated and shall conform to ASTM specification A307.

6.3 Construction Requirements

6.3.1 Workmanship

Lumber for framing and other carpentry or metal framing shall be fitted closely, set accurately to the required lines and levels, and shall be secured in a place in a rigid and substantial manner. Spiking, nailing and bolting shall be done in an approved manner. Spikes, nails and bolts shall be of the proper size, and care shall be taken so as not to split the members. All frames coming in contact with concrete or masonry shall be anchored by means of nails, metal screws with tox spaced sufficiently apart all around the contact surfaces. Bolt holes shall be drilled accurately and shall have a diameter of 3 mm more than the bolt size. All exposed wood surfaces shall be smoothly dressed and if so required, shall be well sand papered to an even smooth surface ready for finishing.

6.3.2 Finish Framing

Grades and species of wood shall be as specifies. Interior finish shall be set plumb, level, square and in true alignment and joints shall be tight and formed to conceal shrinkage. All finish framing, shall be done as much as possible with carefully fitted mortise and tendon joints as much as possible, if not possible locate them in inconspicuous places where nailing is permitted on wood surfaces. Nailing and blocking shall be provided as necessary.

6.3.3 Rough Framing

Framing and other rough carpentry shall be fitted closely and set accurately to the required line and levels and shall be secured in place in a rigid and substantial manner. Framing members shall not be spliced between bearing points and shall be provided as necessary for the proper completion of the work. Nailing shall be done in an approved manner, so as not to split the framing members.

6.3.4 Protection of Work

The Contractor shall protect all finished woodwork and millwork from injury after it has been set in place until completion and final acceptance.

6.3.5 Hardware

Items of hardware to be installed shall be as directed or as shown in the drawings and fitted carefully, attached securely. Care shall be exercised not to mar or injure the work.

7. DOORS AND WINDOWS

7.1 Scope of Work

This section calls for the furnishing, fabrication and installation of doors and windows in accordance with the plans and specifications.

7.2 Material Requirements

7.2.1 Fabricated Doors

The contractor shall provide heavy duty door pivots or thin-slab floor hinges and other required accessories such as stainless steel door handles, standard duty deadbolt lock, stainless steel kick plate and stainless steel push plate for stretchers. Details and sizes shall be in accordance with the plans and supplementary drawings.

7.2.2 Windows

Aluminum Casement Windows

All windows shall be products of reputable and nationally known manufacturers approved by the Construction Officer. Unless otherwise indicated, Windows shall be designed for glazing from outside with continuous glazing heads.

The Contractor shall submit to the Officer shop drawings for approval showing design, elevation of window, full sections of sash, frames and mullion, hardware, construction and assembly details. Details of anchorage, erection, proposed location and method of jointing and splicing of the unit to be installed shall be clearly shown. Fabrication shall not commence until these shop drawings have been submitted and approved.

7.2.3 Materials

Window members shall be aluminum frame.

7.2.4 Construction

Corners of the frames and vents shall be riveted, exposed surfaces ground smooth.

Hinges shall have bronze-to-steel contact surfaces throughout. Hinge pins shall be steel, rust proofed.

Double, full contact weathering shall be provided between vents and frames around the entire perimeter of each vent.

Windows shall be designed for glazing from the outside with angle glazing clips and steel sash putty. All units shall be prepared for and supplied with necessary standard hardware.

7.2.5 Hardware

Hardware for doors and windows shall be acceptable foreign and local products of the types, materials, sizes and mechanism as indicated on the drawings, and shall be free from any mark or other defect. Submit samples for Construction Officer's or Architect's approval.

Hinges and door closer shall be the type size and capacity as indicated on the drawings, however, the Contractor shall verify each hardware item as to weight and other load of doors and windows, and minor modifications may be made without change in construction cost.

Each vent shall be a solid bronze, polished, cam locking handle and strike.

7.2.7 Shop Finish

All windows shall be given one shop coat of approved rust inhibitor of the standard type with the steel window manufacturer.

7.2.8 Painting

Refer to the Section entitled PAINTING.

7.2.9 Protection and Cleaning

The Contractor shall be responsible for protecting the windows during construction and for cleaning at the completion of the building.

7.2.10 Samples and Submittals

Submit samples of panel glass not less other than 2" x 3" and glazing materials in lengths not less than 6" for Construction Officer's approval. Submit manufacturer' specifications and recommendations for glazing conditions specified herein. Submit certificate of compliance, certifying conformity with the requirements of this specification.

7.2.11 Delivery

All glass shall carefully packed for transportation, exercising reasonable precaution to insure avoidance of damage during transit. Care shall be insured in unloading, unpacking and storage on arrival at jobsite to avoid damage. Deliver all glazing accessory materials in manufacturer's original unopened containers, clearly marked as to their contents.

7.2.12 Storage

Store all materials at the jobsite, in a manner assuring its safety from all forms of damage. Protect glass from soiling, condensation, etching, etc., Follow manufacturer's recommendations properly.

7.2.13 Glazing

Prevent glass from contact with metal or any hard or sharp materials by use of resilient shims placed at a quarter points. Use resilient sealants. Use stops in sizes permitting a "good grip" onto glass. Install glass only in opening that are rigid, plumb and square. Allow sufficient clearance at edges of glass to compensate for its expansion or for some settlement of the building. Clearance should be ¼ inch from edge to frame and 1/8 inch for face, markings, banners, posters and other decal should not be spelled directly to glass surface as these could cause thermal stresses. Removal of part of glazing compound smears from glass shall be performed by the glazing contractor during the materials normal work life. Failure to do so may result damage to the glass.

