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ISO 9001:2015 CERTIFIED

BAGONG PILIPINAS

PART III

PROJECT SPECIFICATIONS AND BID DETAILS

PROPOSED OPEN UNIVERSITY BUILDING (PHASE-I)

BSU COMPOUND, KM.5, BALILI, LA TRINIDAD, BENGUET

ABC: ₱ 3,191,537.88

PROJECT MANAGEMENT UNIT

SEPTEMBER 2023

PART I: PROGRAM OF WORKS AND DETAILED UNIT PRICE ANALYSIS
PART II: DETAILED ENGINEERING DESIGN
PART III: PROJECT SPECIFICATIONS AND BID DETAILS

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PROJECT TECHNICAL SPECIFICATIONS

Name of Project: **PROPOSED OPEN UNIVERSITY BUILDING (PHASE I)**
Location: **BSU COMPOUND, KM.5, BALILI, LA TRINIDAD, BENGUET**

A.1.1 (8) – PROVISION OF FIELD OFFICE FOR THE ENGINEER (RENTAL BASIS) *Intended for the BSU Project Engineer

A.1.1 (8).1 Description
This item shall consist of providing and maintaining a 20-footer Container Van with ACU, furnished and maintained (or Equivalent) field office intended for the Benguet State University engineer. The Contractor shall maintain all necessary electricity, water, drainage, for the use of the BSU Engineer. The field office provided by the Contractor shall be near the job site, where necessary and shall conform to the best standard for the required types. On completion of the contract, the Colored Printer (*Can print up to A3 size paper) provided by the Contractor shall be turned-over to the Government.

A.1.1 (8).2 Method of Measurement
The accepted quantities, measured as prescribed in section A.1.1(8).1 shall be paid for at the contract unit price for provision of field office for the engineer which price and payment shall be full compensation for furnishings and placing all materials, including all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

A.1.1 (8).3 Basis of Payment
Payment will be made under:

Pay Item Number	Description	Unit of Measurement
A.1.1 (8)	PROVISION OF FIELD OFFICE FOR THE ENGINEER (RENTAL BASIS) *Intended for the BSU Project Engineer	MONTH

ITEM B.3 – PERMITS AND CLEARANCES (BUILDING PERMIT)

B.3.1 Description
This item shall consist of securing building permit documents before construction of the building.

B.3.2 Method of Measurement
The accepted quantities, measured as prescribed in section B.3.1 shall be paid for at the contract unit price for regulatory permits which price and payment shall be full compensation for furnishings and placing all materials, including all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

B.3.3 Basis of Payment
Payment will be made under:

Pay Item Number	Description	Unit of Measurement
B.3	PERMITS AND CLEARANCES (BUILDING PERMIT)	LUMP SUM

B.5 - PROJECT BILLBOARD / SIGNBOARD

Material Requirements
Tarpaulin

The design and format of the tarpaulin shall have the following specifications:
Color: White
Size: 8 ft. x 8 ft.
Resolution: 70 dpi
Font: Helvetica
Font Size of Main Information : 3 inches
Font Size of Sub-Information : 1 inch
Font Color : Black
Suitable Frame : Rigid wood frame with post; and
Posting: Outside display at the project location after award has been made.

The information shall contain but not limited to i.) logo of the funding agencies, ii.) the name of implementing agencies, iii.) name of contractor, iv.) project's title, location, cost and description, v.) project details to include duration, date started, target date of completion and project status, and vi.) COA Anti-corruption Hotline.

The display/and or affixture of the picture, image, motto, logo, color motif, initials or other symbol or graphic representation associated with the top leadership of the project proponent or implementing agency/unit/office, on project billboard, is considered unnecessary. (General Guidelines No. 2.2.6)

Post and Frame
Posts and frames/braces shall be made from good lumber with a 2X3 and 2x2 inches size respectively and shall be well-seasoned, straight and free of injurious defects. The frame will be covered with 2 pieces ¼ inch thick ordinary plywood where the tarpaulin will be attached.

Method of Measurement
The quantities of project billboard shall be in pieces of such signs of the size specified, including the necessary posts and supports erected and accepted.

Basis of Payment

The quantities measured as determined in the Method of Measurement, shall be paid for at the contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall be full compensation for furnishing and installing project billboard, all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
B.5	PROJECT BILLBOARD / SIGNBOARD	EACH

ITEM B.7 – OCCUPATIONAL SAFETY AND HEALTH PROGRAM

B.7.1 Description
A Company Safety Policy which shall serve as the general guiding principles in the implementation of safety and health on site duly signed by the highest company official or his duly authorized representative who has the over---all control of project execution and should include the contractor's general policy towards occupational safety, worker's welfare and health, and environment.
A Safety policy, which shall include the commitment that the contractor shall comply with DOLE minimum safety requirements, including reporting requirements of the Occupational Health and Safety Standards (OSHS), and other relevant DOLE issuances. These may include, but are not limited to the following:
Registration (Rule 1020 and DO 18---02)
Report of Safety Committee Organization (Rule 1040)
Notification of Accidents and Occupational Illnesses (Rule 1050)
Annual Work Accident/Illness Exposure Data Report (Rule 1050)
Application for installation of mechanical/electrical equipment for construction of structure for industrial use (Rule 1070 and 1160)
Annual Medical Report (Rule 1960)
Specific Construction Safety and Health Program shall contain the tendering agency's requirements in addition to the minimum requirements under the appropriate sections of D.O. No. 13 whenever deemed as applicable.

B.7.2 Method of Measurement
Payment shall be made on a proportional basis, calculated by multiplying the percentage rate of physical progress to the total lump sum amount every progress billing.

B.7.3 Basis of Payment
Payment will be made under:

Pay Item Number	Description	Unit of Measurement
B.7	OCCUPATIONAL SAFETY AND HEALTH PROGRAM	LUMP SUM

B.9 – MOBILIZATION / DEMOBILIZATION

B.9.1 Description
This item shall consist of the mobilization and demobilization of equipment needed for the project. In addition, this item also includes the cleaning of the project site including its surroundings before the final inspection.

B.9.2 Method of Measurement
The accepted quantities, measured as prescribed in section B.9.1 shall be paid for at the contract unit price for mobilization/ demobilization which price and payment shall be full compensation for furnishings and placing all materials, including all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

B.9.3 Basis of Payment
Payment will be made under:

Pay Item Number	Description	Unit of Measurement
B.9	MOBILIZATION / DEMOBILIZATION	LUMP SUM

ITEM 800 (1) – CLEARING AND GRUBBING

800 (1) 1 Description
This item shall consist of clearing, grubbing, removing and disposing all vegetation and debris as designated in the Contract, except those objects that are designated to remain in place or are to be removed in consonance with other provisions of this Specification. The work shall also include the preservation from injury or defacement of all objects designated to remain.

800 (1) 2 Construction Requirements
The Engineer will establish the limits of work and designate all trees, shrubs, plants and other things to remain. The contractor shall preserve all objects designated to remain. Clearing shall extend one (1) meter beyond the toe of the fill slopes or beyond rounding of cut slopes as the case maybe for the entire length of the project unless otherwise shown on the plans or as directed by the Engineer and provided it is within the right of way limits of the project.

800 (1).2.1 General

The Engineer will establish the limits of work and designate all trees, shrubs, plants and other things to remain. The Contractor shall preserve all objects designated to remain. Paint required for cut or scarred surface of trees or shrubs selected for retention shall be an approved asphaltum base paint prepared especially for tree surgery.

Clearing shall extend one (1) meter beyond the toe of the fill slopes or beyond rounding of cut slopes as the case maybe for the entire length of the project unless otherwise shown on the plans or as directed by the Engineer and provided it is within the right of way limits of the project, with the exception of trees under the jurisdiction of the Forest Management Bureau (FMB).

800 (1).2.2 Clearing and Grubbing

All surface objects and all trees, stumps, roots and other protruding obstructions, not designated to remain, shall be cleared and/or grubbed, including mowing as required, except as provided below:

(1) Removal of undisturbed stumps and roots and nonperishable solid objects with a minimum depth of one (1) meter below subgrade or slope of embankment will not be required.

(2) In areas outside of the grading limits of cut and embankment areas, stumps and nonperishable solid objects shall be cut off not more than 150 mm (6 inches) above the ground line or low water level.

(3) In areas to be rounded at the top of cut slopes, stumps shall be cut off flush with or below the surface of the final slope line.

(4) Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.

(5) In areas covered by cogon/talahib, wild grass and other vegetations, top soil shall be cut to a maximum depth of 150 mm below the original ground surface or asdesignated by the Engineer, and disposed outside the clearing and grubbing limits as indicated in the typical roadway section.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted to the required density.

If perishable material is burned, it shall be burned under the constant care of component watchmen at such times and in such a manner that the surrounding vegetation, other adjacent property, or anything designated to remain on the right of way will not be jeopardized. If permitted, burning shall be done in accordance with applicable laws, ordinances, and regulation.

The Contractor shall use high intensity burning procedures, (i.e., incinerators, high stacking or pit and ditch burning with forced air supplements) that produce intense burning with little or no visible smoke emission during the burning process. At the conclusion of each burning session, the fire shall be completely extinguished so that no smoldering debris remains.

In the event that the Contractor is directed by the Engineer not to start burning operations or to suspend such operations because of hazardous weather conditions, material to be burned which interferes with subsequent construction operations shall be moved by the Contractor to temporary locations clear of construction operations and later, if directed by the Engineer, shall be placed on a designated spot and burned.

Materials and debris which cannot be burned and perishable materials may be disposed off by methods and at locations approved by the Engineer, on or off the project. If disposal is by burying, the debris shall be placed in layers with the material so disturbed to avoid nesting. Each layer shall be covered or mixed with earth material by the land-fill method to fill all voids. The top layer of material buried shall be covered with at least 300 mm (12 inches) of earth or other approved material and shall be graded, shaped and compacted to present a pleasing appearance. If the disposal location is off the project, the Contractor shall make all necessary arrangements with property owners in writing for obtaining suitable disposal locations which are outside the limits of view from the project. The cost involved shall be included in the unit bid price. A copy of such agreement shall be furnished to the Engineer. The disposal areas shall be seeded, fertilized and mulched at the Contractor's expense.

Woody material may be disposed off by chipping. The wood chips may be used for mulch, slope erosion control or may be uniformly spread over selected areas as directed by the Engineer. Wood chips used as mulch for slope erosion control shall have a maximum thickness of 12 mm (1/2 inch) and faces not exceeding 3900 mm2
(6 square inches) on any individual surface area. Wood chips not designated for use under other sections shall be
spread over the designated areas in layers not to exceed 75 mm (3 inches) loose thickness. Diseased trees shall be buried or disposed off as directed by the Engineer.

All merchantable timber in the clearing area which has not been removed from the right of way prior to the beginning of construction, shall become the property of the Contractor, unless otherwise provided.

Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be trimmed as directed. Branches of trees extending over the roadbed shall be trimmed to give a clear height of 6 m (20 feet) above the roadbed surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

Timber cut inside the area staked for clearing shall be felled within the area to be cleared.

800 (1).2.3 Individual Removal of Trees or Stumps

Individual trees or stumps designated by the Engineer for removal and located in areas other than those established for clearing and grubbing and roadside cleanup shall be removed and disposed off as specified under Subsection 100.2.2 except trees removed shall be cut as nearly flush with the ground as practicable without removing stumps.

800 (1).3 Method of Measurement

Measurement will be by one or more of the following alternate methods:

1. Area Basis. The work to be paid for shall be the number of hectares and fractions thereof acceptably cleared and grubbed within the limits indicated on the Plans or as may be adjusted in field staking by the Engineer. Areas not within the clearing and grubbing limits shown on the Plans or not staked for clearing and grubbing will not be measured for payment.

2. Lump-Sum Basis. When the Bill of Quantities contains a Clearing and Grubbing lump-sum item, no measurement of area will be made for such item.

3. Individual Unit Basis (Selective Clearing). The diameter of trees will be measured at a height of 1.4 m (54 inches) above the ground. Trees less than 150 mm (6 inches) in diameter will not be measured for payment.

800 (1).4 Basis of Payment

The accepted quantities, measured as prescribed in Section 800 (1).3, shall be paid for at the Contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities, which price and payment shall be full compensation for furnishing all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Pay Item Number	Description	Unit of Measurement
800 (1)	CLEARING AND GRUBBING	SQUARE METER

ITEM 803(1)a – STRUCTURE EXCAVATION

803(1)a.1 Description
This Item shall consist of the necessary excavation for foundation and septic vault of the dormitory, and other structures not otherwise provided for in the Specifications.

It shall also include the furnishing and placing of approved foundation fill material to replace unsuitable material encountered below the foundation elevation of structures.

No allowance will be made for classification of different types of material encountered.

803(1)a.2 Construction Requirements

803(1)a.2.1 Clearing and Grubbing
Prior to starting excavation operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Item 100, Clearing and Grubbing.

803(1)a.2.2 Excavation
General, all structures. The Contractor shall notify the Engineer sufficiently in advance of the beginning of any excavation so that cross-sectional elevations and measurements may be taken on the undisturbed ground. The natural ground adjacent to the structure shall not be disturbed without permission of the Engineer.

Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the Plans or as staked by the Engineer. They shall be of sufficient size to permit the placing of structures or structure footings of the full width and length shown in the Structural Plan under Footing Schedule. The elevations of the bottoms of footings, as shown on the Plans, shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be deemed necessary, to secure a satisfactory foundation.

Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the Plans or as staked by the Engineer. They shall be of sufficient size to permit the placing of structures or structure footings of the full width and length shown. The elevations of the bottoms of footings, as shown on the Plans, shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be deemed necessary, to secure a satisfactory foundation.

803(1)a.2.3 Utilization of Excavated Materials
All excavated materials, so far as suitable, shall be utilized as backfill or embankment. The surplus materials shall be disposed off in such manner as not to obstruct the stream or otherwise impair the efficiency or appearance of the Structure. No excavated materials shall be deposited at any time so as to endanger the partly finished structure.

803(1)a.3 Method of Measurement
The volume of excavation to be paid for will be the number of cubic meters measured in original position of material acceptably excavated in conformity with the Plans or as directed by the Engineer:

Pay Item Number	Description	Unit of Measurement
803(1)a	STRUCTURE EXCAVATION (COMMON SOIL)	CUBIC METER

ITEM 804(1)a – EMBANKMENT (BACKFILL FROM STRUCTURE EXCAVATION)

804(1)a.1 Description
This Item shall consist of the backfilling of the excavated footings and preparation of base materials for the slab-on-fill as indicated in the plan and specification.

It shall also include the furnishing and placing of approved foundation fill material to replace unsuitable material encountered below the foundation elevation of structures.

804(1)a.2 Construction Requirements
Embankment for the base of the slab-on-fill of earth material shall be placed in horizontal layers not exceeding *200 mm (8 inches*), loose measurement, and shall be compacted as specified before the next layer is placed. However, thicker layer maybe placed if vibratory roller with high compactive effort is used provided that density requirement is attained and as approved by the Engineer. Trial section to this effect must be conducted and approved by the Engineer. Effective spreading equipment shall be used on each lift to obtain uniform thickness as determined in the trial section prior to compaction. As the compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density. Water shall be added or removed, if necessary, in order to obtain the required density. Removal of water shall be accomplished through aeration by plowing, blading, discing, or other methods satisfactory to the Engineer.

Throughout the periods when compaction of earthwork is in progress, the Contractor shall adhere to the compaction procedures found from compaction trials for each type of material being compacted, each type of compaction equipment employed and each degree of compaction specified.

804(1)a.3 Method of Measurement
The volume of embankment (Backfill from Structure Excavation) to be paid for will be the number of cubic meters measured in original position of material acceptably backfilled and compacted in conformity with the Plans or as directed by the Engineer:

Pay Item Number	Description	Unit of Measurement
804(1)a	EMBANKMENT (BACKFILL FROM STRUCTURE EXCAVATION)	CUBIC METER

ITEM 804(4) – GRAVEL BEDDING

804(4).1 Description
This Item shall consist of placing and compacting of gravel bedding materials for the footing and slab-on-fill as indicated in the plan and specification.

It shall also include the furnishing and placing of approved foundation fill material to replace unsuitable material encountered below the foundation elevation of structures.

804(4).2 Material and Construction Requirements
Materials for this item is a G1 Gravel as indicated in the DUPA for this item.