7.3 Construction Requirements

7.3.1 Installation of Doors

Doors shall be installed only after the completion of other works, which may affect the moisture content of the door. Doors shall be fitted and trimmed as required by the opening they will cover. Doors shall have a clearance of 3 mm at the side and top and shall have a bottom clearance of 6 mm over thresholds or as shown on details. The lock edge shall be leveled at the rate of 3-mm in 50 mm. Cuts made on the jambs shall be sealed immediately after cutting, using a clear water-resistant varnish or sanding sealer.

Doors with surfaces receive paint finish may be furnished factory primed, and doors with natural finish may be furnished factory pre-finished. Final furnishing shall be done in site in accordance with painting and varnishing specifications.

7.3.2 Installation of Window

Window framing and aluminum and steel frame shall be fitted closely, set accurately to the required lines and levels, and secured and place in a rigid manner with the use of appropriate fasteners. Frame corners shall be mitered and mechanically locked to attain extreme rigidity.

Steel casement and aluminum frames and glass shall be of the design, size and thickness as indicated.

Steel casement and aluminum framing and clip shall be shop fabricated and shall be loosely pivoted to allow free movement. The leaves shall be secured. Movable section of the window shall allow easy operation either to close or open operation.

Doors and windows screen shall be installed by well experienced installer and shall be in accordance with the instruction of the project manager.

7.3.3 Installation of Builders Hardware

(1) Door knobs and lock

All lock and latch strike shall be installed in door frames at the same height from the floor. Door knobs shall be so located that the center of the knob is 0.90 m from the finished floor.

(2) Butt Hinges

Each panel of hinged door shall be provided with two (2) butts for doors 1.50 m or less in height; three (3) butts, over 1.50 m high and not over 2.10 m in height. Doors of a greater height than 2.10 m, unless otherwise specified, shall be provided with an additional one- butt for each 0.65-m or fraction thereof.

7.4 Method of Measurement and Basis of Payment

The quantities for doors to be paid for shall be the number of square meter and/or number of units of door panel completed and accepted. Payment of this item shall be deemed to include the cost of jambs, heads, door frames, nailers, glass pane (if any) and finish hardware.

The quantities accomplished for steel or aluminum casement windows shall be measured in square meters of area and/or number of units completed and accepted. Payment of this item shall be construed to include the cost of window jambs, sill, transom, mullions, aluminum frames and finished hardware.

The quantities accomplished for each type of steel window shall be paid in square meters of area and/or number of units completed and accepted for each item of work. Payment for these items shall be considered to include the cost of steel frames, glass panels, finished hardware and glazing and incidental works.

The quantities accomplished for doors/windows screen shall be paid in square meters of area and/or number of units completed and accepted for each item of work. Payment for this item shall include the cost of aluminum frames, screen, accessories and other incidental works necessary to complete the work.

The quantities measured as stipulated above, shall be paid for at the contract unit price for each item, which price and payment shall be fully compensation for furnishing and placing all materials, labor, equipment, tools and incidentals necessary to complete the work described on this section.

8. FINISHES

8.1 Scope of Work

This section covers all works required in connection with surface finished on wood, metal, masonry and concrete surfaces in accordance with this specification and as shown in the drawings.

8.2 Material Requirement

8.2.1 Plastering Works

(1) Portland Cement

Cement shall conform to ASTM standard C150, Type 1

(2) Sand

Fine aggregates for plastering shall be natural sand and shall be retained between No. 50 and No. 100 sieves.

(3) Lime

It shall be dehydrated lime where the free (un-dehydrated) calcium oxide and magnesium oxide in the hydrated product shall not exceed 8 percent by weight.

(4) Water

Water used in mixing shall be reasonably clean and free of oil, salt, acids, alkali, grass or other substances injurious to the finished product.

8.2.2 Tile Works

Floor Tiles - Tiles shall be standard grade, unglazed vitrified tiles, and 6 mm thick. Color and pattern shall be as specified in the drawing or as approved by the Project Manager.

For all other floor finishes not indicated below, refer to schedule or call-out specifications of finishes indicated in the plan.

Vitrified Unglazed Floor Tile - standard grade unglazed natural clay type dust- pressed or extruded approximately 6 millimeters (¼ inch) thick.

Accessories - soap holders and paper holders shall be recessed type to follow color specified.

Vinyl floor tile wherever indicated in the drawing shall be 2.0mm thick or otherwise specified in the plans. Verify color, design and pattern.

Grout Materials

As required by the Project Manager / Authorized Representative / Authorized Representative or as follows: Portland Cement Grout:

Scratch Coat: 1 part Portland cement to 5 parts damp sand to 1/5 part hydrated lime.

Mortar Bed: 1 part Portland cement to 5 parts sand to ½ part hydrated lime.

Bond Coat: neat Portland cement paste.

Wall Tiles

It shall be 6-mm thick, standard grade, glazed vitrified tiles. Color and pattern shall be as shown in the drawing or as approved by the Project Manager. Tiles shall be free from lamination, serrated edges, chipped off corners and other imperfections affecting their quality, appearance and strength.

200 mm x 300 mm Vitreous Ceramic Wall Tiles (at Utility Room and all Toilets and Baths)

8.2.3 Paints

This item shall consist of furnishing all paints, enamels, varnishes and other products to be used including labor, tools and equipment required as shown on the Plans and in accordance with this Specifications.

Material Requirements

- All paint materials shall meet the requirements of the Standard Specifications of the Standardization Committee on supplies.
- All paint materials shall be delivered on the job-site in their original containers with labels and seals unbroken.
- Manufacture or brand of painting materials to be used shall be any of the leading brands or approved certified by the design Architect.
- Tinting Color, tinting colors shall first be grade pigments ground in alkyd resin, which disperse and mix easily with paint to produce the colors desired.

Preparation of Surfaces

- Inspect all surfaces in regard to their suitability to receive a finishing. In the event that imperfection due to materials or workmanship appear on any surfaces after the application of the paint, the coat of any correction shall be borne by the contractor. Damage to any painted finish due to carelessness or negligence of other shall be corrected.
- Neutralizer shall be quality surface conditioner to be diluted with water, neutralize lime activity in new exterior and interior concrete surfaces to improve paint adhesion and durability.
- Touch all knots, pitch streaks and sappy spots with shellac or other approved sealer. Putty nail holes cracks, etc., after the first coat with non- shrinking putty of a color to match that of the finish.
- Prepare masonry works surfaces to be painted by removing all dirt, dust, oil and grease stain, sand efflorescence. Masonry surfaces to be painted shall be free from alkali and thoroughly dry before paint is applied.
- Before applying succeeding coats, primers and undercoats shall be completely integral and performing the function for which they are specified. Properly prepare and touch up all scratches, abrasions, or any other disfigurement and remove any foreign matter before proceeding with following coat.
- Do not apply final coat on interior work until after other trades are finished with their work in any given area in normal sequence and all materials and debris removed and the premises left in satisfactory broom clean condition as approved.
- Remove or protect hardware accessories, plates, lighting, fixtures and similar items placed prior top paintings, reposition or remove protection upon completion of each space. Disconnect equipment adjacent to walls, where necessary, move to permit painting wall surfaces and following completion of painting, replace and reconnect.
- Except where otherwise noted or specified, all paints shall be applied in three (3) coats (priming body and finish coats). Each coat shall be roller applied (except as otherwise noted) spread evenly and in full covering body.

Patching Compound

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

Natural Wood Paste Filler

- Wood paste filler shall be quality filler ready mixed in can for filling and sealing open grains of interior wood. It shall produce a level finish for succeeding coats of paints, lacquer and other related products.

Application

- Paints when applied by brush shall be non-fluid, thick enough to lay down an adequate film of wet paint. Brush marks shall be flawed out after the application of paint.
- Paints prepared for application by roller must be similar to brushing paint. It must be non sticky when thinned to spraying viscosity to break up easily into droplets.
- Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. This procedure changes the required properties of the paint.
- Craftsmen should be experienced and skilled to assure finished work is of first class quality, appearance and durability shall perform all works.
- All paints and other coatings shall be mixed and applied strictly in accordance with the manufacturers' printed instructions.

Paint Schedule

- The types of paint specified are taken from paint catalogue equivalent materials from manufacturers listed herein and are intended to illustrate the expected quality of material. Where the contractor desires to use those other than what has been specified, a formal request in writing for approval of the Architect or Engineer should accompany such proposal. After the award, no substitution of materials for those mentioned in the accepted proposal will be permitted.

Exterior walls

Cement plaster over concrete use:

- Preparation of exterior and interior concrete walls
Prepare masonry surface to be painted by removing all dirt, dust, oil and grease stains and efflorescence. Treat with masonry Neutralizers # 44 or approve equivalent. Mix one liter of Masonry neutralizer with 16 liters of water, then apply liberally by brush and let dry overnight before rinsing with water. Let dry.
- Coat concrete primer and sealer
- Coats textures paint
- Coat semi gloss latex paint

8.3 Construction Requirements

8.3.1 Cement Finish on Masonry Walls

(1) General

The work consists of furnishing all materials, labor and performing all operations in connection with plastering masonry wall surfaces, complete in every respect as shown in the drawings and as specified herein. Plastering work shall be protected properly from being damaged during plastering operations. Scaffolding shall be amply strong, well braced, tied securely and inspected regularly. Overloading of scaffolding shall not be permitted.

(2) Mixing of Plaster

Except where hand mixing of small patches is approved, mechanical mixer of an approved type shall be used for the mixing of plaster. Materials shall be accurately measured by a device that will maintain the specified proportions within a plus or minus tolerance not in excess of 5% by volume. Plaster materials shall be accurately measured in approved containers to insure the specified proportions. Caked and mixing each batch and kept free of plaster from previous mixes. Plaster materials shall be thoroughly mixed with the proper amount of water until a uniform color and consistency is attained. Tempering shall not be permitted and all plaster that has begun to stiffen shall be discarded.

(3) Proportioning Plaster

Portland Cement plaster shall be a two-coat application, the base and finish coat. Each coat shall be proportioned as follows: One part by volume of Portland, to three parts sand. Hydrated lime may be used as directed by the Consultant.

(4) Application of Plaster

Surface to receive plaster must be free from structural defects and shall be thoroughly dampened prior to application of plaster.

Plaster base coats shall be applied with sufficient pressure and the plaster shall be sufficiently plastic to provide good bond on masonry base. The base coat shall be compacted and straightened to a true surface without the application of water and the entire surface shall be floated to receive the finish coat. The finish coat shall be applied to a thickness approximately 3 mm before the scratch coat has set. Maximum finish free from blemishes or irregularities. Trowling shall be continued until the finish surface sets. Immediately after setting, surfaces shall be sours vigorously with clean burlap or cement bag paper or brush to remove the sheen finish produced by trowling.

Plaster work shall be finished level, plumb, square and true, within a tolerance of 3mm in meters without waves, blisters, pits, crazing, discoloration, projections or other imperfections. Plaster work shall be formed carefully around angles and contours, and well up to screens. Special care shall be taken to prevent consequent dropping of applications. There must be no visible junction marks where one day's work adjoins another. Finished work shall be protected in an approved manner to prevent damage.

(5) Portland Cement Plaster

Cement plaster shall have a total thickness of not less than 12 mm thick. The base coat shall be applied not less than 9 mm thick and allowed to dry slowly for 24 hours. Then the finish coat shall be applied to a thickness of not less than 3 mm and brushed with 4 applications of fog spray of clean water. The first spray shall be applied 12 hours after the finishing coat has been completed and three subsequent spraying shall be applied at sufficient intervals thereafter as approved by the consultants.