Throughout the periods when compaction of gravel fill is in progress, the Contractor shall adhere to the compaction procedures found from compaction trials for each type of material being compacted, each type of compaction equipment employed and each degree of compaction specified.

804(4).3 Method of Measurement
The volume of G1 gravel for the gravel bedding of footings and slab on fill to be paid for will be the number of cubic meters measured in original position of material acceptably of compacted gravel in conformity with the Plans or as directed by the Engineer:

Pay Item Number	Description	Unit of Measurement
804(4)	GRAVEL BEDDING	CUBIC METER

ITEM 900 - STRUCTURAL CONCRETE

900.1 Description
This Item shall consist of furnishing, bending, placing, and finishing concrete in buildings and related structures in accordance with this Specification and conforming to the lines, grades, and dimension shown on the plans. Concrete shall consist of a mixture of Portland Cement, fine aggregate, coarse aggregate, admixture when specified, and water mixed in the proportions specified or approved by the Engineer.

900.2 Materials Requirements

900.2.1 Portland Cement
This shall conform to the requirement of ITEM 700, Volume II (Blue Book), Hydraulic cement.

900.2.2 Concrete Aggregates
Concrete aggregate shall conform to the requirements of subsection 311.2.2 and 311.2.3 under Item 311 of Volume II, (Blue Book) and ASTM C 33 for lightweight aggregates, except that aggregates failing to meet these specifications but which have been shown by special that or actual service to produce concrete of adequate strength and durability may be used under method (2) of determining the proportion of concrete, where authorized by the Engineer.
Except as permitted elsewhere in this section, the maximum size of the aggregate shall be not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms of the member for which the concrete is to be used nor larger than three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars or pretensioning strands.

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

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

900.2.3 Water
Water used in mixing concrete shall conform to the requirement of subsection 311.2.4 under Item 311, Part E, of Volume II, (DPWH Blue Book).

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

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

900.3 Construction Requirements
Notations: The notations used in these regulations are defined as follows:
f'c = compressive strength of concrete
Fsp = ratio of splitting tensile strength to square root of compressive strength.

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

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

900.3.2 Methods of Determining the Proportions of Concrete

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

Method 1, Without preliminary test

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

Method 2. For combination of materials previously evaluated or to be established by trial mixtures.

Water-cement ratios for strengths greater than that shown in Table I 900(7).1 may be used provided that the relationship between strength and I water-cement ratio for the materials to be used has been previously established by reliable test data and the resulting concrete satisfies the requirements of concrete quality. Where previous data are not available. Concrete trial mixtures having proportions and consistency suitable for the work shall be made using at least three different water-cement ratios (or cement content in I the case of lightweight aggregates) which will produce a range of strengths encompassing those required for the work. For each water-cement ratio (or cement content) at least three specimens for each age to be tested shall be made, cured and tested for strength in accordance with ASTM C 39 and C 192.

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

Where different materials are to be used for different portions of the work, each combination shall be evaluated separately.

TABLE 900.1 MAXIMUM PERMISSIBLE WATER-CEMENT RATIOS FOR CONCRETE (METHOD NO.1)

Specified compressive strength at 28 days, psi fc	Maximum permissible water-cement ratio			
	Non air-entrained concrete		Air-entrained concrete	
	U.S. gal. per 42.6 kg. bag of cement	Absolute ratio by weight	U.S. gal per 42.6 kg. bag of cement	Absolute ratio by weight
2500	7 ¼	0.642	6 ¼	0.554
3000	6 ½	0.576	5 ¼	0.465
3500	5 ¾	0.510	4 ½	0.399
4000	5	0.443	4	0.354

900.3.3 Concrete Proportions and Consistency

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

900.3.4 Sampling and Testing of Structural Concrete

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

900.3.5 Consistency

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

900(7).3.6 Strength Test of Concrete

When strength is a basis for acceptance, each class of concrete shall be represented by at least five test (10 specimens). Two specimens shall be made for each test at a given age, and not less than one test shall be made for each 150 cu.yd. of structural concrete, but there shall be at least one test for each days concreting. The Building Official may require a reasonable number of additional tests during the progress of the work. Samples from which compression test specimens are molded shall be secured in accordance with ASTM C 172. Specimens made to check the adequacy of the proportions for strength of concrete or as a basis for acceptance of concrete shall be made and laboratory-cured in accordance with ASTM C 31. Additional test specimens cured entirely under field conditions may be required by the Building Official to check the adequacy of curing and protection of the concrete. Strength tests shall be made in accordance with ASTM C 39.

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

To conform to the requirements of this Item:

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

2. For structures designed in accordance with the ultimate strength design method of this chapter, and for prestressed structures the average of any three consecutive strength test of the laboratory, cured specimens representing each class of concrete shall be equal to or greater than the specified strength, fc' and not more than 10 percent of the strength tests shall have values less than the specified strength. When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements. The strengths of the specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Building Official, the strengths of the job-cured specimens, the contractor may be required to improve the procedures for protecting and curing the concrete, or when test of field-cured cylinders indicate deficiencies in protection and curing, the Engineer may require test in accordance with ASTM Specification C 42 or order load tests as outlined in the load tests of structures for that portion of the structure where the questionable concrete has been placed.

900.3.7 Splitting Tensile Test of Concrete
To determine the splitting ratio, Fsp, for a particular aggregate, test of concrete shall be made as follows:

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

2. The splitting tensile strength shall be determined in accordance with ASTM C 496, and compressive strength in accordance with ASTM C 39. The ratio, Fsp, of splitting tensile strength to the square root of compressive strength shall be obtained by using the average of all 16 splitting tensile test and all 8 compressive tests. Minimum Strength, Concrete other than fill, shall have a minimum compressive strength at 28 days of 140 kilograms per square centimeter (2000 psi).

900.3.8 Batching
Measuring and batching of materials shall be done at a batching plant.
1. Portland Cement
Either sacked or bulk cement may be used. No fraction of a sack of cement shall be used in a batch of concrete unless the cement is weighed. All bulk cement shall be weighed on an approved weighing device. The bulk cement weighing hopper shall be properly sealed and vented to preclude dusting operation. The discharge chute shall not be
suspended from the weighing hopper and shall be so arranged that cement will neither be lodged in it nor leak from it.

Accuracy of batching shall be within plus (+) or minus (-) 1 mass percent.

2. Water
Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within a range of error of not more than 1 percent.

3. Aggregates
Stockpiling of aggregates shall be in accordance with Subsection 311.2.10. All aggregates whether produced or handled by hydraulic methods or washed, shall be stockpiled or binned for draining for at least 12 hours prior to batching. Rail shipment requiring more than12 hours will be accepted as adequate binning only if the car bodies permit free drainage. If the aggregates contain high or non-uniform moisture content, storage or stockpile period in excess of 12 hours may be required by the Engineer.

Batching shall be conducted as to result in a 2-mass percent maximum tolerance for the required materials.

4. Bins and Scales
The batching plant shall include separate bins for bulk cement, fine aggregate and for each size of coarse aggregate, a weighing hopper, and scales capable of determining accurately the mass of each component of the batch.

Scales shall be accurate to one-half (0.5) percent throughout the range used.

5. Batching
When batches are hauled to the mixer, bulk cement shall be transported either in waterproof compartments or between the fine and coarse aggregate. When cement is placed in contact with moist aggregates, batches will be rejected unless mixed within 1-1/2 hours of such contact. Sacked cement may be transported on top of the aggregates.

Batches shall be delivered to the mixer separate and intact. Each batch shall be dumped cleanly into the mixer without loss, and, when more than one batch is carried on the truck, without spilling of material from one batch compartment into another.

6. Admixtures
The Contractor shall follow an approved procedure for adding the specified amount of admixture to each batch and will be responsible for its uniform operation during the progress of the work. He shall provide separate scales for the admixtures which are to be proportioned by weight, and accurate measures for those to be proportioned by volume. Admixtures shall be measured into the mixer with an accuracy of plus or minus three (3) percent.

The use of Calcium Chloride as an admixture will not be permitted.

900.3.9 Mixing and Delivery
Concrete may be mixed at the site of construction, at a central point or by a combination of central point and truck mixing or by a combination of central point mixing and truck agitating. Mixing and delivery of concrete shall be in accordance with the appropriate requirements of AASHTO M 157 except as modified in the following paragraphs of this section, for truck mixing or a combination of central point and truck mixing or truck agitating. Delivery of concrete shall be regulated so that placing is at a continuous rate unless delayed by the placing operations. The intervals between delivery of batches shall not be so great as to allow the concrete in place to harden partially, and in no case shall such an interval exceed 30 minutes.

In exceptional cases and when volumetric measurements are authorized, for small project requiring less than 75 cu.m. per day of pouring, the weight proportions shall be converted to equivalent volumetric proportions. In such cases, suitable allowance shall be made for variations in the moisture condition of the aggregates, including the bulking effect in the fine aggregate. Batching and mixing shall be in accordance with ASTM C 685, Section 6 through 9.

Concrete mixing, by chute is allowed provided that a weighing scales for determining the batch weight will be used.

For batch mixing at the site of construction or at a central point, a batch mixer of an approved type shall be used. Mixer having a rated capacity of less than a one-bag batch shall not be used. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity as shown on the manufacturer's standard rating plate on the mixer except that an overload up to 10 percent above the mixer's nominal capacity may be permitted, provided concrete test data for strength, segregation, and uniform consistency are satisfactory and provided no spillage of concrete takes place. The batch shall be so charge into the drum that a portion of the water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first 15 seconds of the mixing period. Mixing time shall be measured from the time all materials, except water, are in the drum. Mixing time shall not be less than 60 seconds for mixers having a capacity of 1.5m3 or less. For mixers having a capacity greater than 1.5m3, the mixing time shall not be less than 90 seconds. If timing starts, the instant the skip reaches its maximum raised position, 4 seconds shall be added to the specified mixing time. Mixing time ends when the discharge chute opens.

The mixer shall be operated at the drum speed as shown on the manufacturer's name plate on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed off by the Contractor at his own expenses.

The timing device on stationary mixers shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the Contractor will be permitted to continue operations while it is being repaired, provided he furnishes an approved timepiece equipped with minute and second hands. If the timing device is not placed in good working order within 24 hours, further use of the mixer will be prohibited until repairs are made.

Retempering concrete will not be permitted. Admixtures for increasing the workability, for retarding the set, or for accelerating the set or improving the pumping characteristics of the concrete will be permitted only when specifically provided for in the Contract, or authorized in writing by the Engineer.

1. Mixing Concrete: General

Concrete shall be thoroughly mixed in a mixer of an approved size and type that will insure a uniform distribution of the materials throughout the mass.

All concrete shall be mixed in mechanically operated mixers. Mixing plant and equipment for transporting and placing concrete shall be arranged with an ample auxiliary installation to provide a minimum supply of concrete in case of breakdown of machinery or in case the normal supply of concrete is disrupted. The auxiliary supply of concrete shall be sufficient to complete the casting of a section up to a construction joint that will meet the approval of the Engineer.

Equipment having components made of aluminum or magnesium alloys, which would have contact with plastic concrete during mixing, transporting or pumping of Portland Cement concrete, shall not be used.

Concrete mixers shall be equipped with adequate water storage and a device of accurately measuring and automatically controlling the amount of water used.

Materials shall be measured by weighing. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose. The accuracy of all weighing devices except that for water shall be such that successive quantities can be measured to within one percent of the desired amounts. The water measuring device shall be accurate to plus or minus 0.5 mass percent. All measuring devices shall be subject to the approval of the Engineer. Scales and measuring devices shall be tested at the expense of the Contractor as frequently as the Engineer may deem necessary to ensure their accuracy.

Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cut-off shall not vary from the weight designated by the Engineer more than one mass percent for cement, 1-1/2 mass percent for any size of aggregate, or one (1) mass percent for the total aggregate in any batch.

2. Mixing Concrete at Site

Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. The pick-up and throw-over blades of mixers shall be restored or replaced when any part or section is worn 20mm or more below the original height of the manufacturer's design. Mixers and agitators which have an accumulation of hard concrete or mortar shall not be used.

When bulk cement is used and volume of the batch is 0.5m3 or more, the scale and weigh hopper for Portland Cement shall be separate and distinct from the aggregate hopper or hoppers. The discharge mechanism of the bulk cement weigh hopper shall be interlocked against opening before the full amount of cement is in the hopper. The discharging mechanism shall also be interlocked against opening when the amount of cement in the hopper is underweight by more than one (1) mass percent or overweight by more than 3 mass percent of the amount specified.

When the aggregate contains more water than the quantity necessary to produce a saturated surface dry condition, representative samples shall be taken and the moisture content determined for each kind of aggregate.

The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregate. All water shall be in the drum by the end of the first quarter of the specified mixing time.

Cement shall be batched and charged into the mixer so that it will not result in loss of cement due to the effect of wind, or in accumulation of cement on surface of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cement in the concrete mixture.

The entire content of a batch mixer shall be removed from the drum before materials for a succeeding batch are placed therein. The materials composing a batch except water shall be deposited simultaneously into the mixer.

All concrete shall be mixed for a period of not less than 1-1/2 minutes after all materials, including water, are in the mixer. During the period of mixing, the mixer shall operate at the speed for which it has been designed.

Mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanics shall be so interlocked that during normal operation no part of the batch will be charged until the specified mixing time has elapsed.

The first batch of concrete materials placed in the mixer shall contain a sufficient excess of cement, sand, and water to coat inside of the drum without reducing the required mortar content of the mix. When mixing is to cease for a period of one hour or more, the mixer shall be thoroughly cleaned.

3. Mixing Concrete at Central Plant

Mixing at central plant shall conform to the requirements for mixing at the site.

4. Mixing Concrete in Truck

Truck mixers, unless otherwise authorized by the Engineer, shall be of the revolving drum type, water-tight, and so constructed that the concrete can be mixed to insure a uniform distribution of materials throughout the mass. All solid materials for the concrete shall be accurately measured and charged into the drum at the proportioning plant. Except as subsequently provided, the truck mixer shall be equipped with a device by which the quantity of water added can be readily verified. The mixing water may be added directly to the batch, in which case a tank is not required. Truck mixers may be required to be provided with a means of which the mixing time can be readily verified
by the Engineer.

The maximum size of batch in truck mixers shall not exceed the minimum rated capacity of the mixer as stated by the manufacturer and stamped in metal on the mixer. Truck mixing, shall, unless other-wise directed be continued for not less than 100 revolutions after all ingredients, including water, are in the drum. The mixing speed shall not be less than 4 rpm, nor more than 6 rpm.

Mixing shall begin within 30 minutes after the cement has been added either to the water or aggregate, but when cement is charged into a mixer drum containing water or surface wet aggregate and when the temperature is above 32oC, this limit shall be reduced to 15 minutes. The limitation in time between the introduction of the cement to the
aggregate and the beginning of the mixing may be waived when, in the judgement of the Engineer, the aggregate is sufficiently free from moisture, so that there will be no harmful effects on the cement.

When a truck mixer is used for transportation, the mixing time specified in Subsection 405.4.4 (3) at a stationary mixer may be reduced to 30 seconds and the mixing completed in a truck mixer. The mixing time in the truck mixer shall be as specified for truck mixing.

5. Transporting Mixed Concrete

Mixed concrete may only be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturers of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable point for adequate placement and consolidation in place.

Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity. They shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point.

The rate of discharge of mixed concrete from truck mixers or agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within one hour, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete or when the temperature of the concrete is 30oC, or above, a time less than one hour will be required.

6. Delivery of Mixed Concrete

The Contractor shall have sufficient plant capacity and transportation apparatus to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such as to provide for the proper handling, placing and finishing of the concrete. The rate shall be such that the interval between batches shall not
exceed 20 minutes. The methods of delivering and handling the concrete shall be such as will facilitate placing of the minimum handling.

900.4 Concrete Surface Finishing: General
This shall be in accordance with Item 407, Concrete Structures.

900.5 Curing Concrete (See subsection 407)

900.6 Acceptance of Concrete
The strength of concrete shall be deemed acceptable if the average of 3 consecutive strength test results is equal to or exceed the specified strength and no individual test result falls below the specified strength by more than 15 %.
Concrete deemed to be not acceptable using the above criteria may be rejected unless contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be obtained from the affected area and cured and tested in accordance with AASHTO T24.
Concrete in the area represented by the cores will be deemed acceptable if the average of cores is equal to or at least 85 % and no sample core is less than 75 % of the specified strength otherwise it shall be rejected.