(6) Patching and Pointing

Upon completion of the work all loose, cracked, damaged or defective plastering shall be cut and replastered in a satisfactory manner. All pointing and patching of plastered surfaces and where plastering abuts or adjoins any other finished works shall be done in a neat and workmanship manner ready to receive pain or other finish.

(7) Curing and Protection

Damp curing shall begin as soon as the mortar has hardened sufficiently to prevent injury and water applied in a fog spray to keep the plaster damp throughout without soaking. The period for damp curing shall be specified for each coat. Protect the plaster from uneven and excessive evaporation during hot or drying weather conditions.

(8) Cleaning

After the completion of plastering work, all scaffolding surplus materials, debris and plaster daubs and stains in floors, windows and other surface shall be removed to the satisfaction and approval of the Project Manager.

8.3.2 Cement Finish on Concrete Floor Slabs

(1) General

This work includes plain cement finish with or without red cement, and plain cement finish as bed for tiles, including all labor, materials, equipment and other facility to complete the work in accordance with the plans and specifications.

(2) Finishing Requirements

Floors and slabs shall be sloped uniformly to the drains. In areas where tiles are to be laid, the concrete base slab shall be depressed to not less than 50 mm, when not indicated. Floor and slab finishes, where not indicated, shall receive a single steel trawling. Dry cement shall not be placed directly on the new concrete surface to absorb excess moisture.

(3) Finishing Procedures

Finishing procedures for floors and slabs, where not indicated on the drawings, shall be as follows:

Finish	Description	Uses Screened
	Rough, free from Ridges and holes	Slab and concrete surfaces under Earth fill
Floated	Medium rough with Texture finished	Light storage areas, base slabs And heavy machine pads
Trawled	Fine and texture To flossy glass Finish depending Upon the number of passes	All surfaces: 1) under floor- 1 pass 2) normal wearing surface - 2 passes 3) Dense wearing surfaces-3

(4) Screened Finish

Concrete shall be placed, consolidated and immediately struck off to bring the top surface of the slab to proper grade. Floors shall be leveled with a tolerance of 3mm in 3.0 m, except where drain occurs, in which

case the floors shall be pitched to the drains. Striking off and bull floating shall be completed before water appears on the surface of the freshly-placed concrete. If water is still visible by the time floating is to start, the excess water shall first be scrubbed off the surface by appropriate means.

(5) Floated Finish

Floating shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to support a man without indenting the surface. Floating shall be performed by hand with a wood float. During the floating, the surface shall be checked with a 3.0-m straight edge applied at different angles. The surface shall be floated to a true plane within 3 mm in 3.0 meters.

(6) Trowled Finish

Upon attaining proper set, the floor shall first be given a floated finish as specified herein above and then hand trowled. The first trowling should produce a smooth surface, free of defects. The finished surface shall be free of trowled marks, uniform in texture and true to a plane within 3mm in 3.0 meters.

(7) Broomed Finish

The floor shall first be given a floated finish and a steel trowled finish as specified herein above and then surface shall be broomed with flexible bristle broom. The topping mixture shall be spread evenly over the roughened base before the final set has taken place. At the time of brooding, the trowled surface shall have hardened sufficiently to retain the scoring on ridges. The brooding shall be in a direction transverse to that of traffic or at right angles to the slope of the floor.

(8) Mixing of Red Cement

Red cement shall be thoroughly dry, mixed with fresh Portland cement using dry and clean equipment. The proportion shall be three (3) parts red cement to one (1) part Portland cement. Cement top finish shall be one (1) part Portland cement - red cement mix and one (1) part sand, mix with minimum water content.

(9) Application of Cement Finishes

The concrete slab to receive cement top finish shall be roughened before the concrete has set. Before applying the cement top finish, the concrete surface shall be further roughened with a pick of a similar tool remove laitance, loose particles, plaster and anything that would prevent bond and then cleaned by an approved method or device. After cleaning, the slab shall be thoroughly wet before top finish is applied. The cement top finish shall have a minimum thickness of 19 mm and shall be poured continuously until the entire section is complete. Cement top finish shall be floated either manually or machine, struck off with straight edge, steel trowled to a hard smooth surface, and graded to drain where required. Where the floor is to be hardened, ½ of the pre-mixed floor hardener shall be spread over the freshly poured cement top finish after screening and removing any excess water from the mixture and the floor shall then be floated. The balance of pre-mixed floor hardener shall be evenly spread over the surface at the right angles to the first application. The floor shall then be floated and care shall be taken to embed the floor topping with hardener firmly in surface of the concrete floor. The treated cement top shall be allowed to set sufficiently so that the surface may be steel trowled to a hard-scaled surface.

8.3.3 Other Cement Finish

(1) Patching of Surface Defects

All surface defects shall be repaired with cement mortar of the same composition as used in the concrete. Part of the cement in the mortar may be white cement, for patching exposed areas to match the color of the surrounding concrete. Patching shall begin as soon as the forms are removed and areas to be patched are cleaned thoroughly. Minor defective areas shall be cut out of the solid concrete to a depth of not less than 25 mm. And edges of cuts shall be perpendicular to the surface of the concrete. Area to be patched and about 150 mm of the adjacent surrounding areas approximately one (1) hour before placing and remix occasionally during this period without adding water. An initial grout of cement and water mixed to the consistency of paint of the required color shall be applied into the surface to which the mortar is to be bonded.

(2) Repairing of Structural Defects

Concrete with excessive honey-comb, exposed reinforcing bars and other defects which affect the structural strength of the members shall be removed and repaired by the Contractor to the satisfaction of the Project Manager.

(3) Finishing of Formed Surfaces

Finishing of formed surfaces, where not indicated in the drawings, shall be as follows:

(a) Surfaces exposed to public view shall be smooth form finished. No plastering work shall be done on exposed surfaces to correct imperfections. Form facing materials shall be used to produce a smooth, hard and uniform texture on the concrete. Tie holes and defects shall be patched and all fins shall be completely removed.