900.7 Method of Measurement
The quantity of structural concrete to be paid for will be the final quantity placed and accepted in the completed structure. No deduction will be made for the volume occupied by the pipe less than 100mm (4") in diameter nor for reinforcing steel, anchors, weep holes or expansion materials.

900.8 Basis of Payment
The accepted quantities, measured as prescribed in Section 900.5, shall be paid for at the contract unit price for each of the pay item listed below that is included in the Bill of Quantities.

Payment shall constitute full compensation for furnishing, placing and finishing concrete including all labor, equipment, tools and incidentals necessary to complete the work prescribed in the item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
900(1)	STRUCTURAL CONCRETE	CUBIC METER

ITEM 902 – REINFORCING STEEL

902.1 Description
This Item shall consist of furnishing, bending, fabricating and placing of steel reinforcement of the type, size, shape and grade required in accordance with this Specification and in conformity with the requirements shown on the Plans or as directed by the Engineer.

902.2 Material Requirements

Reinforcing steel shall meet the requirements of item 710, Reinforcing Steel and Wire Rope.
Reinforcing steel bars shall conform to the requirements of the following Specifications:

Deformed & Plain Billet Steel Bars for concrete Reinforcement	ASTM A 615
Bars for concrete Reinforcement	AASHTO M 31
Deformed Rail - Steel and Plain Bars for Concrete Reinforcement	ASTM A 616
Deformed A x b - Steel and Plain Bars for Concrete Reinforcement	ASTM A 617

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

Bar and rod mats for concrete reinforcement	ASTM A 187
Cold-Drawn Steel Wire for concrete reinforcement	ASTM A 82 AASHTO M 32
Welded steel wire fabric for concrete reinforcement	ASTM A 185 AASHTO M55 except that the weld shear strength requirement of those specification shall be extended to include a wire size differential up to and including six gages.

Wire and Strands for prestressed concrete	ASTM A 416 ASTM A 421

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

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

Tensile strength fs'	1000 MPa
Yield strength (0.2 offset)	0.90 fs'
Elongation at rupture in 20 diameter	4 percent
Reduction of area at rupture	25 percent
Structural steel	ASTM A 36
Steel Pipe for concrete-filled pipe columns	ASTM A 53
Cast-Iron Pipe for composite columns	ASTM A 377

4.4.3 Construction Requirements

902.3.1 Order Lists
Before materials are ordered, all order lists and bending diagrams shall be furnished by the Contractor, for approval of the Engineer. The approval of order lists and bending diagrams by the Engineer shall in no way relieve the Contractor of responsibility for the correctness of such lists and diagrams. Any expense incident to the revisions of materials furnished in accordance with such lists and diagrams to make them comply with the Plans shall be borne by the Contractor.

902.3.2 Protection of Material
Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to
conditions producing rust. When placed in the work, reinforcement shall be free from dirt, detrimental rust, loose scale, paint, grease, oil, or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross sectional area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel specified.

902.3.3 Bending
All reinforcing bars requiring bending shall be cold-bent to the shapes shown on the Plans or required by the Engineer. Bars shall be bent around a circular pin having the following diameters (D) in relation to the diameter of the bar (d):

Nominal diameter, d, mm	Pin diameter (D)
10 to 20	6d
25 to 28	8d
32 and greater	10d

Bends and hooks in stirrups or ties may be bent to the diameter of the principal bar enclosed therein.

902.3.4 Placing and Fastening

All steel reinforcement shall be accurately placed in the position shown on the Plans or required by the Engineer and firmly held there during the placing and setting of the concrete. Bars shall be tied at all intersections except where spacing is less than 300mm in each directions, in which case, alternate intersections shall be tied. Ties shall be fastened on the inside.

Distance from the forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports, so that it does not vary from the position indicated on the Plans by more than 6mm. Blocks for holding reinforcement from contact with the forms shall be precast mortar blocks of approved shapes and dimensions. Layers of bars shall be separated by precast mortar blocks or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe and wooden blocks shall not be permitted. Unless otherwise shown on the Plans or required by the Engineer, the minimum distance between bars shall be 40mm. Reinforcement in any member shall be placed and then inspected and approved by the Engineer before the placing of concrete begins. Concrete placed in violation of this provision may be rejected and removal may be required. If fabric reinforcement is shipped in rolls, it shall be straightened before being placed. Bundled bars shall be tied together at not more than 1.8m intervals.

902.3.5 Splicing
All reinforcement shall be furnished in the full lengths indicated on the Plans. Splicing of bars, except where shown on the Plans, will not be permitted without the written approval of the Engineer. Splices shall be staggered as far as possible and with a minimum separation of not less than 40 bar diameters. Not more than one-third of the bars may be spliced in the same cross-section, except where shown on the Plans.

Unless otherwise shown on the Plans, bars shall be lapped a minimum distance of:

Splice Type	Grade 40 min. lap	Grade 60 min. lap	But not less than
Tension	24 bar dia	36 bar dia	300 mm
Compression	20 bar dia	24 bar dia	300 mm

In lapped splices, the bars shall be placed in contact and wired together. Lapped splices will not be permitted at locations where the concrete section is insufficient to provide minimum clear distance of one and one-third the maximum size of coarse aggregate between the splice and the nearest adjacent bar. Welding of reinforcing steel shall be done only if detailed on the Plans or if authorized by the Engineer in writing. Spiral reinforcement shall be spliced by lapping at least one and a half turns or by butt welding unless otherwise shown on the Plans.

902.3.6 Lapping of Bar Mat
Sheets of mesh or bar mat reinforcement shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges. The overlap shall not be less than one mesh in width.

902.4 Method of Measurement
The quantity of reinforcing steel to be paid for will be the final quantity placed and accepted in the completed structure.

No allowance will be made for tie-wires, separators, wire chairs and other material used in fastening the reinforcing steel in place. If bars are substituted upon the Contractor's request and approved by the Engineer and as a result thereof more steel is used than specified, only the mass specified shall be measured for payment.

No measurement or payment will be made for splices added by the Contractor unless directed or approved by the Engineer.

When there is no item for reinforcing steel in the Bill of Quantities, costs will be considered as incidental to the other items in the Bill of Quantities.

902.5 Basis of Payment
The accepted quantity, measured as prescribed in Section 404.4, shall be paid for at the contract unit price for Reinforcing Steel which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
902	REINFORCING STEEL	KILOGRAMS

ITEM 1046(2)a1 – CHB NON-LOAD BEARING, 100mm (INCLUDING REINFORCING STEEL)

1046(2)a1.1 Description
This item shall consist of furnishing labor, materials, equipment and minor tools for the laying of Concrete Hollow Blocks including concrete mortar fill and reinforcing bars.

1046(2)a1.2 Material Requirements
Masonry Mortar:
Sand : ASTM C 35 – 67
Portland Cement: ASTM C 150 or PNS 07; Type 1.
Water: Clean and free from deleterious substances.

Mixes:
Cement mortar shall either be 1 part Portland cement 2 parts fine aggregate by volume, but not more than 1 part Portland cement and 3 parts sand.

1046(2)a1.3 Method of Measurement
The accepted quantities, measured as prescribed in section 1046(2)a1.1 shall be paid for at the contract unit price for the laying of CHB including concrete mortar fill and reinforcing bars which price and payment shall be full compensation for furnishings and placing all materials, including all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

1046(2)a1.3 Basis of Payment

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1046(2)a1	CHB NON-LOAD BEARING, 100mm (INCLUDING REINFORCING STEEL)	SQUARE METER

ITEM 1027(1) - CEMENT PLASTER FINISH

1027.1 Description
This Item shall consist of furnishing all cement plaster materials, labor, tools and equipment required in undertaking cement plaster finish as shown on the Plans and in accordance with this Specification.

1027.2 Material Requirements
Manufactured materials shall be delivered in the manufacturer's original unbroken packages or containers which are labelled plainly with the manufacturer's name and trademark.

1027.2.1 Cement
Portland cement shall conform with the requirements as defined in Item 700, Hydraulic Cement.

1027.2.2 Hydrated Lime
Hydrated lime shall conform with the requirements as defined in item 701, Hydrated Lime.

1027.2.3 Fine Aggregates
Fine aggregates shall be clean, washed sharp river sand and free from dirt, clay, organic matter or other deleterious substances. Sand derived from crushed gravel or stone may be used with the Engineer's approval but in no case shall such sand be derived from stone unsuitable for use as coarse aggregates.

1027.3 Construction Requirements

1027.3.1 Mixture

Mortar mixture for brown coat shall be freshly prepared and uniformly mixed in the proportion by volume of one part Portland Cement, three (3) parts sand and one fourth (1/4) part hydrated lime.
Finish coat shall be pure Portland Cement properly graded conforming to the requirements of Item 700, Hydraulic Cement and mixed with water to approved consistency and plasticity.

1027.3.2 Surface Preparation

After removals of formworks reinforce concrete surfaces shall be roughened to improve adhesion of cement plaster.
Surfaces to receive cement plaster shall be cleaned of all projections, dust, loose particles, grease and bond breakers. Before any application of brown coat is commenced all surfaces that are to be plastered shall be wetted thoroughly with clean water to produce a uniformly moist condition.

1027.3.3 Application

Brown coat mortar mix shall be applied with sufficient pressure starting from the lower portion of the surface to fill the grooved and to prevent air pockets in the reinforced concrete/masonry work and avoid mortar mix drooping. The brown coat shall be lightly broomed/ or scratch before surface had properly set and allowed to cure. Finish coat shall not be applied until after the brown coat has seasoned for seven days and corrective measures had been done by the Contractor on surfaces that are defective. Just before the application of the finish coat, the brown coat surface shall be evenly moistened with potable water. Finish coat shall be floated first to a tue and even surface, then troweled in a manner that will force the mixture to penetrate into the brown coat. Surfaces applied with finish coat shall then be smooth with paper in a circular motion to remove trowel marks, checks and blemishes. All cement plaster finish shall be 10 mm thick minimum on vertical concrete and/or masonry walls.

Wherever indicated on the Plans to be "Simulated Red Brick Finish", the Contractor shall render brick design on plaster surface before brown coat had properly set and then allowed to dry. Cement plaster shall not be applied directly to:

Concrete or masonry surface that had been coated with bituminous compound and,
Surfaces that had been painted and previously plastered.

1027.3.4 Workmanship
Cement plaster finish shall be true to details and plumbed. Finish surface shall have no visible junction marks where one (1) Day's work adjoins the other. Where directed by the Engineer or as shown on the Plans vertical and horizontal groove joints shall be 25 mm wide and 10 mm deep.
1027.4 Method of Measurement
All cement plaster finish shall be measured in square meters or part thereof for work actually completed in the building.

1027.5 Basis of Payment
The work quantified and determined as provided in the Bill of Quantities shall be paid for at the Contract Unit Price which price constitutes full compensation including labor, materials, tools and equipment and incidentals necessary to complete this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1027(1)	CEMENT PLASTER FINISH	SQUARE METER

ITEM 1021 - CEMENT FLOOR FINISH

1021.1 Description

This Item shall consist of furnishing all materials, labor, tools and equipment in undertaking cement floor finishing were shown on the Plans and in accordance with this Specification.

1021.2 Material Requirements
Manufactured materials shall be delivered in the manufacturer's original unbroken packages or containers which are labeled plainly with the manufacturer's name and trademark.

1021.2.1 Cement
Portland cement shall conform to the requirement of Item 700, Hydraulic Cement.

1021.2.2 Fine Aggregates
Fine aggregates shall be clean, washed, Sharp River sand and free from dirt, clay, organic matter or other deleterious substances. Sand derived from crushed gravel or stone may be used with the Engineer's approval but in no case shall such sand be derived from stone unsuitable for use as coarse aggregate.

1021.2.3 Coloring Material
The coloring material shall be red or green oxide powder of the quality capable of achieving the best staining power and homogeneity.

1021.2.4 Metallic Floor Hardener (Premix)
Metallic floor hardener shall be a mixture of oil-free specially graded clean iron particles, mineral oxide pigment and Portland cement binder, premixed according to the manufacturer's instruction manual.

Non-Metallic Floor Hardener

a) Powder type hardener shall be silica quartz aggregates, workability admixtures, mineral oxide pigments and Portland cement mixed according to the manufacturer's instruction manual.
b) Epoxy type topping hardener shall be a combination of epoxy resins filled with hard and natural emery or silica quartz aggregates, premixed according to the manufacturer's instruction manual.

1021.3 Construction Requirements

1 021.3.1 Mixture
Concrete topping materials shall be measured accurately in accordance with the following:

a) Mortar topping shall be one (1) part Portland cement and three (3) parts fine aggregate by loose volume.
b) Finish topping shall be pure Portland cement properly graded conforming to the requirements of Item 700, Hydraulic Cement, mixed with water to approved consistency and plasticity. Where required to be colored cement floor finish, red or green oxide powder shall be premixed with Portland cement complying with finish topping requirements and the desired color intensity. Cement floor finish floor hardener shall be premixed as required and applied in accordance with the manufacturer's instruction manual.

1021.3.2 Preparation of Concrete Surface
Surface to receive mortar concrete topping shall be cleaned of all projections, dust, loose particles and other foreign matters.
Finish elevation shall be established over the areas indicated on the Plans.

1021.3.3 Application
Before any mortar concrete topping is applied, the prepared concrete base surface shall first be wetted and grouted with Portland cement.

a) Mortar topping of the thickness specified on the Plans, shall be spread over the prepared concrete base and shall be float finished using wood hand trowel. Batches of mortar topping shall be emplaced within one hour of mixing thereof.
b) As soon as the water sheen has disappeared the surface shall be lightly scratched with a stiff bristle broom
c) The finish topping mixture whether plain, colored, or with floor hardener shall be spread over the lightly scratched surface before final set taken place and hand troweled to produce a smooth surface.
d) The finished surface shall be free of trowel marks, have uniform texture and true to a plane within an allowable tolerance of 3 mm in 3.0 meters.

1021.3.4 Protection of Finished Surface
Cement floor finished surface shall be covered with burlap or appropriate covering to avoid injurious action by sun, rain, flowing water and mechanical injury.

1021.3.5 Workmanship
Cement floor shall be finished level and true to finish elevation as shown on the Plans Finish topping shall have no visible junction marks where one (1) day's work adjoins the other. V-cut groove lines shall be provided where shown on the Plans or as directed by the Engineer.

1021.4 Method of Measurement
All cement floor finish shall be measured in square meters or part thereof to work actually completed and accepted.

1021.5 Basis of Payment
The work actually completed and accepted as measured in square meters shall be paid for at the Unit Price or contract price which price constitute full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1021	CEMENT FLOOR FINISH	SQUARE METER

ITEM 1032 - PAINTING, VARNISHING AND OTHER RELATED WORKS

1032.1 Description

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

1032.2 Material Requirements

1032.2.1 Paint Materials
All types of paint material, varnish and other related product shall be subject to random test as to material composition by the Bureau of Research and Standard, DPWH or the National Institute of Science and Technology. (Use the following approved and tested brand name: Boysen, Davies, Dutch Boy, Fuller 0 Brien, or any approved equal).

1032.2.2 Tinting Colors
Tinting colors shall be first grade quality, pigment ground in alkyd resin that disperses and mixes easily with paint to produce the color desired. Use the same brand of paint and tinting color to effect good paint body.

1032.2.3 Concrete Neutralizer
Concrete neutralizer shall be first grade quality concentrate diluted with clean water and applied as surface conditioner of new interior and exterior walls thus improving paint adhesion and durability.

1032.2.4 Silicon Water Repellant
Silicon water repellant shall be transparent water shield especially formulated to repel rain and moisture on exterior masonry surfaces.

1032.2.5 Patching Compound
Patching compound shall be fine powder type material like calciumine that can be mixed into putty consistency, with oil base primers and paints to fill minor surface dents and imperfections.

1032.2.6 Varnish
Varnish shall be a homogeneous solution of resin, drying oil, drier and solvent. It shall be extremely durable clear coating, highly resistant to wear and tear without cracking, peeling, whitening, spotting, etc. with minimum loss of gloss for a maximum period of time.

1032.2.7 Lacquer

Lacquer shall be any type of organic coating that dries rapidly and solely by evaporation of the solvent. Typical solvent are acetates, alcohols and ketones. Although lacquers were generally based on nitrocellulose, manufacturers currently use, vinyl resins, plasticizers and reacted drying oils to improve adhesion and elasticity.

1032.2.8 Shellac
Shellac shall be a solution of refined lac resin in denatured alcohol. It dries by evaporation of the alcohol. The resin is generally furnished in orange and bleached grades.

1032.2.9 Sanding Sealer
Sanding sealer shall be quick drying lacquer, formulated to provide quick dry, good holdout of succeeding coats, and containing sanding agents such as zinc stearate to allow dry sanding of sealer.

1032.2.10 Glazing Putty
Glazing putty shall be alkyd-type product for filling minor surface unevenness.

1032.2.11 Natural Wood Paste Filler
Wood paste filler shall be quality filler for filling and sealing open grain of interior wood. It shall produce a level finish for following coats of paint varnish/lacquer and other related products.

1032.2.12 Schedule

Exterior

Plain cement plastered finish to be painted	-3 coats Acrylic base masonry paint
Concrete exposed aggregate and/or tool finish	-1 coat water repellant
Ferrous metal	-1 coat primer and 2 coats enamel pain
Galvanized metal	-1 coat zinc chromate primer and
2 coats portland cement paint	
Wood painted finish	-3 coats oil based paint
Wood varnished finish	- varnish water repellant

Interior

Plain cement plastered finish to be painted	- 2 coats acrylic base masonry paint
b) Concrete exposed agree gate and/or tool finish	- clean surface
c) Ferrous metal	-1 coat primer and 2 coats enamel paint
d) Woodwork sea-mist	-3 coats of 3 parts thinner 1 part lacquer
e) Woodwork varnish	- 1st coat, of one part sanding sealer to one part solvent 2nd coat of 2/3
sanding sealer to 1/3 solvent	
f) Woodwork painted	- 3 coats of oil base paint finish 109
g) Ceiling boards textured finish	-1 coat oil based paint allow to dry
then patch surfaces unevenness and apply	
textured paint coat	

1032.3 Construction Requirements

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

1032.3.1 Surface Preparation

All surfaces shall be in proper condition to receive the finish. Woodworks shall be hand-sanded smooth and dusted clean. All knotholes pitch pockets or sappy portions shall be sealed with natural wood filler. Nail holes, cracks or defects shall be carefully puttied after the first coat, matching the color of paint.
Interior woodworks shall be sandpapered between coats. Cracks, holes of imperfections in plaster shall be filled with patching compound and smoothed off to match adjoining surfaces.

Concrete and masonry surfaces shall be coated with concrete neutralizer and allowed to dry before any painting primer coat is applied. When surface is dried apply first coating. Hairline cracks and unevenness shall be patched and sealed with approved putty or patching compound.
After all defects are corrected apply the finish coats as specified on the Plans (color scheme approved).
Metal shall be clean, dry and free from mill scale and rust. Remove all grease and oil from surfaces. Wash unprimed galvanized metal with etching solution and allow it to dry. Where required to prime coat surface with Red Lead Primer same shall be approved by the Engineer. In addition, the Contractor shall undertake the following:

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

1032.3.2 Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall flaw out after application of paint. Paints made for application by roller must be similar to brushing paint. It must be nonstick when thinned to spraying viscosity so that it will 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. These procedures change the required properties of the paint.

1032.3.3 Mixing and Thinning

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

1032.3.4 Storage

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

1032.3.5 Cleaning

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

1032.3.6 Workmanship in General

All paints shall be evenly applied. Coats shall be of proper consistency and well brushed out so as to show a minimum of brush marks. All coats shall be thoroughly dry before the succeeding coat is applied. Where surfaces are not fully covered or cannot be satisfactorily finished in the number of coats specified such preparatory coats and subsequent coats as may be required shall be applied to attain the desired evenness of surface without extra cost to the owner.
Where surface is not in proper condition to receive the coat, the Engineer shall be notified immediately. Work on the questioned portion(s) shall not start until clearance be proceed is ordered by the Engineer. Hardware, lighting fixture and other similar items shall be removed or 'protected during the painting varnishing and related work operations and re-installed after completion of the work.

1032.3.7 Procedure for Sea-Mist Finish

Depress wood grain by steel brush and sand surface lightly.
Apply sanding sealer.
Apply two coats of industrial lacquer paint.
Spray last coat of industrial lacquer paint mixed with sanding sealer.
Apply wood paste filler thinned with turpentine or paint thinner into the wood surface.
Wipe off wood paste filler immediately.
Spray flat or gloss lacquer whichever is specified.

1032.3.8 Procedure for Varnish Finish

Sand surface thoroughly.
Putty all cracks and other wood imperfections with wood paste filler.
Apply oil stain.
Apply lacquer sanding sealer.
Sand surface along the grain.
Spray three (3) coats of clear dead flat lacquer.
Polish surface coated using cloth pad.
Spray gloss lacquer or flat lacquer whichever is desired or specified.

1032.3.9 Procedure for Ducco Finish

Sand surface thoroughly.
Apply primer surface white or gray by brush or spray.
Apply lacquer spot putty in thin coat. Allow each coat for become thoroughly dry before applying next coat.

Apply primer surfaces and then allow drying in two (2) hours before applying the next coat.
Apply a coat of flat tone semi-gloss enamel as per color scheme submitted and approved by the Engineer.

1032.4 Method of Measurement
The areas of concrete, wood and metal surfaces applied with varnish, paint and other related coating materials shall be measured in square meters as desired and accepted to the satisfaction of the Engineer.

1032.5 Basis of Payment
The accepted work shall be paid at the unit bid price, which price and payment constitute full compensation for furnishing all materials, labor, equipment, tools and other incidental necessary to complete this Item.

Payment will made under:

Pay Item Number	Description	Unit of Measurement
1032 (1)	PAINTING WORKS	SQUARE METER

ITEM 1003 - CARPENTRY AND JOINERY WORKS

1003.1 Description
The work under this Item shall consist of furnishing all required materials, fabricated woodwork, tools, equipment and labor and performing all operations necessary for the satisfactory completion of all carpentry and joinery works in strict accord with applicable drawings, details and these Specifications.

1003.2 Material Requirements

1003.2.1 Lumber
Lumber of the different species herein specified for the various parts of the structure shall be well seasoned, sawn straight, sundried or kilndried and free from defects such as loose unsound knots, pitch l~- pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance.

Grades of Lumber and Usage
a.Stress grade is seasoned, close-grained and high quality lumber 1~ of the specified specie free from defects and suitable for sustaining heavy loads.
Stress grade lumber shall be used for wooden structural members, subject to heavy loads, and for sub-floor, framing embedded or in contact with concrete or masonry.
b.Select grade lumber of the specified specie is generally of high quality, of good appearance, without imperfections, and suitable for use ff without waste due to defects and suitable also for natural finish.
Select grade lumber shall be used for flooring; sidings, facia and it base boards, trims, mouldings, millwork, railings, stairs, cabinet work, shelvings, doors, windows and frames of openings.
c.Common grade lumber has minimum tight medium knot not larger, than 25 mm in diameter, with minimal imperfections, without sapwood, without decay, insect holes, and suitable for use with some waste due to minor defects and suitable also for paint finish.

Common grade lumber shall be used for light framework for wall partitions, ceiling joist and nailers.

1003.2.1.2 Lumber Species and Usage
Unless otherwise specified on the Plans, the following lumber species shall be used as indicated:

a.Yacal (stress grade) for structural member such as post, girders, girts, sleepers door and window frames set or in contact with concrete or masonry.
b.Guijo (select grade) for door and window frames set in wooden framework, for stairs, for roof framing supporting ceramic or cement tiles, for floor joists and other wooden structural parts.
c.Apitong (common grade) for roof framing supporting light roofing materials such as galvanized iron, aluminum or asbestos sheets, for wall framing, ceiling joists, hangers and nailers.
d.Tanguile (select grade) for doors and windows, facia and base boards, trims, mouldings, millwork, railings, stairs, cabinet, work, shelvings, flooring and siding.
e.Narra (select grade) for stair railings, flooring boards, wall panels base boards, trims, mouldings, cabinet work, millwork, doors and windows when indicated as such in the Plans.
f.Dao (select grade) for parts of the structure as enumerated under Section 1003.2.1.2 (e), when indicated as such on the Plans.

1003.2.1.3 Moisture Content
Rough lumber for framing and siding boards shall be air-dried or sun-dried such that its moisture content shall not exceed 22 percent. Dressed lumber for exterior and interior finishing, for doors and windows, millwork, cabinet work and flooring boards shall be kiln-dried and shall not have moisture content in excess of 14 percent at the time of installation in the structure.

1003.2.1.4 Substitution in Lumber Specie
Any lumber equally good for the purpose intended may be substituted for the specified kind subject to the prior approval of the Engineer, provided the substitution shall be of an equal or better specie acceptable to the Engineer. In case of substitution with better specie, no additional cost therefore shall be allowed to the contractor.

1003.2.2 Plyboard
Plyboard shall be good grade and made of laminated wood strips of uniform width and thickness bounded together with water resistant resin glue. The laminated core shall be finished both faces with select grade tanguile or red lauan veneers not less than 2 mm thick similarly bonded to the core. The plyboard of not less than 19 mm thick shall be free 'from defects such as split in veneer, buckling or warping.

1003.2.3 Plywood
Plywood shall conform to the requirements of the Philippine Trade Standards 631-02. Thickness of a single layer laminae shall not be less than 2 mm. The laminae shall be superimposed in layers with grains crossing at right angles in successive layers to produce stiffness. The face veneers shall be rotary cut from select grade timber. The laminae and face veneers shall be bonded with water resistant resin glue, hot pressed and pressure treated. Ordinary tanguile or red lauan plywood with good quality face veneers, 6 mm thick shall be used for double walling and ceiling not exposed to moisture; waterproof or marine plywood shall be used for ceiling exposed to moisture such as at toilets and eaves, and ceiling to be finished with acrytex.

1003.2.4 Lawanit
Lawanit, when required per plans, shall be 6 mm thick, tempered or oil impregnated for moisture/water resistance. Texture of lawanit shall be subject to the approval of the Engineer.

1003.2.5 Materials Other Than Lumber

1003.2.5.1 Plastic Sheet
When required for counter top, plastic sheet such as Formica shall not be less than 1.50 mm thick and shall have hard, durable and glossy surface resistant to stain, abrasion and heat. Color and design shall be as selected from the manufacturer's standard and approved by the Engineer.

1003.2.5.2 Glue
Glue shall be from water resistant resins which, upon hardening, shall not dissolve nor lose its bond or holding power even when soaked with water for extended period.
Glue in powder form be in sealed container and shall be without evidence of lumping or deterioration in quality.

1003.2.5.3 Fasteners
Nails, screw, belts and straps shall be provided and used where suitable for fixing carpentry and joinery works. All fasteners shall be brand new and of adequate size to ensure rigidity of connections.

a. Nails of a,dequate size shall be steel wire, diamond-pointed, ribbed shank and bright finish.
b. Screws of adequate size shall be cadnium or brass plated steel with slotted head.
c. Lag screws of adequate size, for anchoring heavy timber framing in concrete or masonry, shall be galvanized steel.
d. Bolts and nuts shall be of steel having a yield point of no't less than 245 MPa. Bolts shall have square heads and provided with standard flat steel washers and hexagonal nuts. Threads shall conform to American coarse thread series. The threaded portion shall be long enough such that the nut can be tightened against the bolted members without any need for blocking. The bolt's threaded end shall be finished smooth for ease of engaging and turning of the nut.
e. Wrought iron straps or angles, when required in conjunction with bolts or lag screws to provide proper anchorage, shall be of the shape and size shown on the Plans.

1003.3 Construction Requirements

1003.3.1 Quality of Materials
All materials to be incorporated in the carpentry and joinery works shall be of the quality specified under Section 2. Before incorporation in work, all materials shall have been inspected/accepted by the Engineer or his authorized representative.

1003.3.2 Storage and Protection of Materials
Lumber and other materials shall be protected from dampness during and af1er delivery at the site. Materials shall be delivered well in advance of actual need and in adequate quantity to preclude delay in the work. Lumber shall be piled in orderly stack at least 150 mm above ground and at sheltered place where it will be of least obstruction to the work.

1003.3.3 Shop Drawings
Shop drawings complete with essential dimensions and details of construction, as may be required by the Engineer in connection with carpentry and joinery work, shall be submitted for approval before proceeding with the work.

1003.3.4 Rough Carpentry
Rough carpentry covers timber structural framing for roof, flooring, siding, partition and ceiling.

a. Framing shall be stress grade or common grade lumber of the specie specified under Section.
b. Rough carpentry shall be done true to lines, levels and dimensions. It shall be squared, aligned, plumbed and well fitted at joints.
c. Trusses and other roof framing shall be assembled, fitted and set to exact location and slope indicated on the Plans.
d. Fasteners, connectors and anchors of appropriate type and number shall be provided and fitted where necessary.
e. Structural members shall not be cut, bored or notched for the passage of conduits or pipes without prior approval of the Engineer. Members damaged by such cutting or boring shall be reinforced by means of specifically formed and approved steel plates or shapes, otherwise, damaged structural members shall be removed and replaced to the satisfaction of the Engineer.
f. Timber framing in contact with concrete or masonry shall be treated with termite-proofing solution and after drying coated with bituminous paint.

1003.3.5 Finished Carpentry
Finished carpentry covers works on flooring, siding and ceiling boards, stairs, cabinets, fabricated woodwork, millwork and trims.

a. Framing lumber shall be select grade, free from defects and where exposed in finished work, shall be selected for color and grain.
b. Joints of framing shall be tenoned, mortised or doweled where suitable, closely fitted and secured with water resistant resins glue. Exterior joints shall be mitered and interior angles coped.
c. Panels shall be fitted allow for contraction or expansion and ensure that the panels remain in place without warping, splitting and opening of joints.
d. Plyboard shall be as specified under Section 1003.2.3 unless otherwise indicated on the Plans.
e. Plywood shall be specified under Section 1003.2.4.
f. Exposed edges of plywood or plywood for cabinets shall be provided with select grade hardwood strips, rabbetted as necessary, glued in place and secured with finishing nails. To prevent splitting, hardwood for trims shall be drilled before fastening with nails or screws.
g. Fabricated woodwork shall be done preferably at the shop. It shall be done true to details and profiles indicated on the Plans. Where set against concrete or masonry, woodwork shall be installed when curing is completed.
h. Exposed wood surfaces shall be free from disfiguring defects such as raised grains, stains, uneven planning, sanding, tool marks and scratches.

Exposed surfaces shall be machine or hand sanded to an even smooth surface, ready for finish.

1003.6 Basis of Payment
The work actually completed and accepted as measured in square meters shall be paid for at the Unit Price or contract price which price constitute full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1003	CARPENTRY AND JOINERY WORKS	LUMP SUM

ITEM 1006 - STEEL DOORS AND FRAMES

1006.1 Description
This Item shall consist of furnishing and installing all fabricated steel doors and frames equipped with fixing accessories and locking devices in accordance with the Plans and/or shop drawings and as herein specified.

1006.2 Material Requirements
All door cladding plates or panels shall be formed from gauge 20 cold-rolled, prime quality steel. Frames shall be formed from gauge 16 cold-rolled steel. The materials used shall conform to the specification requirement of ASTM-A505.

1006.2.1 Tubular Door (Casement/Sliding)

a. Hollow steel doors shall be custom built of size and details as indicated on the Plans and/or shop drawings. Cladding of doors shall be flush or louver type. Doors shall be 44 mm thick, side hinged or overhead· hung, as called for on the Plans.
b. Flush doors shall be constructed from two outer steel sheets not lighter than gauge 20, with edges welded and finished flush. The outer face sheets shall be reinforced with gauge 24 vertical channels or interlocking zee members. Sound insulation fillers of cork fiberboard, mineral wool board or asbestos shall be placed full height in spaces between reinforcing channels. Doors shall have smooth, flush surfaces without any visible joints or seams on exposed faces or stile edges except around glazed or louvered pane inserts. Top and bottom frame of doors shall have continuous reinforcing channels welded to face sheets. The channel for exterior doors shall be inverted type, not lighter than gauge 16, constructed to form a weather seal. Glazed opening shall be provided where indicated and molding around glazed openings shall not be lighter than gauge 20 metal.