(b) Surfaces not exposed to public view shall be rough form finished. Tie holes and defects shall be patched and fins exceeding 6 mm in height shall be chipped off or rubbed off.

(c) Finishing of formed surfaces shall be accomplished after removal and repair of surface defects.

8.3.4 Tile Works

(1) General

The work consists of furnishing all materials, labor and performing all operations in connection with tile finishing of floors and walls, complete including mortar beds for the tile. Tile work shall not be started on portions where embedded lines crossed over the area until roughing-ins for plumbing and electrical work has been completed and tested. The work of all other trades in the areas where the work is to be done shall be protected from damage in a workmanship manner as directed by the Project Manager.

(2) Mortar for Tiles

A scratch coat for wall tile shall consist of one part Portland cement, $\frac{1}{4}$ part lime putty and 3 parts sand by volume. Scratch coat shall have a minimum thickness of 9mm. The buttering mortar for setting wall tiles and mortar setting bed for floor tiles shall have the same proportion as that of scratch coat.

(3) Floor Tiling

a. Preparation of Surfaces

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

b. Application of Floor Tile

All tiles shall be soaked in clean water to a minimum of one (1) hour before they are installed. Placing tile on a wetted cloth in a shallow pan before installing shall damp absorptive mounted tile. Before the initial set has taken place in the setting bed, a skim of Portland cement mortar 75 mm to 1.5 mm 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 carefully tapped into the mortar until true and even with the place of the finished floor base. Tapping and leveling shall be completed within one (1) hour after placing tiles. Borders and defined lines shall be laid before the field or body of the floor. Where floor drain is provided, the floor shall be sloped properly to the drains. Cutting of tiles, where necessary, shall be done along the outer edges of the tile against trim, base, thresholds, pipes, built-in fixtures and similar surfaces and shall be geared and joined carefully. Tiles shall be secured firmly in place, and loose tiles or tiles sounding hollow shall be removed and replaced to the satisfaction of the Project Manager. All lines shall be kept straight, parallel and true all finished surface brought to true and even planes.

(4) Wall Tiling

a. Preparation of Surfaces

Scratch coat shall be applied on prepared surface to serve as backing for wall tiles, not less than 24 hours or more than 48 hours before starting the tile setting. Temporary screeds shall be applied to the scratch coat to provide a true and plumb surface to the proper distance back from the finished wall. The setting bed shall be applied, rotted and floated flushed with the screeds over an area greater than will be covered with the tile while the bed remains plastic. The thickness of the setting bed shall not exceed 20 mm and the mortar shall not be tempered.

b. Application of Wall Tile

Tiles shall be soaked in clean water for a minimum of one (1) hour before they are installed. A skim coat of Portland cement mortar shall be mixed with water to the consistency of thick cream. 75 mm thick shall be applied to the mortar setting bed, or to the back of each tile. The tiles shall then be pressed firmly upon the setting bed and tapped until flush and even plane of the other tiles. The tiles shall be applied before the mortar bed has taken its initial set. Intersections and returns shall be formed accurately. All lines shall be kept straight and true; and all finished corners rounded. Horizontal joints shall be maintained level and vertical joints plumb alignment.

(5) Jointing

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

(6) Grouting

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

(7) Cleaning

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

8.3.5 Painting

(1) General

The work covered by this section consists of furnishing all labor, equipment, tools and materials in performing all operations in connection with painting and finishing, including protective coating of metal surfaces, complete in accordance with the specifications and the applicable drawings.

(2) Color and Samples

The Project Manager / Authorized Representative / Authorized Representative shall, in accordance with the color schemes shown in the drawings or as directed, follow all colors. Sample panels of selected colors, as least (1) meter square in area shall be prepared for approval by the Project Manager / Authorized Representative / Authorized Representative prior to the application.

(3) Workmanship

Skilled workers shall do all work in a workmanlike manner. Paints shall be evenly applied and free from sags, runs, crawls and other defects. All coats shall be of proper consistency and well brushed out or rolled

on so as to show a minimum brush or rolled marks. Brushes or rollers shall be clean and in good condition.

All coats shall be thoroughly dry before the succeeding coat is applied. Allow at least twenty-four (24) hours or more between applications of coat. For exterior painting during rainy season, allow one (1) week drying time before the succeeding coat is applied.

Painting coats as specified are intended to cover surfaces perfectly, if its surfaces are not fully covered, further coats shall be applied to attain the desired evenness of the paint application. All finishes shall be uniform as to sheen, color and texture. Paint may be applied by spray method, except when, in the opinion of the Project Manager, spraying in any particular application would produce unsatisfactory results. The Contractor shall provide all drop cloths and other covering requisite to the protection of the floors and other work.

Each surface shall be inspected carefully before applying any finish; and if surface is not in proper condition, they shall be notified to that effect in writing, otherwise the Contractor shall be held responsible for any defects in the finishes arising there from. Should a coat of paint be applied to a certain area with defects, it shall be knocked out and re-plastered by the Contractor and repainted to the satisfaction of the Project Manager.

(4) Inspection of Surfaces

The Contractor shall inspect all surfaces to be painted and all defects shall be remedied before starting the work. No work shall be started unless the Contractor has made certain the dryness of the surfaces. Test shall be made, in the presence of the Project Manager, to verify the dryness of surfaces to be painted.

(5) Concrete Surfaces

a. Surface Preparation

Before applying paint, concrete and cement surfaces shall be allowed to dry thoroughly. Clean surfaces of all dirt, alkali and grease before commencing work. Treat all surfaces with a solution of two (2) kilos of zinc sulfate to four

(4) liters of water and sufficient phenolphthalein to act as color warning. Presence of alkali is indicated when phenolphthalein turns red and further treatment is required to neutralize it. Allow the surface to dry at least three (3) days and remove and loose crystals from the surface before finishing.

b. Finishing:

For exterior and interior concrete surfaces and all other surface with cement plaster finish, use flat concrete paint with the specified brand approved by the Project Manager.