1006.2.2 Grille doors shall be of flat, square or round bars (wrought iron) as indicated on the Plans framed on galvanized black iron pipe or flat wrought iron bars, of the design shown on the Plans.

1006.2.3 Tubular steel frames shall be machine pressed true to details, to size and shape as shown on the Plans and shall have full welded unit or knockdown field assembled type construction at corners and other joints.

1006.2.4 Steel Louvers

Louvers shall be machine pressed conforming to the size and design indicated on the Plans with removable louver pane formed to fit the metal sub frame of openings. The steel sheets shall meet the requirement of ASTM 505, rivets of ASTM B 316, screws, bolts, nuts and washers of ASTM B 211.

1006.2.5 Anchors and Fasteners
Anchors shall be steel, zinc coated or coated or painted with rust inhibitive paint, of sizes, shapes and design per manufacturer's standards.
Floor anchors shall not be lighter than gauge 18, with exception of jamb anchors for installing door frames in metal latch and plaster assemblies which shall be minimum of gauge 16 and shall not extend no more than 20 mm out of the back of the jamb.

1006.3 Construction Requirements

1006.3.1 Fabrication
Corner joints of frames shall be mitered and welded conforming to manufacturer's standard manual for metal doors. All contact edges be closed tight. Welds on exposed surface shall be ground smooth and shall be neat in appearance.
Joints for knock-down type frame corners shall be designed for simple field assembly of header to jamb members by concealed tenon, splice plates, or other type concealed in interlocking joint that will produce square and rigid corners. Joints shall be securely locked in place during erection and the alignment of adjoining members shall be maintained. All bolted connections shall be provided with lock units.

1006.3.2 Shop Finish

Hot or Cold Phosphate Surface Treatment
All steel doors, frames and louvers shall be cleaned thoroughly, phosphate-treated to assure maximum paint adherence and prime finish, in accordance with the following operations:

1. After fabrication, grease and dirt shall be removed by a hot alkali solution and rinsed with hot water.
2. After cleaning, all parts shall be immersed in hot or cold phosphate solution and rinsed with a diluted solution or chronic acid.
3. After drying under controlled temperature, one coat of shop primer shall be applied by dipping type especially developed for materials treated with phosphates.

The cleaning, phosphate, dipping or spraying of shop primer and even drying shall be done on a continuous operation in the factory.

1006.3.3 Installation
Steel doors, frames and louvers shall be set plumb and true in 'The joint between frame and masonry shall be carefully contacts between door/frame and adjacent steel shall be sealed with mastic.

1006.3.4 Wall Anchors
A minimum of three anchors shall be provided for each jamb. Anchors shall be located opposite the top and bottom hinges and midway between top and bottom anchors.
Anchors for fastening frames to masonry shall be adjustable, and perforated and shall extend not less than 200 mm into masonry.
Anchors for fastening frames to metal or wood stud partitions shall be welded to metal or nailed to wood studs respectively.
Anchors for fastening frames to previously placed concrete or masonry shall be secured to existing construction with expansion bolts. Frames shall be fastened securely with anchors.

Anchors for fastening frames to partitions of plaster on metal lathe shall be secured firmly to back of frames that shall receive the latch. Adjustable strut anchors shall be provided on each side of frame for fastening to the structural members of the partition and of the ceiling framing above. The size and type of strut anchors shall be as recommended by the metal door manufacturer.

1006.3.5 Floor Anchors
Floor anchors shall be provided at the bottom of each jamb member, anchors shall be fixed/ adjustable and drilled for 10mm diameter anchor bolts.
Where floor fill occurs, the bottom of frames shall terminate at the indicated finished floor levels and shall be supported by adjustable extension clips resting on and anchored to the structural slab.

1006.3.6 Hardware
Side bronze butts for side hung doors, overhead pocket hardware for track and roller types and locksets shall be suitable for the service required and subject to the approval of the Engineer and as provided in Item 1004, Hardware.

1006.4 Method of Measurement
Steel doors, frames, louvers, accessories and hardware shall be measured in square meters/per set as shown on the Plans. A set shall consist of metal door, jambs, anchors and hardware except locksets.

1006.5 Basis of Payment
The area in m2 for every hollow steel door, flush door, grille door and steel louver installed ready for service shall be the basis of payment based on the unit bid or contract unit price
Payment will be made under:

ITEM 1008(2) - ALUMINUM FRAMED GLASS WINDOWS

1008(2).1 Description
This Item shall consist of all fabricated steel windows fully equipped with fixing accessories and locking devices as shown on the Plans and in accordance with this Specification.

1008(2).2 Material Requirements
All members shall be of hot-rolled, low carbon, new billet steel, heavy section with depth of at least 33mm and web thickness of at least 3mm. Frame members shall be of equal leg design section only at points where called for or shown on detailed drawings. Continuous angle fins, as indicated shall be furnished. Zee type section of special design with offset permitting down turned leg of the ventilator member to seat flush when ventilator is in a fully closed position, shall be used for frame at sills.Ventilator members shall be special angle shape. Frames of ventilator members shall have integral weather baffles providing double flat parallel weathering contacts of not less than 6mm width on all four sides of the ventilator. Muntins shall be 25mm by 25mm rolled-tee sections. All members to be used shall conform to the specification requirements of ASTM A "505. The frame member shall afford not less than 16mm continuous anchorage to surrounding masonry. Unless otherwise specified/or indicated on Plan as residential casement, special size of section shall be used.

1008(2).2.1 Residential Casement
Sections shall be hot rolled new billet steel special design. Frame and ventilator members shall be specially designed zee sections, not less than 25 mm in depth and not less than 3 mm in thickness, with weathering baffles rolled integrally to provide continuous double contact between frame and casement ventilator members. Muntins shall be 19mm by 19 mm rolled tee-sections. Side hung hinges shall be of extension friction type welded to both frame and ventilator with friction washers and steel acorn-nuts.

1008(2).2.2 Heavy Duty Side-hinged Ventilator
Frame and ventilator members shall be specially designed zee section not less than 33 mm in depth and not less than 3 mm in thickness, with weathering baffles rolled integrally to provide continuous double contact between frame and side-hinged ventilator members. Muntin shall be 25 mm by 25 mm rolled tee-sections. Simplex-type hinges shall be of extension friction type with bronze friction washers and rust proofed steel acorn-nuts., hinged design shall provide ferrous to non-ferrous contacts between all movable surfaces. Hinges shall be welded to both frame and ventilator.

1008(2).2.3 Projected Ventilators
All members shall be hot rolled new billet steel window. Frames and ventilator sections shall be special angle shape and not less than 33 mm deep from front to back not less than 3 mm in thickness. Weathering projections, overlapping, parallel contacts at both insides and outside points of closure on all four sides of the ventilator shall be 6 mm.

1008(2).2.4 Awning ventilators (for series of ventilators operating simultaneously)
Frame, ventilator and muntin members shall be hot rolled new billet steel section not less than 33 mm deep, specifically designed for steel windows.

1008(2)..3 Construction Requirements

1008(2).3.1 Fabrication and Welds
Corners of frame and ventilator shall be mitered and electrically butt welded with exposed welds ground smooth. Head drips shall be provided where ventilator extend to the top of the windows. Muntins shall be welded to frames. Muntin intersections shall be welded with flush interior surfaces.

1008(2).3.2 Hardware (fixing accessories and locking devices)

1008(2).3.2.1 Residential Casement, heavy duty side-hinged ventilator
a. Roto Type: Each ventilator shall be hung on two heavy hot rolled steel of the extension type, welded to both frame and ventilator. Hinged design shall provide ferrous to nonferrous-to-nonferrous contacts between all movable surfaces. Hardware shall control ventilator independently of the screen and shall consist of a polished bronze locking handle and worn drive operator. Provide however that roto hardware shall not be used on any ventilator, the size of which exceeds 1 square meter in area. Ventilators over 150 mm in height shall have three (3) hinges and double locking device.

b. Simplex-Type: Hinges shall be of extension friction type with bronze friction washers and rust proofed steel acorn-nuts. Hinged design shall provide ferrous to nonferrous contacts between all movable surfaces. Hinges shall be welded to both frame and ventilator.

c. Polished bronze locking handle and strike shall be furnished for ventilator 500 mm and under in height, two-point locking devices and three (3) hinges for ventilators over 500 mm in height. Sill adjuster shall be provided for ventilator over 1000 mm square meter in area.

1008(2).3.2.2 Projected Ventilators
Each ventilator shall be balanced on two heavy steel arms riveted to ventilator -and frame. Rivet holes in arms shall be bronze bushed. Uniform tension to hold ventilator in open position shall be obtained by two heavy bronze, sliding friction shoes with adjustable compression springs enclosed in bronze housing attached to the ventilator top rail member. The window frame member shall act as a guide for the friction shoe. Hardware shall consist of polished bronze pole hook ring, cam handle and strike for outward projecting ventilators. Polished bronze, pole operated spring latches, shall be substituted for locking handles on outward projecting ventilator, out of each floor, polished bronze, cordoperated, spring latches for inward projecting vents not within reach of floor provided with double line of best quality sash cord 5 mm to 6 mm in diameter extending to 762 mm above floor. Polished bronze, under screen push bar working through the member to be furnished for outward projecting ventilator when so indicated on Plans or drawings.

1008(2).3.2.3 Awning Ventilators
Each awning window so indicated on the Plans shall be of the awning type window in which the ventilators operate simultaneously and controlled manually. Each projecting ventilator shall be balanced on two heavy steel supporting arms. Arms for upper ventilators shall have tops pivots enclosed in malleable iron housing riveted to ventilator and pivoting point shall be located outside of window to provide efficient leverage. Ventilator in each window shall be equipped with extension arms attached to connecting steel frame and shall be concealed within frame when ventilators are in closed position. All ventilators shall open or close simultaneously. The bottom ventilator shall be the means of control and shall be fitted with a solid bronze, polished, cam locking handle and strike. Base of handle to dowel with strike to prevent side motion of ventilator. Where windows are screened, provide a bronze under screen push bar working thru the frame member.

1008(2).3.3 Installation
All steel windows shall be set plumb and true in openings. The joints between the window frame and masonry shall be carefully caulked. Contacts between windows or doors and adjacent steel including mullions shall be sealed with mastic furnished and applied by the Contractor. Windows shall be designed for glazing from the outside with spring wire glazing clips and glazing putty.
Mullions and anchors shall be manufacturer's standard, vertical mullions, anchors and bolts for attaching shall be furnished where required.
Adequate anchorage shall be provided to ensure firm installation.

1008(2).3.4 Shop Painting
All windows shall be given a coating of gray metallic paint applied to all surfaces as paint base for prevention of corrosion. Prior to application of paint primer the steel sections shall be cleaned of rust, oil, grease and other foreign matter.

1008(2).4 Method of Measurement
Steel windows shall be measured by actual in place installed with respective design/style and type of operation in square meters.

1008(2).5 Basis of Payment
The actual area in square meters of windows satisfactorily installed and ready for service shall be the basis for payment based on the unit bid or contract unit price.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1008(2)	ALUMINUM FRAMED GLASS WINDOWS	SQ.M.

ITEM 1010 - WOODEN DOORS AND WINDOWS

1010.1 Description
This Item shall consist of furnishing all materials, hardware, plant, tools, labor and services necessary for complete fabrication and installation of wooden doors and windows of the type and size as shown I on the Plans and in accordance with the following specifications and I applicable specifications under Item 1003 on Carpentry and Joinery I Works.

1010.2 Material Requirements

1010.2.1 Lumber
Lumber of doors, windows and jambs, and panels when required, shall be kiln-dried with moisture content of not more than 14% and shall be of the specie indicated on the Plans and/or specified under Item 1003 on Carpentry and Joinery Works.

1010.2.2 Plywood.
Plywood for veneer of solid core and hollow core flush doors shall be 3-ply, rotary cut, 6mm thick ordinary plywood, Class B grade. Marine or waterproof plywood, rotary cut, 3-ply, 6 mm thick shall be used for flush doors at toilets and bathrooms or at places where these are exposed to moisture.

1010.2.3 Adhesive
Adhesive shall be water resistant resins and shall be non-staining.

1010.2.4 Glass
Glass for window panes shall be 3 mm thick, smoked or Industry type unless otherwise shown on the Plans or indicated in the Schedule of Doors and Windows.

1010.2.5 Capiz Shells
Capiz shells, when required for window sashes, shall be of selected quality, free from dirt or blemishes and shall be large enough to obtain flat square piece.

1010.2.6 Hardware
Hardware shall be as specified under Item 1004 on Building Hardware.

1010.3 Construction Requirements

1010.3.1 Fabrication
Wooden doors and windows, including frames, shall be fabricated in accordance with the designs' and sizes shown on the Plans. The fabricated products shall be finished square, smoothly sanded and free from damage or war page.

Flush Type Hollow Core Doors
Flush type hollow core doors shall be adequately framed with stiles and top and bottom rails having a minimum thickness of 44 mm and width of 75 mm. Two intermediate rails at least 44 mm wide shall be provided for stiffness. The stiles and the top and bottom rails shall be rebutted at least 10 mm wide to receive the 6 mm thick plywood veneer. A lock block shall be' provided at each stile, long enough to connect to the two intermediate rails and at least 75 mm wide for mounting the lockset. The plywood veneer shall be glued and nailed to the framing with 25 mm long finishing nails space at not more than 150 mm on centers.

Flush Type Solid Core Doors
Flush type solid core doors shall be fabricated in the same manner as the hollow core type except that spaces between stiles and r3i1s shall be filled and fitted with wood blocks of the same specie and of uniform thickness thinner by about the thickness of the plywood veneers. The filler blocks shall be secured to either stiles or rails by nails. Stiles and rails of flush type doors shall be joined by means of blind mortise and tenon joint, tightly fitted, glued and locked with bamboo pin 5 mm round.

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

Rails minimum thickness of 44 mm and width of 140 mm. Rails shall be framed to stiles by mortise and tenon joints. Rabbets or grooves of stiles by mortise and tenon joints. Rabbets or grooves of stiles and rails to receive panels shall be 6.5 mm wide and 20 mm deep. Integral moldings formed on both faces of stiles and rails framing the panels shall be true to shape and well defined. Intersections of moldings shall be mitered and closely fitted.
Panels of the same specie and having a minimum thickness of 20 mm shall be beveled around its edges up to a minimum width of 50 mm, both faces. The beveled edges shall closely fit into the grooves of stiles ',"j and rails, but free to move to prevent splitting when shrinkage occurs.

Window Sashes with Glass Panes or Wood Panels
Window sashes shall be fabricated in conformity with the design, .1 size and type of installation shown on the Plans. Unless otherwise shown on the Plans, stiles and rails shall be Tanguile with minimum I thickness of 30 mm and width of 70 mm. Jointing of stiles and rails shall I be mortise and tenon secured with glue and bamboo pin. Stiles and rails shall rebut at the exterior face for mounting glass panes or wood I panels. Integral moldings formed as frames for panes or panels shall be true to shape, sharply defined and mitered at joints. Separate moldings, Of the same design shall be provided for fixing glass panes and wood panel from the outside.

Window Sashes with Capiz Shells
Stiles and rails shall be of the same sizes specified under Item 1010.3.1 (d) and assembled with mortise and tenon joint. Unless otherwise indicated on the Plans, lattices for framing capiz shall be tanguile, 8 mm thick and 15 mm wide, spaced at not more than 60 mm on centers both ways. Grooves 2 mm wide and 5 mm shall be made at sides of lattices to receive the preformed capiz shells. The lattices shall be assembled with half lap joints at their intersections and the assembled lattices containing the capiz shells shall be framed into the stiles and rails. Selected capiz shells shall be washed to remove dirt and blemishes and drier under the sun for bleaching effect. Capiz shells shall be cut square to required sizes with sharp bench cutter to produce non-serrated and non-peeling edges.

Sliding Type Window Sashes
Stiles of sliding type window sashes shall be framed to the top and bottom rails with mortise and tenon joints. Tenons shall be formed on the stiles. Joints shall be tightly fitted, glued and locked with bamboo pins. Top and bottom rails shall be 10 mm wider than the stiles. Top rails shall be rabbeted to form tongue flush with the outer face, with width of 8 mm and height of 10 mm. The stiles and rails shall be rabbeted as specified under Item 1010.3.1 (d) to receive glass panes or wood panels.