First Coat- Apply flat concrete paint thinned with ½ liter water per 4 liters of paint; tint with latex tinting color to closely match color of topcoat or use premixed paint. Dry for 3 to 6 hours.

Intermediate Coat- Repair all minor surface imperfection with paint putty made by mixing paint with patching compound powder. Let it dry for 24 hours, and then smoothen the surface with sand paper, before applying the final coat.

Final Coat- Apply semi-gloss or gloss paint tinted with latex tinting color to the shade specified.

Ducco or semi-ducco finish shall be applied using the appropriate paint sprayer by a well experienced painter.

8.4 Method of Measurement and Basis of Payment

The finished area to be paid for under each item shall be measured by the number of square meter painted surfaces accepted in accordance with the plans and specifications. The cost of tinting color, thinner, sand paper, putty including mixing, application, curing, false work and protection work shall be deemed to be included in the contract unit price for each pay item as shown in the bid schedule.

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

9 PLUMBING WORKS

9.1 Scope of Work

This item shall consist of furnishing all materials, tools, equipment and fixtures required as shown on the Plans for the satisfactory performance for the entire plumbing system including installation in accordance with the latest edition of the National Plumbing Code, and this Specification.

9.2 Material Requirements

This item shall consist of furnishing all materials, tools, equipment and fixtures required as shown on the Plans for the satisfactory performance of the entire plumbing system including installation in accordance with the latest edition of the National Plumbing Code, and this specification.

9.2.1 Water Closets shall be Tank Type Dual type/Lever Flush, elongated, Free Standing Combination round front bottom outlet siphon vortex or wash-down bowl with jet round front with close coupled tank with cover with complete fittings and mounting accessories.

9.2.2 Toilet lavatories shall be Semi-Pedestal Type, Wall hung lavatory with rear overflow and cast-in soap dishes pocket hanger and integral China Brackets complete with twin faucets, supply pipes, P-trap and mounting accessories.

Installation

- a. Align & mark flange holes for drilling, the top of the flange must be 20" from the floor
- b. Bolt knee control assembly flanges to the wall.
- c. Connect UNION fitting to in house water source pipe.
- d. Bolt in sink brackets 36" from the floor. Keep it centered with the knee controls and drain pipe.
- e. Connect flexible plastic hose to showerhead water supply.
- f. Install Drain and "P" trap.
- g. Install showerhead assembly.

9.2.3 Where indicated in the plans, the counter top model make and color shall be approved by the Architect or Engineer.

9.2.4 Stainless steel working sink shall be used to all working counters, it shall be made of stainless steel self-rimming, single compartment complete with supply fittings, strainer traps, dual control lever and other accessories, fitted to actual requirement as shown in the plans.

9.2.5 Pipes, plumbing fixtures, water lines, clean out and vents shall be supplied and installed in accordance with the approved workmanship.

9.2.6 Septic Tank

The septic tank shall be provided as shown on the plans including all pipe vents and fittings. Various construction materials such as concrete masonry work shall conform to the corresponding Items of this specification.

Inlet and outlet pipes shall conform to the latest edition of the National Plumbing Code.

9.2.7 Water Supply Pipes and Fittings

- a. Pipes shall be Pn 25 Fusion Weld Polypropylene Pipe conforming to specification requirements including Trims and Fittings.
- b. Valves for water supply shall be bronze body with threaded ends rated 21.0 kgf/cm square. All valves are gate valves unless otherwise specified. Gate valves shall have solid wedge body and discs conforming to specification requirements defined in ASTM B-62. Globe valves shall have plug type discs with ferrule-threaded ends and bronze body.
- c. Unions in ferrous pipe 50 mm in diameter and smaller shall be malleable iron.

9.2.8 Approved Alternate Pipes and Fittings

Pipes and fittings for sanitary and potable water lines as approved alternative shall be High Density Polyethylene (HOPE) pipes and fittings, Chlorinated Polyvinyl Chloride Pipes and Fittings (CPVC), and Unplasticized Polyvinyl Chloride Pipes and Fittings (UPVC). Pipes and fittings shall be made of virgin materials conforming to specification requirements defined in ASTM D-2241 and PNS 65: 1986. Fittings shall be molded type and designed for solvent cement joint connection for water lines and rubber O-ring seal joint for sanitary lines or Fusion weld.

9.3 Construction Requirements

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual structural and finishing work condition affecting all this work. Where actual condition necessities a rearrangement of the approve pipe layout for approval by the Project Manager.

9.3.1 Installation of Waste and Vent Pipes

- a. Horizontal lines shall be secured strongly by hooks to the building frame and suitable brackets or chairs shall be provided at the floor which they start.
- b. Vent pipes in roof spaces shall be run as closest possible to under side of roof with horizontal piping pitched down to stacks without forming traps. Vertical vent pipes connected into one main vent riser above the highest vented fixtures.
- c. Where an end circuit vent pipe from any fixtures is connected to a vent line serving other fixtures, the connection shall be at least 1.20 m above the floor on which the fixtures are located.
- d. Horizontal waste line receiving the discharge from two or more fixtures shall be provided with end vents separate venting of fixtures is noted on the plans.
- e. All changes in pipe size on soil and waste lines shall be made with reducing fittings or recessed reducers. All changes in direction shall be made by appropriate use of 45 degrees, wyes, half wyes, quarter bends or elbows in waste lines where the change in direction of flow is the horizontal to the vertical and on the discharge from waste closets. Where it becomes necessary to use short radius fittings in other location, the approval of the Project Manager / Authorized Representative / Authorized Representative shall be obtained prior to installation of the same.
- f. Vent pipe shall be provided with Vent Cap (Studer) and flashed and made watertight at the roof with ferrule lead. Flashing shall be turned down into pipes.