Awning Type Window Sashes
Tenons of rails shall be fitted into the mortises formed on the stiles and the joints glued and locked. The stiles and rails shall be rabbeted as specified under Item 1010.3.1 (d) for mounting of glass panes. Series of sashes to be installed vertically shall have their meeting rails rabbeted for half lapping when in closed position.

Casement Type Window Sashes
Rails of casement type window sashes shall be fitted to stiles with mortise and tenon joint. Tenons shall be formed in the rails. Meeting rails shall be rabbeted to provide for half lapping when in closed position. The stiles and rails shall be rabbeted as specified under Item 1010.3.1 (d) for mounting of glass panes or wood panels.

Door and Window Frames
Framing of the specie(s) specified under Item 1003 shall be fabricated in conformity with the profile and sizes shown on the Plans. Frames shall be assembled with tightly fitted tongue and groove joint mitered at both sides, and nailed. The assembled frames shall be finished square and flat on the same plane. Assembled frames shall be braced temporarily to prevent their distortion during delivery to the site and installation.

Installation

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

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

b. Hinged Doors

Hinged doors, whether panel or flush type with standard height of 2100 mm and width of not more than 900 mm shall be hung with four loose-pin butt hinges, 100 mm x 100 mm. Swing out exterior doors shall be hung with four fast-pin butt hinges. Two hinges shall be fitted 150 mm from top and bottom edge of door. The other two hinges shall be fitted at third points between top and bottom hinges. Care should be taken to ensure that the hinges are fitted such that their pins are aligned for ease of pin insertion and smoothness of operation. For added smoothness pins should be lightly greased. Hammering of hinges to attain proper, alignment shall not be allowed. For wider and heavier doors such as narra panel doors, an additional hinge shall be fitted 100 mm below the top hinge to counteract the door tilting action. Mounting screws shall be screwed in place in their entire length, not forced into place by hammering. Hammering of screw into place shall not be permitted.

c. Sliding Doors

Overhead tracks, standard, locally manufactured as per Plans shall be installed level and mounting bracket secured in place with lag screws supplied with the set. Bracket shall be spaced 1000 mm 'on centers. Hangers, two each per door leaf, shall be per fitted and bolted to the dour rail. For panel doors the hangers shall be centered on the door stiles. For flush doors, the hangers shall be centered 100 mm from the edges of the door. If there is no adequate space for

installing the door with its attached rollers, through either end of the track the per fitted hangers shall be disassembled for connection to the rollers. After installation on the track, set the door plumb and in alignment by means of the adjustment mechanism integrated with the roller assembly.

d. Lock Installation

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

e. Sliding Type Window Sashes

Sashes shall be trimmed to fit height of opening. A clearance of 2 mm shall be provided between the toungue's base at the top rail and the bottom of the window head. Paraffin wax shall be applied to contacts of sliding sufaces. The bottom rails shall be fitted with standard brass guided spaced 75 mm from both ends of the rail, mounted flush with the inner face and secured with three brass screws each guide.

f. Casement Type Window Sashes

Sashes shall be trimmed to fit size of opening, with provision for half lapping of meeting stiles. Right side sash shall lap onto the left side sash. Sashes shall be fitted with two brass-plated narrow hinges, 50 mm x 75 mm, spaced 150 mm from top and bottom of stiles. In lieu of hinges, sashes maybe hung with cadmium-plated steel casement adjusters 200 mm long, subject to prior approval of the Engineer. The top and bottom rails of casement type window sashes shall be milled to provide for the installation of adjusters.

g. Awning type Window Sashes

Installation of awning type sashes shall be by means of casement adjusters specified under Item 1010.3.2 (f).

Measurement and Payment

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

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

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

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1010	WOODEN PANEL DOORS WITH GLASS	SQUARE METER

ITEM 1018 - CERAMIC TILES

1018.1 Description

This Item shall consist of furnishing all ceramic tiles and cementitious materials, tools and equipment including labor required in undertaking the proper installation of walls and floor tiles as shown on the Plans and in accordance with this Specification.

1018.2 Material Requirements

1018.2.1 Ceramic tiles and trims shall be made of clay, or a mixture of clay and other materials which is called the body of the tile. Tile bodies are classified by ASTM C 242 as to their degree of water absorption. Ceramic tiles and trims are manufactured either by dust-pressed process in which the clays are ground to dust mixed with a minimum of water shaped in steel dies and then fired or by plastic process in which the clays are made plastic by mixing with water, shaped by extrusion or in molds and then fired.

1018.2.1.1 Glazed Tiles and Trims

Glazed tiles' and trims shall have an impervious face of ceramic materials fused onto the body of the tiles and trims. The glazed surface may be clear white or colored depending on the color scheme approved by the Engineer. Standard glazes may be bright (glossy) semimatte (Less glossy) matte (dull) or crystalline (mottled and textured; good resistance to abrasion). Glazed tiles are used principally for walls; crystalline glazed tiles may be used for floors provided how8ver that these are used as light duty floors.

1018.2.1.2 Unglazed Tiles

Unglazed tiles shall be hard dense tile of homogeneous composition.

Its color and characteristics are determined by the materials used in the body, the method of manufacture and the thermal treatment. It is used primarily for floors and walks.

1018.2.1.3 Trims

Trims are manufactured to match wall tile color, texture and to coordinate with it in dimension. These are shaped in various ceramic trim units such as caps, bases, coves, bullnoses, corners, angles, etc. that are necessary for edging or making a transition between intersecting planes.

1018.2.1.4 Accessories

Accessories like some soap holders and shall be made wall mounted type with colors to reconcile with the color of the adjacent wall tiles.

1018.2.1.5 Cement

Cement shall be Portland conforming to the specification requirements defined in Item 700, Hydraulic Cement.

1018.2.1.6 Sand

Sand shall be well graded fine aggregate clean river sand, free from soluble salts and organic impurities.

1018.2.1.7 Lime

Lime shall be hydrated lime with free un hydrated oxide and magnesium oxide content not to exceed 8 percent by weight.

1018.3 Construction Requirements

Tile work shall not be started until roughing-ins for plumbing, electrical and other trades have been completed and tested. The work of all other trades shall be protected from damage.

Surface Preparation

a) Mortar mix for scratch coat and setting bed shall consist of one part Portland cement 1/4 part lime and 3 parts sand by volume. Surface to receive tile must be level, true to elevation, dry, free from dirt, oil and other ointments. Allow at least seven days curing of scratch coat and setting bed. Installation work shall not be allowed to proceed until unsatisfactory conditions are corrected.
b) Bond coat shall be portland cement paste.

1018.3.1.1 Thoroughly dampen surfaces of masonry or concrete walls before scratch coat is applied.

1018.3.1.2 On masonry or concrete surface first apply a thin coat with pressure, then bring it out sufficiently to compensate for the major irregularities of the surface to a thickness not less than 10 mm. at any point.

1018.3.1.3 Evenly rate scratch coat to provide good mechanical key before the mortar mix has fully hardened.

1018.3.2Installation Procedure
Ceramic tiles shall be soaked in clean water prior to installation for a minimum of one hour

Ceramic Glazed Wall Tiles
a) Determine and mark layout of ceramic tiles, joint location, position of trims and fixtures so as to minimize cut less than one-half tile in size.
b) Thoroughly dampen surface of wall but do not saturate surface.
c) Apply a bond coat mix with consistency of cream paste 1.5 mm thick to the wall surface or to the back of the tile to be laid.
d) Lay the tiles true to profile then exert pressure and tamp tile surface before the bond coat mix has initially set.
e) Continue with the next full tile to be laid and pressed firmly upon the setting bed tamped until flush and in place of the other tiles.
f) Intersections and returns shall be formed accurately using the appropriate trims.
g) All lines shall be kept straight and true to profiles, plumbed and internal corners rounded using the appropriate trims.

Vitrified Unglazed Floor Tiles
a) Before tire is applied the floor surface shall be tested for levelness or uniformity of slope by' flooding it with water. Area where water ponds are filled or levelled, shall be retested before the setting bed is applied.
b) Establish ljnes of borders and center of the walls at the field work in both direction to permit the pattern to be laid with a minimum of cut tiles.
c) Clean concrete subfloor then moisten but do not soak. Then sprinkle dry cement over the surface and spread the mortar on the setting bed.
d) Apply and spread mortar mix for setting bed and tamp to assure good bond over the entire area to be laid with tile.
e) Pitch floor to drain as shown on Plans or as directed by the Engineer
f) Allow the setting bed to set sufficiently to be worked over then spread a bond coat over the surface and lay tile in accordance with Items 1019'.3.2.1 a, b, c, d, e, f, g.

1018.3.3 Grouting and Pointing

1018.3.3.1 Tiles shall have laid in place for at least 24 hours before grouting of the joints is started. Grouting mortar shall be white Portland cement or blended with pigments to acquire the color appropriate for the ceramic tile.

1018.3.3.2 Grouting mortar shall be applied over the tile by float or squeegee stroked diagonally across the joints. Remove excess mortar with a wet sponge stroked diagonally or in a circular motion after 12-15 minutes. Follow with a barely damp or dry sponge to remove remaining haze while smoothing all grouted joints.

Cleaning
a) Clean ceramic tile surfaces thoroughly as possible upon completion of grouting.
b) Remove all grout haze, observing tile manufacturers recommendations as to use of acid or chemical cleaners.
c) Rinse tile thoroughly with clean water before and after using chemical cleaners.
d) Polish surface of tile with soft cloth.

Protection from Construction Dirt
a) Apply a protective coat of neutral cleanser solution diluted with water in the proportion of 1:4 or 1 liter cleanser concentrate to 1 gallon water.
b) In addition, cover tile flooring with heavy-duty no staining construction paper, taped in place.
c) Just before final acceptance of the work removes paper and rinse protective coat of neutral cleaner from tile surface. Do not let protective paper get torn 'or removed.

Method of Measurement
All works performed under this Item shall be measured in square meters for areas actually laid with ceramic tiles and accepted to the satisfaction of the Engineer.

1018.5 Basis of Payment
Ceramic tile work determined and provided in the Bill of Bill of Quantities shall be paid for based at the unit bid price which price and payment constitute full compensation for furnishing all materials, tools, equipment and other incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1018	GLAZED TILES AND TRIMS	SQUARE METER

ITEM 1100 - CONDUITS, BOXES & FITTINGS

1100.1 Description
This Item shall consist of the furnishing and installation of the complete conduit work consisting of electrical conduits; conduit boxes such as junction boxes, pull boxes, utility boxes, octagonal and square boxes; conduit fittings such as couplings, locknuts and bushings and other electrical materials needed to complete the conduit roughing-in work of this project.

1100.2 Material Requirements

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

Conduits
Conduits shall be standard rigid steel, zinc coated or galvanized. Intermediate metal conduit may be used if shown or specified on the approved Plans. PVC conduit if required shall be Schedule 40. Enamel coated steel conduits and conduits with rough inner surfaces are not acceptable.

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

Conduit Fittings
All conduit fittings such as locknuts and bushings shall be galvanized of standard make.

1100.3 Construction Requirements
All works throughout shall be executed in the best practice in a workmanlike manner by qualified and experienced electricians under the immediate supervision of a duly licensed Electrical Engineer.

Conduits
Conduits should be cut square with a hacksaw and reamed. Bends shall be made with the required radius. In making bends only conduit bending apparatus will be used. The use of a pipe tee or vise for bending conduits shall not be permitted. Conduits which have been crushed, deformed or flattened shall not be installed. No running thread shall be allowed. Conduit runs crossing construction joints of the building shall be provided with standard expansion fittings of the approved type.

No conduits shall be used in any system smaller than 12 mm diameter electric trade size nor shall have more than four (4) 9O-degree bends in anyone run and where necessary, pull boxes shall be provided. All ends of conduits which are left empty in cabinets and conduit boxes shall be plugged with lead or approved pipe caps so as to prevent the entrance of white ants and dirt within the conduit system. Pull wires shall be inserted in the empty ducts before they are closed with lead or pipe caps and shall be left therein for future use.

On exposed work, all pipes and outlet boxes shall be secured by means of galvanized metal clamps which shall be held in place by means of machine screws. When running over concrete surfaces, the screws shall be held in place by means of expansion sleeves for big pipes and rolled lead sheet for small pipes. All pipes shall be run at right angles to and parallel with the surrounding walls. No diagonal run shall be allowed and all bends and offsets shall be avoided as much as possible. Conduits shall be supported at 1,500 mm intervals maximum.

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

Support boxes independently of conduits entering by means of bolts, red hangers or other suitable means. Conduit boxes shall be installed plumb and securely fastened. They shall be set flush with the surface of the structure in which they are installed where conduits are run concealed.

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

Floor mounted outlet boxes required shall be waterproof type with flush brass floor plate and brass bell nozzle.
All boxes shall be painted with antirust red lead paint after installation.
All conduits shall be fitted with approved standard galvanized bushing and locknuts where they enter cabinets and conduit boxes.

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

1100.4 Method of Measurement
The work under this Item shall be measured either by lengths, pieces, pairs, lot and set actually placed and installed as shown on the approved Plans.

1100.5 Basis of Payment
All works performed and measured and as provided for in the Bill of Quantities shall be paid for at the Unit Bid or Contract Unit Price which payment shall constitute full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
(1)	RSC Conduit Pipe - mm dia., with couplings	length
(2)	Locknut & Bushings	pairs
(4)	Conduit pipe elbow	pieces
(6)	Conduit clamp	pieces
(11)	Rubber Tape 19 mm dia x 227g	rolls
(14)	Octagonal junction boxes	pieces
(15)	Utility Boxes	pieces
(16)	Metal Pull Box	pieces

1100.6 General Specifications
The work to be done under this division of specifications consists of the fabrication, furnishing, delivery and installation, complete in all details of the electrical work, at the subject premises and all work material's incidental to the proper completion of the installation, except those portions of the work which are expressly stated to be 90ne by other fields. All' works shall be done in accordance with the rules and regulations and with the specifications.

1100.7 Specifications on:
Lighting fixtures and lamp
All lighting fixtures and lamps are as specified and listed on lighting fixture schedule.

For fluorescent lamp, it shall be 40-watt rapid start cool-white. All fluorescent ballast shall be 230-volt, high power factor, of good quality materials and approved by the Bureau of Product Standards (BPS).

Material Requirements
All materials to be used shall conform to the BPS specification.

Construction Requirements
All grounding system installation shall be executed in accordance with the approved plans.
Grounding system shall include building perimeter ground wires, ground rods, clamps, connectors, ground wells and ground wire taps as shown in the approved design.

1100.8 Auxiliary Systems
All auxiliary systems such as telephone and intercom system, time clock system, fire alarm system and public address/nurse's call/paging system installations shall be done in accordance with the approved design. All materials to be used shall conform to the Bureau of Product Standards (BPS) specifications.

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

1100.10 Test and guarantee
Upon completion of the electrical construction work, the contractor shall provide all test equipment and personnel and to submit written copies of all test results. The contractor shall guarantee the electrical installation are done and in accordance with the approved plans and specifications. The contractor shall guarantee that the electrical systems are free from' all grounds and from all defective workmanship and materials and will remain so for a period of one year from date and acceptance of works. Any defect shall be remedied by the Contractor at his own expense.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1100	CONDUITS, BOXES, AND FITTINGS	LUMP SUM

ITEM 1101 - WIRES AND WIRING DEVICES

1101.1 Description
This Item shall consist of the furnishing and installation of all wires and wiring devices consisting of electric wires and cables, wall switches, convenience receptacles, heavy duty receptacles and other devices shown on the approved Plans but not mentioned in these specifications.

1101.2 Material Requirements
Wires and cables shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the PSA mark. Unless specified or indicated otherwise, all power and lighting conductors shall be insulated for 600 volts.

All wires shall be copper, soft drawn and annealed, smooth and of cylindrical form and shall be centrally located inside the insulation.

All wiring devices shall be standard products of reputable electrical manufacturers. Wall switches shall be rated at least 1 OA, 250 volts and shall be spring operated, flush, tumbler type. Duplex convenience receptacles shall be rated at least 15A, 250 volts, flush, parallel slots.

Single heavy-duty receptacles shall be rated at least 20A, 250 volts. 3wire, flush, polarized type.

1101.3 Construction Requirements
Conductors or wires shall not be drawn in conduits until after the cement piaster is dry and the conduits are thoroughly cleaned and free from dirt and moisture. In drawing wires into conduits, sufficient slack shall be allowed to permit easy connections for fixtures, switches, receptacles and other wiring devices without the use of additional splices.
All conductors of convenience outlets and lighting branch circuit home runs shall be wired with a minimum of 3.5 mm in size. Circuit home runs to panel boards shall not be smaller than 3.5 mm but all home runs to panel board more than 30 meters shall not be smaller than 5.5 mm. No conductor shall be less than 2 mm in size.

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

All joints, taps and splices on wires larger than 14 mm shall be made of suitable solder less connectors of the approved type and size. They shall be taped with rubber and PVC tapes providing insulation not less than that of the conductors. No splices or joints shall be permitted in either feeder or branch conductors except within outlet boxes or accessible junction boxes or pull boxes. All joints in branch circuit wiring shall be made mechanically and electrically secured by approved splicing devices and taped with rubber and PVC tapes in a manner which will make their insulation as that of the conductor.

All wall switches and receptacles shall be fitted with standard Bakelite face plate covers. Device plates for flush mounting shall be installed with all four edges in continuous contact with finished wall surfaces without the use of coiled wire or similar devices. Plaster fillings will not be permitted. Plates installed in wet locations shall be gasketed. When more than one switch or device is indicated in a single location, gang plate shall be used.

1101.4 Method of Measurement
The work under this Item shall be measured either by meters, rolls, pieces, and set, actually placed and installed as shown on the Plans.

1101.5 Basis of Payment

All work performed and measured and as provided for in this Bid of Quantities shall be paid for at the Unit Bid or Contract Unit Price which payment shall constitute full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1101	WIRES AND WIRING DEVICES	LUMP SUM

ITEM 1102 - POWER LOAD CENTER, SWITCHGEAR AND PANELBOARDS

1102.1 Description

This Item shall consist of the furnishing and installation of the power load center unit substation or low voltage switchgear and distribution panel boards at the location shown or the approved Plans complete with transformer, circuit breakers, cabinets and all accessories, completely wired and ready for service.

1102.2 Material Requirements
All materials shall be brand new and shall be of the approved type. It shall conform to the requirements of the Philippine Electrical Code and shall bear the Philippine Standard Agency (PSA) mark.

Power Load Center Unit Substation
The Contractor shall furnish and install an indoor-type Power Load Center Unit Substation at the location shown on the approved Plans if required. It shall be totally metal-enclosed, dead front and shall consist of the following coordinated component parts:

High Voltage Primary Section:
High voltage primary incoming line section consisting of the following parts and related accessories:

One (1) Air-filled Interrupter Switch, 2-position (open-close) installed in a suitable air-filled metal enclosure and shall have sufficient interrupting capacity to carry the electrical load. It shall be provided with key interlock with the cubicle for the power fuses to prevent access to the fuses unless the switch is open.
Three (3)-power fuses mounted in separate compartments within the switch housing and accessible by a hinged door.
One 1) set of high voltage potheads or 3-conductor cables or three single conductor cables.
Lightning arresters shall be installed at the high voltage cubicle if required.

Items (a) and (b) above could be substituted with a power circuit breaker with the correct rating and capacity.

Transformer Section
The transformer section shall consist of a power transformer with ratings and capacities as shown on the plans. It shall be oil liquid-filled non-flammable type and designed in accordance with the latest applicable standards.
The transformer shall be provided with four (4 approximately 2 1/2 % rated KVA taps on the primary winding in most cases one (1) above and three (3) below rated primary voltage and shall be changed by means of externally gang-operated manual tap changer only when the transformer is de-energized. Tap changing under load is acceptable if transformer has been so designed.
The following accessories shall be provided with the transformer, namely: drain valve, sampling device, filling connection, oil liquid level gauge, ground pad, top filter press connection, lifting lugs, diagrammatic nameplate, relief valve, thermometer and other necessary related accessories.
The high-voltage and low-voltage bushings and transition flange shall be properly coordinated for field connection to the incoming line section and low voltage switchboard section, respectively.

Low-Voltage Switchboard Section
The low-voltage switchboard shall be standard modular-unitized units, metal-built, dead front, and safety type construction and shall consist of the following:

Switchboard Housing
The housing shall be heavy gauge steel sheet, dead front type, gray enamel finish complete with frame supports, steel bracings, steel sheet panel boards, removable rear plates, copper bus bars, and all other necessary accessories to insure sufficient mechanical strength and safety. It shall be provided with grounding bolts and clamps.

Secondary Metering Section
The secondary metering section shall consist of one (1) ammeter, AC, indicating type; one (1) voltmeter, AC, indicating type, one (1) ammeter transfer switch for 3-phase; one (1) voltmeter transfer switch for 3phase; and current transformers of suitable rating and capacity.
The above-mentioned instruments shall be installed in one compartment above the main breaker and shall be complete with all necessary accessories completely wired, ready for use.

Main Circuit Breaker
The main circuit breaker shall be draw-out type, manually or electrically operated as required with ratings and capacity as shown on the approved Plans.
The main breaker shall include insulated control switch if electrically operated, manual trip button, magnetic tripping devices, adjustable time over current protection and instantaneous short circuit trip and all necessary accessories to insure safe and efficient operation.

Feeder Circuit Breakers
There shall be as many feeder breakers as are shown on the single line diagram or schematic riser diagram and schedule of loads and computations on the plans. The circuit breakers shall be draw out or molded case as required. The circuit breakers shall each have sufficient interrupting capacity and shall be manually operated complete with trip devices and all necessary accessories to insure safe and efficient operation. The number, ratings, capacities of the feeder branch circuit breakers shall be as shown on the approved Plans.
Circuit breakers shall each be of the indicating type, providing "ON" - "OFF" and "TRIP" positions of the operating handles and shall each be provided with nameplate for branch circuit designation. The circuit breaker shall be so designed that an overload or short on one pole automatically causes all poles to open.

Low-Voltage' Switchgear
(For projects requiring 'low-voltage switchgear only).
The Contractor shall furnish and install low-voltage switchgear at the location shown on the plans. It shall be metal-clad, dead front, free standing, safety type construction and shall have copper bus bars of sufficient size, braced to resist allowable root mean square (RMS) symmetrical short circuit stresses, and all

necessary accessories. The low-voltage switchgear shall consist of the switchgear housing, secondary metering, main breaker and feeder branch circuit breakers and all necessary accessories, completely wired, ready for service.

Grounding System:
All non-current carrying metallic parts like conduits, cabinets and equipment frames shall be properly grounded in accordance with the Philippine Electrical Code, latest edition.
The size of the ground rods and ground wires shall be as shown on the approved Plans. The ground resistance shall not be more than 5 ohms.

Panel boards and Cabinets
Panel boards shall conform to the schedule of panel boards as shown on the approved Plans with respect to supply characteristics, rating of main lugs or main circuit breaker, number and ratings and capacities of branch circuit breakers.
Panel boards shall consist of a factory completed dead front assembly mounted in an enclosing flush type cabinet consisting of code gauge galvanized sheet steel box with trim and door. Each door shall be provided with catch lock and two (2) keys. Panel boards shall be provided with - directories and shall be printed to indicate load served by each circuit. Panel board cabinets and trims shall be suitable for the type of mounting shown on the approved Plans. The inside and outside of panel board cabinets and trims shall be factory painted with one rust proofing primer coat and two finish shop coats of pearl gray enamel paint.
Main and branch circuit breakers for panel boards shall have the rating, capacity and number of poles as shown on the approved Plans. Breakers shall be thermal magnetic type. Multiple breakers shall be of the common trip type having a single operating handle. For 50-ampere breaker or less, it may consist of single-pole breaker permanently assembled at the factory into a multi-pole unit.

1102.3 Construction Requirements
The Contractor shall install the Power Load Center Unit Substation or Low-Voltage Switchgear and Panel boards at the locations shown on the approved Plans. Standard panels and cabinets shall be used and assembled on the job. All panels shall be of dead front construction furnished with trims for flush or surface mounting as required.

1102.4 Method of Measurement
The work under this Item shall be measured either by set and pieces actually placed and installed as shown on the approved Plans.

1102.5 Basis of Payment
All works performed and measured and as provided for in the Bill of Quantities shall be paid for at the Unit Bid or Contract Unit Price which payment shall constitute full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1102	POWER LOAD CENTER, SWITCHGEAR AND PANELBOARDS	LUMP SUM

ITEM 1001 - STORM DRAINAGE AND SEWERAGE SYSTEM

1001.1 Description
This Item shall consist of furnishing all materials, equipment and labor for the complete installation of the storm drainage system to include all piping's, gutters, canals, catch basins, junction boxes, hand holes, manholes and other appurtenant structures, and sewerage system to include all sanitary sewer piping and septic vault where no public sewer exist, from the building to the point of discharge.

1001.2 Material Requirements

1001.2.1 Materials for storm drainage system shall meet the requirements specified in the following standard specifications:

Portland Cement	ASTM C-150
Fine and Coarse Aggregate	ASTM C-33
Reinforcing Steel	ASTM A-615
Non-reinforced Concrete Pipes	ASTM C-14
Reinforced Concrete Pipes	ASTM C-76 (AASHTO M-86)
Cast Iron Pipes (for conductors and downspout)	ASTM A-74
Galvanized Iron Pipes Scheduled 40 (for conductors and downspouts)	ASTM A-120
Polyvinyl Chloride (PVC) (for conductors and downspouts)	ASTM 2729

Where the covers for catch basins, junction boxes, manholes and canals for gratings are required same shall be made of wrought iron and of the dimensions as shown on the Plans.

1001.2.2 Materials for sewerage system shall meet the requirements specified in the following standard specifications:

Cast Iron Pipes and Fittings	ASTM A-74
Pig Lead (for securing and sealing joint)	ASTM B 29-77
PVC Pipes and Fittings (where called in Plans)	ASTM 01784
Solvent Cement (for securing PVC joints)	ASTM 02564

Where PVC pipes and fittings are used, joints shall be secured with rubber "0" ring or solvent cement, as the case maybe.
Oakum for joints in bell and spigot pipes shall be made from hemp fiber, braided or twisted and oil impregnated free from lumps, dirt and extraneous matter.

1001.3 Construction Requirements

1001.3.1 Installation of Pipes
Under no circumstances shall pipes shall be laid under water and when the trench condition or the weather is unsuitable for such work.

a. Bedding. Materials such as sand, sandy soil or any approved material shall be used to provide a firm foundation of uniform density. The bedding shall have a minimum thickness equivalent to one-fourth (1/ 4) of the pipe's diameter.

b. Laying of Pipes. Proper facilities shall be provided for lowering and' placing pipes into trenches in order to preclude damage. Laying of pipes shall start upgrade with the spigot end of bell-and-spigot pipe, or the tongue end of tongue-and-groove pipe, positioned towards the direction of the flow. The pipes shall be laid in accordance with the grades and alignments shown in the Plans. The spigots or tongues shall be adjusted in bells or grooves to provide uniform space around joints to receive mortar. Blocking or wedging between spigot and bell or between tongue and groove to attain proper spacing shall be allowed provided such blocking/wedging shall not interfere and shall not affect the water tightness of the joint.

c. Bell and Spigot Joint for Drain Pipe. The first pipe shall be properly bedded at the required grade. Just below the spigot of the first unit, a sufficient space shall be provided for engaging the bell end of the second pipe. The spigot shall be carefully cleaned with a wet brush and the upper exterior portion applied with mortar to such a thickness as to bring the inner surfaces of the abutting pipes flush and even. The bell end of the second pipe shall be cleaned with a wet brush and uniformly matched with the spigot of the first pipe so that the sections are closely fitted. After the second pipe is laid, the remainder of the joint shall be fitted with mortar, and a bead shall be formed around the outside of the joints with sufficient amount of additional mortar. The inside of the joints shall be wiped and finished smooth. The mortar bead on the outside shoe immediately be protected with a cover of wet burlap or wet earth for at least three (3) days for curing.

d. Tongue and Groove Joint for Concrete Pipe. The first pipe shall be properly bedded. A shallow excavation shall be made underneath the joint and filled with mortar to provide a bed second pipe. The tongue end of the first pipe shall be carefully cleaned with wet brush and soft mortar applied around the upper half of the tongue. After cleaning and positioning the second pipe close to the first, mortar shall be applied around the lower half of the groove. With just sufficient thrust, the second pipe shall be brought in close contact with the first until mortar is squeezed out of the joint. Sufficient mortar shall be used to fill the joint and to form a bead on the outside.

e. Mortar for Joint. Mortar shall be a mixture of Portland Cement, sand and water mixed in the proportion by volume of one part cement to two parts of clean sand with just sufficient amount of water for plasticity.

f. Leaded Joints of Cast Iron Pipes. Joints of cast iron pipes shall be packed with braided or twisted oil-impregnated hemp or oakum, properly caulked around the joint. The packing shall be at least 20mm below the rim of the hub or bell and this space shall be filled with molten pig lead in one continuous pouring. The "ring" of pig lead formed around the joint shall be properly caulked by appropriate caulking tools to render the joints watertight.

1001.3.2 Concrete structures.
Concrete structures such as catch basins, canal gutters, junction boxes and manholes for the drainage system, and septic vault for sewerage system, shall be constructed in accordance with the Plans and Specifications on Concrete Work.

Sewer Connections and Clean-Outs

a. The outlet of the septic vault shall be connected to the street drain or to other discharge point where no sanitary sewer exists. Connection with the sanitary sewer shall not be made without the permission of the proper authorities, but shall be made in such a manner that any and all the service water, as well as house and other liquid wastes, will flow to the sanitary sewer. Provided, that isolated faucets used exclusively for garden purposes may, in the discretion of the proper authorities, be allowed not to flow into the sanitary sewer.

b. Clean-outs or rodding holes consisting of cast iron extensions with long sweep elbow fittings shall be provided at the ends of runs and at every change of directions. Clean-outs shall be capped with cast brass ferrules with threads and screwed-on removable brass plugs. Clean-outs extended outside the building and raised to the level of finished grade shall be terminated with the same cast brass ferrule with brass plug set into a concrete slab shall be 150mm thick and 300mm square, finish flush with grade.

Incidental Earthwork

Incidental earthwork for the storm drainage and sewerage systems, such as excavation and backfilling shall be undertaken in accordance with applicable part of Excavation Filling and Grading.

Inspection and Quality Control

Materials shall be inspected and accepted as to quality before same are installed. Piping's installed in trenches shall first be inspected, tested and approved by the Engineer before these are covered or backfilled. All defects/ lakes disclosed by the water test shall be remedied to the satisfaction of the Engineer and any extra cost shall be at the expense of the Contractor.

1001.4 Method of Measurement

Pipes, culverts, gutters, canals and gratings installed in place and accepted by the Engineer, shall be measured by the meter along their axes. Catch basins, junction boxes, manholes and septic vault shall be measured by the number of units constructed and accepted.

1001.5 Basis of Payment

The quantities as determined in sub-section 1001.4 shall be paid at the contract unit price for each of the Items which shall constitute full compensation for all materials, labor, tools and equipment and all other incidentals necessary to complete the Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1001.2 (a)	Pipe (kind and size)	meter
1001.2 (b)	Fitting (kind and size)	each
1001.2 (f)	Catch Basin	each

ITEM 1002 - PLUMBING AND PLUMBING FIXTURES

1002.1 Description
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.

1002.2 Material Requirements
All piping materials, fixtures and appliances fitting accessories whether specifically mentioned or not but necessary to complete this Item shall be furnished and installed.

1002.2.1 Cast Iron Soil Pipes and Fittings
a. Pipes and fitting materials shall comply with the specification requirements defined in PNS/SAO 4-1: 1974. The material description and standards of manufacture are herein described:

1. Cast Iron - the casting shall be made of gray iron which shall be sound, free from cracks, sand holes and blow holes. They shall be uniformly low hardness that permits drilling and cutting by ordinary methods. Pipes and fittings shall be true to pattern and of compact closed grained structure.
2. Quality of Iron - the iron shall be made by the cupola, air furnace, electric furnace or other processes which shall be checked by regular chemical and physical control test. The resultant shall be gray iron of good quality.
3. Manufacture - the pipes shall be made with hub and spigot ends or hub ends only. All hubs for pipes and fittings shall be provided with held lead grooves and all spigot ends shall be made with beads or plain if machine cast centrifugally. Plugs shall be wrought or cast, machined to the dimensions required and shall be free from defects.
4. Freedom from defects - pipes and fittings shall be true, smooth and cylindrical, their inner and outer surfaces being as nearly concentric as practicable. They shall be in all aspects, sound and good casting free from laps, pin holes or other imperfections and shall be neatly dressed and carefully fettled. The ends shall be finished reasonably square to their axes.

b. Clean-outs shall be made of heavy cast brass ferrule with counter sunk screw cover same diameter as the pipe except that they shall not be larger than 100mm diameter.
c. Caulking lead shall be of molten type peg lead conforming to specification requirements defined in ASTM 8-29.
d. Oakum shall be twisted or braided hemp or abaca fibers slightly impregnated with oil.