9.3.2 Water Pipes, Fittings and Connections

- a. The water piping shall be extended to all fixtures, outlets and equipment from the gate valves installed in the branch neat the rise.
- b. The cold water system shall be installed with a fall towards a main shut off valve band drain. Ends of pipes and outlet shall be capped or plugged and left ready for future connections.
- c. Mains and Branches
All pipes shall be cut accurately to measurements and shall be worked into place without springing or forcing. Care shall be taken so as to not to weaken the structural portions of the building.
- d. All piping above the ground shall be run parallel with the lines of the building unless otherwise indicated on the plans.
- e. All service pipes, valves and fittings shall be kept at sufficient distance from other work to permit finished covering on the different services
- f. No water piping shall be buried in floors, unless specifically indicated on the Plans and approved by the Project Manager.
- g. Changes in pipes shall be made with reducing fittings.
- h. Threaded Pipe Joints
All pipes shall be reamed before threading. All screw joints shall be made with graphite and oil or with an approved granite compound applied to make threads only. Threads shall be cut not more than three threads on the pipe shall remain exposed.
- i. Expansion and Contraction of Pipes
Accessible contraction-expansion joints shall be made whenever necessary. Horizontal runs of pipe over 15 m length shall be anchored to the wall to the supporting structure about midway on the run to force expansion and contraction equally toward the ends or as shown on the Plans.
- j. Valve shall not be installed with its stem below the horizontal. All valves shall be gate valves unless otherwise indicated on the Plans.

9.3.3 Fixtures, Equipment and Fastenings

- a. All fixtures and equipment shall be supported and fastened in a safe and satisfactory workmanship as practiced.
- b. Insert shall be securely anchored and properly flushed into the walls. Inserts shall be concealed and rigid.
- c. Bolts and nuts shall be horizontal and exposed. It shall be provided with washers and chromium plate finish.

9.3.4 Bathroom and Toilet Accessories

- a. Shower head (low water consumption) and fittings shall be movable, cone type with escutcheon arm complete with stainless steel; shower valve and control lever (ceramic disk type). All exposed surface to be chromium finish.
- b. Grab bars shall be made of tubular stainless steel pipe provided with safety grip and mounting flange for disabled people.
- c. Concealed floor drains shall be made of steel beehive type, measuring 10cm x 10 cm and provided with detachable stainless strainer, expanded metal lath type.
- d. Toilet paper holder and soap holder shall be vitreous china or approved equal wall mounted. Color shall reconcile with the adjacent fixture and facing tiles.
- e. Faucets shall be made of stainless steel for interior use (gooseneck type). Ceramic disk type.
- f. Hose bibs shall be made of stainless steel finish. Ceramic disk type.
- g. Cleanout shall be made of counter sunk plug brass.

9.4 Drainage System test

- 9.4.1 The entire drainage and venting system shall have all necessary openings, which can be plugged to permit the entire system to be filled with water to the level of the highest water or a full 30 minutes during which time there shall be no drop greater than 102 mm.
- 9.4.2 Where only a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system except that a vertical stack 3.00 m highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure or water pump may be used to supply required pressure.
- 9.4.3 If and when the Project Manager / Authorized Representative / Authorized Representative decides that an additional test is needed, such as an air to smoke test on the drainage system, the Contractor shall perform such test without any designated representative.

9.5 Water Test on System

- 9.5.1 Upon completion of the roughing-in and before connecting fixtures the entire cold water piping system shall be tested at a hydrostatic pressure 1 ½ times the expected working pressure in the system during operation and remain tight and leak-proofed.
- 9.5.2 Where piping system is to be concealed the piping system and in the presence of the Engineer of his duly designated representative.

9.6 Defective Work

- 9.6.1 All defective materials replaced and tested will be repeated until satisfactory performance is attained.
- 9.6.2 Any material replaced for the satisfactory performance of the system made shall be at the expense of the Contractor.
- 9.6.3 Caulking of screwed joints or holes will not be permitted.

9.7 Method of Measurement and Basis of Payment

The work done under this item shall be quantified per length and/or number of units as provided in the Bill of Quantities, tested and accepted to the satisfaction of the Project Manager. The accepted quantities measured shall be paid at the contract unit price and payment shall be full compensation including labor, materials and incidentals necessary to complete this Item.

10 ELECTRICAL WORKS

10.1 Work Included

- a. To secure and pay for the electrical permits, certificates, and other related permits.
- b. To secure and pay for the service charges and other fees required by the local electric utility company
- c. To secure and pay for the insurance required for the project.
- d. Supply and install/cause to install primary metering.
- e. Supply, installation, and testing of automatic transfer switches, manual transfer switches, panel boards, and disconnect switches.
- f. Supply and installation of pull boxes, circuit breaker and the like.
- g. Supply and installation of lighting fixtures, switches, and power outlets.
- h. Testing for electrical system:
 - Insulation resistance test
 - Ground resistance test
 - Continuity test
 - Operational test
 - Polarity check
- i. Anything that has been omitted in any of work or materials usually furnished which are necessary for the completion of the works as outlined herein shall be undertaken or supplied by the contractor included in this division of work and must be included in the bid proposal.

10.2 Code Regulations

All materials and equipment to be used in the electrical installations and construction shall be in accordance with the provisions of the latest edition of the Philippine Electrical Code and the pertinent ordinances of the municipality wherein the project is located.

All work shall comply with the rules and regulations of the local power utility company in so far as they are concerned in providing the respective permanent services to the building.

10.3 Drawings and Specifications

The electrical plans and these specifications are meant to be complementary to each other, and what is called for in one shall be as binding as if called for by both.