1002.2.2 WATER SUPPLY Pipes and Fittings

a. Pipes shall be galvanized iron pipe schedule 40 conforming to specification requirements defined in ASTM A-120 with threaded connection. Under roads where necessary shall be suitably protected as shown on the Plans.
Fittings shall be malleable iron Type II, galvanized iron conforming to specification requirements defined in ASTM A338.

b. Valves
Valves for water supply shall be bronze body with threaded ends rated 21.0 kgf/cm. square, All valves shall be gate valves unless otherwise specified. Gate valves shall have solid wedge body and discs conforming to specification requirements defined in ASTM 8-62. Globe valves shall have plug type discs with ferrule threaded ends and bronze body.
Unions
Unions on ferrous pipe 50mm in diameter and smaller shall be malleable iron.
Water Meter
Water meter where required to be furnished by the Contractor shall be of the type tested and approved by MWSS.

1002.2.3 Approved Alternate Pipes and Fittings
Pipes and fittings for sanitary and potable water lines as approved alternate shall be Un plasticized Polyvinyl Chloride Pipes and Fittings (UPVC).

Pipes and fittings shall be made of virgin materials conforming to specification requirements defined in ASTM 0-2241 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.

1002.2.4 Septic Tank
The septic tank shall be provided as shown on the Plans including all pipe vents and fittings. The various construction materials such as concrete masonry work shall conform to the corresponding Items of these Specifications. Inlet and outlet pipes shall conform to the latest edition of the National Plumbing Code.

1002.2.5 Plumbing Fixtures and Fittings
All fittings and trimmings for fixtures shall be chromium-plated and polished brass unless otherwise approved. Exposed traps and supply pipes for fixtures shall be connected to the roughing in, piping system at the wall unless otherwise indicated on the Plans. Built-in fixtures shall be watertight with provision of water supply and drainage outlet, fittings and trap seal. Unless otherwise specified, all plumbing fixtures shall be made of vitreous china complete with fittings.

a. Water closet shall be vitreous china, free standing toilet combination, round front bottom outlet symphonic wash down bowl with extended rear self and closed coupled tank with cover complete with fittings and mounting accessories. Model make and color shall be submitted for approval prior to delivery at jobsite by the Engineer.
b. Lavatory shall be vitreous china, wall-hung with rear overflow and cast-in soap dishes, pocket hanger with integral china brackets, complete with twin faucets, supply pipes, P-trap and mounting accessories. Where indicated on the Plans to be counter top model make and color shall be approved by the Engineer.
c. Urinal shall be china vitreous, wall-hung wash-out urinal with extended shields and integral flush spreader, concealed wall-hanger pockets, 19mm top spud complete with fitting and mounting accessories. Model make and color shall be approved by the Engineer.

Bathroom and Toilet Accessories
a. Shower head and fitting shall be movable, cone type with escutcheon arm complete with stainless steel shower valve and control lever, 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.
c. Floor drains shall be made of stainless steel beehive type, measuring 100mm x 100mm, and provided with detachable stainless strainer, expanded metal lath type.
d. Toilet paper holder shall be vitreous china wall mounted. Color shall reconcile with the adjacent fixture and facing tiles.
e. Soap holder shall be vitreous china wall mounted. Color shall reconcile with the adjacent tile works.
f. Faucet(s) shall be made of stainless steel for interior use.
h. Hose-bib(s) shall be made of bronze cast finish.

Special Plumbing Fixtures
a. Kitchen sink shall be made of stainless steel self-rimming, single compartment complete with supply fittings, strainer traps, dual control lever and other accessories.

b. Laboratory sink shall be made of cast iron metal with white porcelain finish with single compartment, flat rim ledge, 762mm x 533mm complete with supply fittings, strainer, trap and other accessories.
c. Scrub-up sink shall be made of cast iron metal with white porcelain finish measuring 610mm x 610mm complete with supply fittings, strainer, trap and wall mounting accessories.
d. X-ray developing tank shall be made of cast iron white porcelain finish with three (3) compartment x-ray processing tank, drain plug, open standing drain, 19mm IPS inlet spud complete with stand and mounting accessories.
e. Squat bowl(s) shall be vitreous china, wash down squat bowl with integral foot treads, pail flush type. Color, make and type to be approved by the Engineer.
f. Grease traps shall be made of cast bronze with detachable cover and mounting accessories.

1002.2.8 Roof Drains, Downspout, Overflow Pipes and Steel Grating
The Contractor shall provide, fit and/or install necessary drains with strainers, where shown on the Plans. Each drain with strainer shall fit the size of the corresponding downspout (or roof leader) over which it is to be installed and in conformity with the following schedule:

a. Scrupper drains (for balconies, parapet) shall be made of bronze base with flashing. Flange threaded outlet and convex with integral flashing clamp bolted to flange.
b. "Josam" type drains shall be made of bronze base semi-dome with large free area, flashing clamp and integral gravel stopper. To be used at roof decks, canopies, gutters, and elsewhere indicated on the Plans.
c. Downspouts when encased in concrete, unless otherwise shown on the Plans shall be polyvinyl chloride (PVC). Whether indicated or specified to be cast iron or galvanized iron the same shall meet the specification requirement as herein described.
d. Overflow pipes shall be made of galvanized iron pipe measuring at least 13mm diameter and spaced 200mm on center.
e. Steel grating shall be made of wrought iron metals of design on shop drawings approved and surfaces to be coated with shop finish.

1002.2.9 Fire Protection System
Fire hose cabinets shall be locally available consisting of 38mm diameter valve hose rack with nipple 30mm rubber lined hose cable with standing 4268 kg/cm square, nozzle 38mm diameter brass, chromium plated. Fire standpipe system shall consist of risers and hose valves. Pipe shall be extra strong black iron. Valves to be high grade cast bronze mounted withstanding 79.40 kg. working pressure as indicated on the Plans.
Fire extinguisher shall be portable, suitable for Class A, B, C fires, mounted inside cabinet. Cabinet shall be full flush mounting door with aluminum trim for glass plate, frame and box shall be made of gauge 14 galvanized iron sheet with white interior and red exterior baked enamel finish over primer. Cabinet to be wall mounted and size to be able to accommodate the defined components. Yard hydrant were shown on the Plans shall match the Integrated Fire Department requirements. Outlet shall be single 63mm diameter gate valves with chain connected caps.

1002.2.10 Built-in appliances such as urinal trough, lavatory and slope sink shall be made as indicated on the Plans, exposed surfaces to be tile wainscoating Complete with fitting accessories required as practiced in this specialty trade.

1002.3 Construction Requirement
The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual structural and finishing work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the Engineer.

Installation of Soil, Waste, Drain and Vent Pipes

a. All cast iron soil and drainage pipes shall be pitch 6mm per 300mm but in no case flatter than 3mm per 300mm.
b. Horizontal lines shall be supported by well secured length heavy strap hangers. Vertical lines shall be secured strongly by hooks to the building frame and a suitable brackets or chairs shall be provided at the floor from which they start.
c. All main vertical soil and waste stacks shall be extended full size to and above the roof line to act as vents, except otherwise indicated on the Plans.
d. Vent pipes in roof spaces shall be run as close as possible to underside of roof with horizontal piping pitched down to stacks without forming traps. Vertical vent pipes may be connected into one main vent riser above the highest vented fixtures.
e. Where an end or circuit vent pipe from any fixtures is connected to a vent line serving other fixtures, the connections shall be at least 1.20 m above the floor on which the fixtures are located.
f. Horizontal waste line receiving the discharge from two or more fixtures shall be provided with end vents unless separate venting of fixtures is noted on the Plans.
g. All changes in pipe sizes on soil and waste lines shall be made with reducing fittings or recessed reducers. All changes in directions shall be made by appropriate use of 45-degree wyes, half wyes, long sweep quarter bends or elbows may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical and on the discharge from waste closets. Where it becomes necessary to use short radius fittings in other locations the approval of the Engineer shall be obtained prior to installation of the same.
h. All joints of cast iron pipes in bell and spigot shall be firmly packed with oakum or hemp and caulked with pig lead at least 25 mm deep.
i. Cleanouts at the bottom of each soil stack, waste stack, interior downspout and where else indicated shall be the same size as the pipe up to and including 102 mm. 152 mm, for larger pipes.

Cleanouts on floors shall be cast iron ferrule caulked into cast hub and fitted with cast brass screw plug flush with floor. Cleanouts for threaded pipes snail be installed at the foot of soil, waste and drain stacks and on each building drain outside the building.

j. Vent pipe shall be flashed and made watertight at the roof with ferrule lead sheet. Flashing shall be turned down into pipes.
k. Each fixture and place of equipment requiring connection to the drainage system except fixtures with continuous waste shall be equipped with a trap. Each trap shall be placed as near to the fixture as possible. Traps installed on threaded pipe shall be recessed drainage pattern.
l. Overhead horizontal runs of pipes shall be hung with adjustable wrought iron pipe hanger spaced not over 3.04 m apart except hub and spigot soil pipe which shall have hanger spaced not over 1.50 m apart and located near a hub.

1002.3.2 Water Pipes, Fittings and Connections.
All water piping inside the building and underground, 100 mm. diameter and smaller shall be galvanized iron threaded pipe with malleable iron fittings.

a. The water piping shall be extended to 'all fixtures, outlets, and equipment from the gate valves installed in the branch near the riser.

b. The cold water system shall be installed with a fall towards a main shutoff valve and drain. Ends of pipes and outlets shall be capped or plugged and left ready for future connections.
c. Mains and Branches
    1. All pipes shall be cut accurately to measurements and shall be worked into place without springing or forcing. Care shall be taken so as not to weaken the structural portions of the building.
    2. All piping above the ground shall be run parallel with the lines of the building unless otherwise indicated on the Plans.

3. All service pipes, valves and fittings shall be kept at sufficient distance from other work to permit finished covering not less than 12.5mm from such work or from finished covering on the different service.
4. No water piping shall be buried in floors, unless specifically indicated on the Plans and approved by the Engineer.
5. Changes in pipes shall be made with reducing fittings.

d. Drain Cocks

Pipe drain indicated on the drawings shall consist of 12 mm globe valve with renewable disc and installed at low points on the cold water piping so that all piping shall slope 100 mm in 30.5 m.

e. Threaded Pipe Joints

All pipes shall be reamed before threading. All screw joints shall be made with graphite and oil or with an approved graphite compound applied to make threads only. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

f. Expansion and Contraction of Pipes

Accessible contraction-expansion joints shall be made whenever necessary. Horizontal runs of pipe over 15m in 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.

g. Fire Standpipe System

Fire standpipe system shall consist of risers and hose valve. Pipe shall be extra strong black iron. Valves to be underwriter's approval high grade cast bronze mounted.

h. Valves and Hose Bibs

1. Valves shall be provided on all supplied fixture as herein specified.
2. The cold water connections to the domestic hot water heater shall be provided with gate valves and the return circulation connection shall have gate and a check valve.
3. All connection to domestic hot water heaters shall be equipped with unions between valve and tanks.
4. Valve shall not be installed with its stem below the horizontal. All valves shall be gate valves unless otherwise indicated on the Plans.
5. Valves up to and including 50 mm diameter shall be threaded ends, rough bodies and finished trimmings, except those on chromium plated brass pipe.
6. Valves 63 mm in diameter and larger shall have iron bodies, brass mounted and shall have either screws or flange ends.
7. Hose bibs shall be made of brass with 12.5 mm inlet threads, hexagon shoulders and 19 mm male.

Fixtures, Equipment and Fastenings

a. All fixtures and equipment shall be supported and fastened in a safe and satisfactory workmanship as practiced.
b. All fixtures, where required to be wall mounted on concrete or concrete hollow block wall, fasten with brass expansion bolts. Expansion bolts shall be 6 mm diameter with 20 mm threads to 25 mm into solid concrete, fitted with loose tubing or sleeves of proper length to acquire extreme rigidity.
c. Inserts shall be securely anchored and properly flushed into the walls. Inserts shall be concealed and rigid.
d. Bolts and nuts shall be horizontal and exposed. It shall be provided with washers and chromium plate finish.

Pipe Hangers, Inserts and Supports

a. Pipe hangers shall be wrought iron or malleable iron pipe spaced not more than 3m apart for horizontal runs or pipe, except hub and spigot soil pipe which shall have hanger spaced not over 1.50 m apart located near the hub.

b. Chains, straps perforated turn-buckles or other approved means of adjustment except the' turn-buckles may be omitted for hangers on sailor waste lines or individual toilet rooms to maintain stacks when spaced does not permit.

c. Trapeze hangers may be used in lieu of separate hangers on pipe running parallel to and close to each other.

d. Inserts shall be cast steel and shall be of type to receive a machine bolt or nut after installation. Insert may be permitted adjustment of the bolts in one horizontal direction and shall be installed before pouring of concrete.

e.Wrought iron clamps or collars to support vertical runs of pipe shall be spaced not more than 6 m apart for as indicated on the Plans.

Plates and Flashing

a. Plates to cover exposed pipes passing through floor finished walls or ceiling shall be fitted with chromium plated cast brass plates or chromium plated cast iron or steel plates on ferrous pipes.
b. Plates shall be large enough to cover and close the hole around the area where pipes pass. It shall be properly installed to insure permanence.
c. Roof areas penetrated by vent pipes shall be rendered watertight by lead sheet flashing and counter flashing. It shall extend at least 150 mm above the pipe and 300 mm along the roof.

Protection and Cleaning

a. During installation of fixtures and accessories and until final acceptance, protect items with strippable plastic or other approved means to maintain fixtures in perfect conditions.
b. All exposed metal surfaces shall be polished clean and rigid of grease, dirt or other foreign materials upon completion.
c. Upon completion, thoroughly clean all fixtures and accessories to leave the work in polished condition.

1002.3.7 Inspection, Warranty Test and Disinfection

All pipes, fittings, traps, fixtures, appurtenances and equipment of the plumbing and drainage system shall be inspected and approved by the Engineer to ensure compliance with all requirements of all Codes and Regulations referred to in this Specification.

Drainage System Test

a. 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 stack vent above the roof.
b. The system shall hold this water for a full 30 minutes during which time there shall be no drop greater than 102 mm.
c. 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 the required pressure.
d. If and when the Engineer 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 additional cost.

Water Test on System

a. Upon completion of the roughing-in and before connecting fixtures the entire cold water piping system shall be tested at a hydrostatic pressure 1 1/2 times the expected working pressure in the system during operation and remained tight and leak-proofed.
b. Where piping system is to be concealed the piping system shall be separately in manner similar to that described for the entire system and in the presence of the Engineer or his duly designated representative.

1002.3.7.3 Defective Work

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

Disinfection

a. The entire water distribution system shall be thoroughly flushed and treated with chlorine before it is operated for public use.
b. Disinfection materials shall be liquid chlorine or hypochlerite and shall be introduced in a manner approved as practiced or approved by the Engineer into the water distribution system.
c. After a contact period of not less than sixteen hours, the heavenly chlorinated water shall be flushed from the system with potable water.
d. Valves for the water distribution system shall be opened and closed several times during the 16 hours chlorination treatment is done.

1002.3.8 As-Built Drawings

Upon completion of the work, the Contractor shall submit two sets of prints with all as-built changes shown on the drawings in a neat workmanship manner. Such prints shall show changes or actual installation and conditions of the plumbing system in comparison with the original drawings.

1002.4 Method of Measurement

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 Engineer.

1002.5 Basis of Payment

The quantified items, installed in place shall be the basis for payment based from the unit bid price for which prices and payments shall constitute full compensation including labor, materials and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1002	PLUMBING AND PLUMBING FIXTURE	LUMP SUM