Any permanent conflict between the electrical plans and these specification and any unclear points of controversial matter in either shall be referred to the owner's assigned representative for final decision.

Upon final completion of the work herein described, the electrical contractor shall furnish the Owner two (2) copies of the "As-built" plans for future reference and maintenance purposes.

The electrical plans indicate the general layout of the complete electrical system, arrangement of feeders, circuit outlets, switches, controls, panel boards, service equipment and other work. Field verification of the scale dimensions on the plane must be made, since actual locations, distances and levels will be governed by actual field conditions.

The Electrical Contractor shall check architectural, structural and plumbing plans if necessary to resolve such conflicts. The Electrical Contractor shall notify the architect and secure approval and agreement on necessary adjustments before installation is started.

10.4 Permits and Inspection

The Electrical Contractor shall obtain all necessary permits and certificates of electrical inspection from the proper government authorities concerned, required both for the performance of the work involved and the operation of the system upon completion of the work.

The Electrical Contractor shall pay all the fees necessary to secure the above- mentioned permits and certificates.

The Electrical Contractor shall at his own expense, reproduce the electrical plans to the necessary scale and size, complete them with all the necessary information and requirements as maybe required by the government authorities concerned with the approval of plans.

The Electrical Contractor shall coordinate with the local power company regarding the power facilities and secure approval of the power requirements.

10.5 Materials and Workmanship

All materials to be used shall be brand new, with trade name, unused, and shall in every case be the best where such standards have been established for the particular type of materials used.

Trade/brand name of materials indicated in the specifications are recommendatory in nature and are included for the purpose of uniformity in bids. If trade/brand names other than those indicated are to be used during construction, brochures and samples shall be submitted to the owner's representative for approval.

Only skilled workmen using proper tools and equipment shall be employed during the entire course of the installation work. All workmanship shall be of the best quality and all works shall be done in accordance with the best engineering practice of the trade involved.

10.6 Wiring Method

Lighting and Power Branch Circuit - uPVC pipes concealed in ceilings and double walls and/or embedded in concrete walls/slabs. All uPVC pipes ran underground outside of buildings shall be buried not less than 40mm below nat. grd. line and enclosed in concrete envelope. All concrete envelopes passing under roadways or areas accessible to vehicles shall be steel reinforced up to 1.0m from the edge of the roadway.

Fire Alarm System Layout - rigid steel conduit concealed in ceiling and double walls and/or embedded in concrete walls/slabs.

Low Voltage Service Entrance and All Feeders - rigid steel conduit, exposed/concealed in ceiling/double walls, embedded in concrete walls/slabs or ran underground encased in concrete.

All Other Auxiliary Layout - uPVC pipes concealed in ceilings/double walls and/or embedded in concrete walls/slabs.

Use flexible metal pipe for connection between junction boxes inside ceiling and lightings and other fixtures using approved fittings.

All boxes, cabinets and other equipment shall be flush-mounted unless specified/approved otherwise.

All boxes for lighting outlets, convenience outlets, tumbler switches and other devices shall be galvanized pre-painted and approved products of reputable manufacturers. Cut ends of conduits shall be reamed and cleaned to remove burr and sharp edges. Threads cut on conduits shall be the same thread dimensions as factory cut conduit threads. Conduits joints shall be made straight and true. Elbows and offsets and changes in direction and runs shall be uniform. Bends shall be made without kinking or destroying the cross-sectional contours of the conduits. Conduit terminals shall be provided at outlet boxes and cabinets with locknuts and bushing. Conduits shall be continuous from outlet and from outlet to pull boxes and cabinets in the manner that the conduit system shall be electrically continuous.

Where conduit runs are exposed, they shall be supported at an interval of not more than 0.75 m maximum with proper clamps and bolts or expansion shields or other means of support.

All splices, taps, junction in wires larger than 8.0 sq.mm. shall be done with solderless connectors of suitable sizes and properly insulated with rubber tapes and protected by friction tapes, so that the insulation strength shall at least be equal to the insulation of the conductors they join.

Unless otherwise specified, the type of wires to be used shall either be THW or THHN. Smallest size of wire to be used for lighting and power unless otherwise indicated shall be 3.5 sq.mm.

11.7 Feeders

Feeders shall be laid out in accordance with the riser diagram shown in the electrical plans.

Unless otherwise specified type THW or THHN wires shall be used for feeder lines. The wires and conduits sizes shown in the electrical plans shall be the minimum sizes to be used.

10.8 Wall Switches and Receptacles

All wall switches shall be flush type and mounted 1.40 meters above finish floor line unless otherwise specified.

Convenience outlets shall be grounding type, wall flushed, mounted 0.30 meter above finished floor line or finished counters unless otherwise specified in the plan. Ground fault circuit interrupter protected convenience outlets shall be used in bathrooms, lavatories, sinks, laundry areas and the like.

10.9 Main Switches, Transfer Switches and Panelboards

The cabinets for the above shall be of standard sizes and shall be gauge #16. Circuit breakers shall be 250 Volts, AC, rated 75C, interrupting ratings specified in the plan shall be followed at all times.

10.10 Lighting Fixtures


Install all lighting fixtures and lamps as specified and as shown on plans. LED lamps shall either be 10, 20 or 100 watts.

11.0 GUARANTEE

All equipment, materials and workmanship shall be guaranteed for a period of one (1) year from date of acceptance at any time within the period of guarantee and upon notification, the contractor shall repair and rectify the deficiencies, including replacement of parts or entire units. Under such guarantee, the Contractor shall make good any defect due to faulty materials or workmanship caused by him without any additional cost to the Owner for the period specified.

NOTE: Contractors' proposal covers all items and other incidental works necessary to complete each item of works mentioned above.

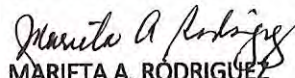
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